

The Know Your Numbers (KYN) program 2008 to 2010: impact on knowledge and health promotion behavior among participants

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Background Since 2007, the National Stroke Foundation in Australia has undertaken a community-based 'Know Your Numbers' program on blood pressure and other stroke risk factors.

Aims The aims of this study are to assess, in a sample of registrants participating in a three-month follow-up survey, retention of knowledge of risk factors and health conditions associated with hypertension, and whether those who were advised to see their doctor sought treatment or performed other health promotion actions.

Methods Various organizations (mainly pharmacies) were recruited to offer a 'free' standardized blood pressure check and educational resources for one-week/year between 2008 and 2010. Data collection was done thru registration log and detailed questionnaires for a sample of registrants at baseline and three-months. Descriptive statistics were used for comparison of baseline and three-month data.

Results There were 59 817 registrants over three-years. A total of 2044/2283 (90%) registrants completed a baseline survey (66% female, 50% aged >55 years); 43% had blood pressure $\geq 140/90$ mmHg whereby 32% were unaware of their blood pressure status. Follow-up surveys were obtained from 510/805 (63%) baseline participants who provided consent. At three-months, improved knowledge was found for 9 of 11 risk factors for hypertension (e.g. lack of exercise baseline 73%; three-months 85%, $P < 0.001$). Knowledge for all the health conditions assessed that are associated with hypertension improved (e.g. stroke baseline 72%; three-months 87%, $P < 0.001$, heart attack baseline 69%; three-months 84%, $P < 0.001$). All respondents reported at least one health promotion action. Among 141/510 advised to visit their doctor, 114 (81%) did.

Conclusion Know Your Numbers is a successful health promotion program and encourages people to be reviewed by their doctor.

Key words: cerebrovascular disease, health care, health promotion, hypertension, prevention, risk factors

Introduction

Stroke is a major cause of death and long-term disability worldwide. In Australia, approximately 60 000 people each year have a stroke (1). Although there have been major advances during past decades in stroke prevention and management, there is evidence that health promotion and prevention strategies remain underutilized (2,3). In Australia, about 11.7 million adults (90%) have at least one modifiable risk factor for cardiovascular disease (1). Hypertension has the strongest association for first and subsequent stroke (2). In 1999–2000, the prevalence of hypertension in Australia was 28.6 per 100 (95% CI, 25.0–32.3), and untreated hypertension was 15.2 per 100 (95% CI, 13.2–17.2) (3). High blood pressure (BP) can be controlled by lifestyle modification (such as reducing salt intake) or by taking medication. The effect of lowering BP for primary and secondary prevention of cardiovascular disease and stroke is well established, including for the elderly (4,5).

Knowledge about stroke risk factors in the population is reportedly poor (6–9). Programs designed to increase knowledge about BP and cardiovascular disease have been implemented in the United States (10), Canada (11), and in the United Kingdom (UK) (12). In Australia, the National Stroke Foundation (NSF) identified the opportunity to develop a 'Know your numbers' (KYN) community-based program for BP and other stroke risk factors, based on a similar UK program (13), and piloted the program in 2007 (14). In brief, the Australian KYN program is designed to encourage the general public to know their BP numbers and to self-assess their other stroke risk factors using a 'tick test'. The main feature of the program includes a free, standardized BP test at a 'pressure station' which is a resourced registration table located in the community (e.g. pharmacies, shopping centers, Rotary clubs, etc.). Health promotion educational information about BP and stroke is provided using brochures supplied by the NSF.

The KYN program is conducted by volunteers (health professionals, e.g. pharmacists; supervised pharmacy assistants; and supervised lay community members) who are provided with 'hands-on' standardized training. Each volunteer group received the same digital BP monitor (Omron IA1B, North Ryde, New South Wales) and a procedure manual including instructions for BP measurements. BP assessments were to be completed by, or supervised by, a qualified health professional familiar with the recommended national guidelines for BP measurement. Additional instructions included asking the person to be tested to be seated and relaxed, and to ensure that the arm used for measurement was free from constricting or thick clothing; to center the cuff over the line of the artery; and to wait two to three-minutes before taking another BP measurement. Common problems and

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advice were also included in the manual, as well as instructions for using the data collection forms and educational resources. Although BP testing is the main feature of KYN, the health promotion messages and educational materials are focused on multiple risk factors. This includes a self-assessment tick box survey and a guide to what action should be taken to reduce a person's overall risk based on the number of risk factors he/she self-identified and his/her current BP reading (14). If a BP result was $\geq 140/90$ mmHg, pressure station volunteers also documented whether they provided a generic referral letter for the person's doctor. This referral letter includes the KYN BP result and information about the purpose of KYN so that the doctor can decide whether there is a need for formal health assessments or referrals to a lifestyle program.

It remains unclear how effective community-based health promotion programs are for changing knowledge about stroke risks, and whether participation leads to health promotion actions. It is also unclear if the KYN program should be conducted at regular intervals or throughout the year. Initially, the KYN Program was conducted for one-week (Fig. 1). Since 2009, participating pharmacies in Queensland have also been able to run the KYN program on a permanent basis, as part of their day-to-day service.

Aims

The main aims of this study were to assess, in a sample of registrants participating in a three-month follow-up survey, retention of knowledge of risk factors and health conditions associated with high BP, and whether those who were advised to see their doctor sought treatment or performed other health promotion actions. *Our primary hypothesis was that people who participate in a KYN program would improve their knowledge of risk factors and health conditions associated with hypertension within three-months of attending a KYN program.*

Methods

Figure 1 provides an outline of the study design and information about when various Australian regions commenced their involvement in the KYN Program. All sites collected data on a KYN registration log. Only pressure stations providing the 'weeklong' program, where there was funding to support additional data collection in a sample of registrants, obtained consent from these registrants to do three-month follow-up surveys. Even though not all sites recruited registrants for the follow-up survey, we did randomly select sites from States where this aspect of the project

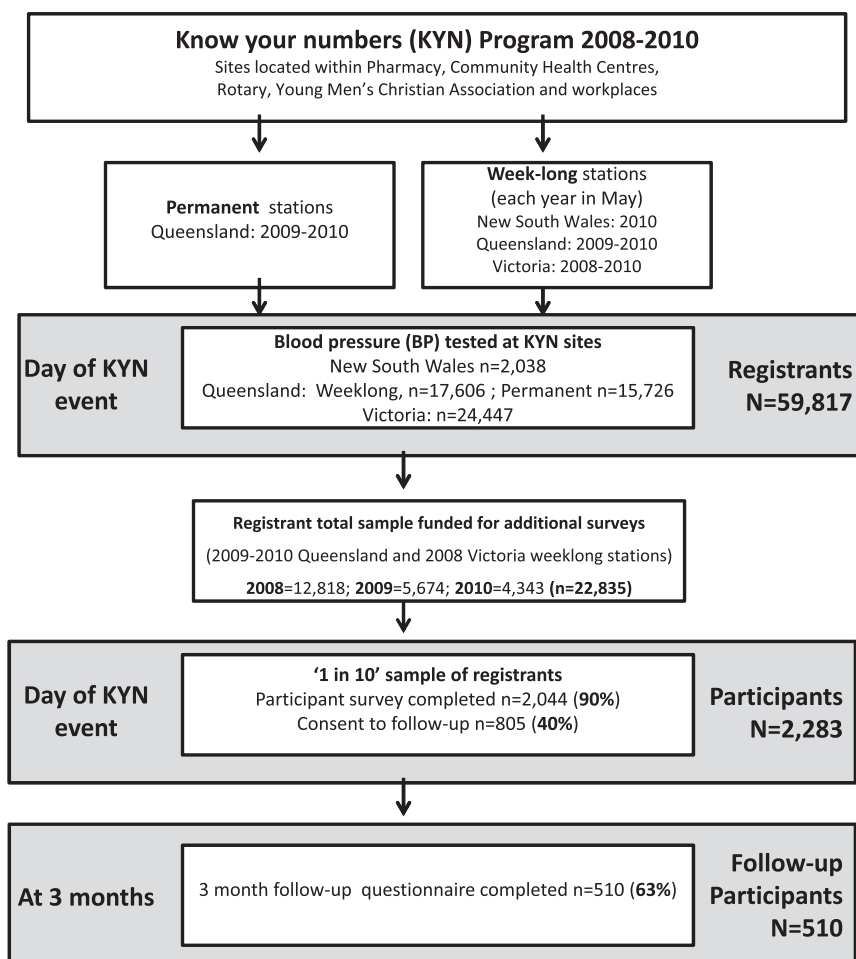


Fig. 1 Flowchart of registrants in the KYN Program (2008–2010).

was funded to participate in this component of the study. In each year we would randomly select a 50% sample of eligible sites ensuring a stratified distribution between urban and rural locations. At these selected sites, the additional survey data were obtained in a nonrandomized sample of registrants. Registrants who were requested to provide additional information were prospectively selected using a '1 in 10' sample design (i.e. every 10th person who had their BP checked) (14). This sampling method was determined to be the most pragmatic approach for this large-scale, multisite project since pressure station volunteers had variable research experience.

The additional baseline data and the written consent to be followed-up in three-months' time via a mailed survey were collected at the time of the KYN event. These surveys include self-reported medical history and risk factor profile information, as well as statements to assess knowledge of risk factors for hypertension and health conditions associated with hypertension using closed-ended lists of options. The three-month survey included additional questions to describe any health promotion actions undertaken by the participant. The participants who provided written consent to a three-month follow-up were sent reply-paid envelopes to return questionnaires. Nonresponders were followed-up by mail at least twice and then by phone (where telephone number had been provided) to increase the response rate.

Ethics approval for this study was provided by Austin Health Human Research Ethics Committee (H2007/03028) in September 2007, August 2008, and January 2011.

Data

Basic demographic information and the reason for participation were recorded via a registration log for each participant. Additional data for baseline and follow-up surveys were mostly categorical. In brief, gender, age group, medical history, knowledge of last BP reading, history of high BP, and referral to doctor were documented as categorical variables. BP readings were recorded as the systolic and diastolic continuous measurement. BP readings were then categorized according to Australian guidelines into grades of systolic and diastolic BP, where high BP was systolic BP ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg (15). When a BP level was between two categories, the highest value was used. High-normal was defined as 120–139/80–89 mmHg (15).

Data analysis

Descriptive statistics were performed using Intercool STATA 10.1 for Windows (Stata Corp. PL, College Station, TX, USA). The chi-square test was used for categorical and dichotomous variables to measure differences between groups. Differences in change in knowledge within the same individuals from baseline to three-month follow-up were compared using the McNemar's test. Means and standard deviations were calculated for systolic and diastolic BP readings. Level of significance was $P < 0.05$.

Results

Table 1 and Fig. 1 includes information about all registrants and the types of organizations involved in KYN between 2008 and

2010 to provide context for the registrant sample used to answer the research questions. We found that across all participating and nonparticipating sites in the additional sample data collection, the age and gender distributions of registrants were similar. About 60 000 registrants had their BP recorded by the end of November 2010. Almost two thirds of these registrants were women and about half were aged over 55 years. The majority of the registrants had their BP checked in a pharmacy. Just under half of registrants had high BP readings. Among registrants with a high BP reading, about one third claimed to not have a history of high BP. The main reason given by registrants for participating in KYN was that they were opportunistically 'passing by' (66%) or heard about it (15%) or have high BP and wanted it checked (15%). There was no difference between genders and reasons for participation. Registrants aged 55 years or more (14%) were more likely to report a history of high BP and wanted it checked than registrants aged less than 55 years (7%; $P < 0.001$).

Findings from the sample of registrants

There were 2044 of 2281 (90%) eligible registrants who agreed to complete the additional baseline survey (Fig. 1). The demographic characteristics of the sample registrants were similar to the total registrant cohort (Table 2). Additional data from this sample revealed a range of preexisting medical conditions and cardiovascular risk factors (Table 2). About one third of the sample registrants reported having previously been told they had high BP (defined as hypertension systolic BP ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg) by a doctor, and this was more common among women (64%) and older participants (75% if aged ≥ 55 years). Among the sample registrants with a history of high BP, 59% had a high BP reading on the day they participated in KYN. Among those with a history of high BP, most were taking at least one action to manage their BP, including taking medication (79%) and adopting a healthy lifestyle (57%). Among those with a previous history of hypertension at baseline, 9% reported taking no action to treat their hypertension.

Overall, 93% of sample registrants had had their BP checked before. For the majority of sample registrants (85%), this had been done within the last 12 months. Among all sample registrants, 24% (and 56% of those with high BP) were told by pressure station staff to seek advice from their doctor.

Sample registrants reported their intended 'next steps' for action. Most sample registrants with high BP (72%) detected at baseline from a KYN BP assessment intended to keep checking their BP; 61% intended to visit their doctor; and 35% reported that they would follow the KYN lifestyle tips. Among those identified with a high BP reading at baseline from a KYN BP assessment, 4% intended to do nothing about it.

Three-month follow-up survey findings from the sample registrants

Approximately two thirds of the sample registrants who gave consent completed the follow-up survey (Fig. 1). Among the 510 sample registrants who completed follow-up, 342 (67%) were women and 67% were aged over 55 years. The profile of participants who completed follow-up was consistent with the whole sample for gender (follow-up 67%; all registrants 63%) and history

Table 1 Summary of registrants tested in the 'Know your numbers' programs by year

	2008 (<i>N</i> = 13 925) <i>n</i> (%)	2009 (<i>N</i> = 16 452) <i>n</i> (%)	2010 (<i>N</i> = 29 440) <i>n</i> (%)	Total (<i>N</i> = 59 817) <i>n</i> (%)
Site of pressure station				
Pharmacy	5 956 (43)	11 054 (67)	25 106 (86)	42 116 (71)
Community health center	3 064 (22)	2 788 (17)	2 096 (7)	7 948 (13)
Rotary	2 275 (16)	519 (3)	1 280 (4)	4 074 (7)
YMCA	1 806 (13)	1 548 (9)	807 (3)	4 161 (7)
Workplace	542 (4)	266 (2)	72 (<1)	880 (2)
Other	282 (2)	263 (2)	–	545 (<1)
Tested in Queensland permanent pressure stations	–	2 909 (18)	12 817 (44)	15 726 (26)
Demographics				
Female [†]	8 328 (61)	10 355 (64)	18 127 (63)	36 810 (63)
Age 55 years or more [†]	6 812 (51)	8 641 (54)	16 731 (58)	32 184 (55)
BP readings [†]				
Systolic mean (SD)	132 (20)	136 (20)	135 (21)	134 (20)
Diastolic mean (SD)	81 (12)	82 (16)	82 (12)	82 (12)
BP categories* [†]				
Normal	2 881 (21)	3 155 (19)	5 233 (18)	11 269 (19)
High-normal	5 392 (39)	6 370 (39)	10 764 (37)	22 526 (38)
High	5 424 (40)	6 771 (42)	13 129 (45)	25 324 (43)
Knowledge of BP number				
Did not know their BP number [‡]	5 671 (42)	6 288 (40)	9 337 (33)	21 296 (37)
Reported no history of high BP [§]	7 376 (57)	8 194 (53)	12 569 (46)	28 139 (51)
Referral to doctor [§]	3 668 (29)	3 882 (26)	7 439 (28)	14 989 (27)
Recorded high BP check				
Did not know their BP number [‡]	1 914 (37)	2 293 (35)	3 675 (29)	7 882 (32)
Reported no history of high BP [§]	2 179 (43)	2 444 (38)	3 968 (33)	8 591 (36)
Referred to doctor [§]	3 021 (60)	3 420 (55)	6 454 (54)	12 895 (55)

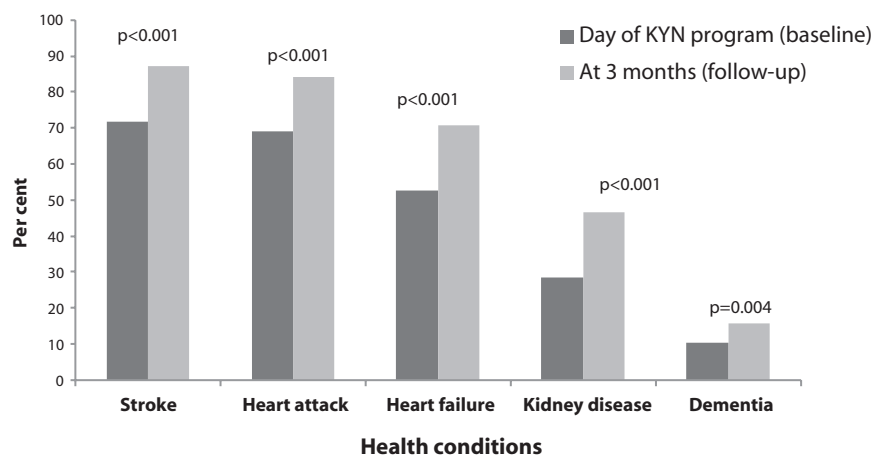
*Isolated systolic BP not reported as this represents <0.3% of data.

[†]<2% missing/unknown.

[‡]<5% missing/unknown.

[§]<8% missing/unknown.

High-normal, 120–139/80–89 mmHg; high, ≥140/90 mmHg; SD, standard deviation; YMCA, Young Men's Christian Association.

**Fig. 2** Change in knowledge about conditions associated with hypertension (*n* = 485). McNemar's test was used to estimate the *P* values.

of high BP (follow-up 53%; all registrants 50%), but not age (55 years or more: follow-up 67%; all registrants 55%; *P* < 0.001).

Changes in knowledge regarding risk factors for hypertension and conditions associated with hypertension

At follow-up, we found significant improvements from baseline in knowledge of 9 of the 11 risk factors for hypertension outlined in

the surveys (Table 3). Knowledge for all the health conditions assessed that are associated with hypertension, such as stroke and heart attack, improved from baseline to follow-up (Fig. 2).

Reported health promotion actions including visiting a doctor

Figure 3 provides a summary of the health promotion actions taken by respondents since participation in KYN. The most

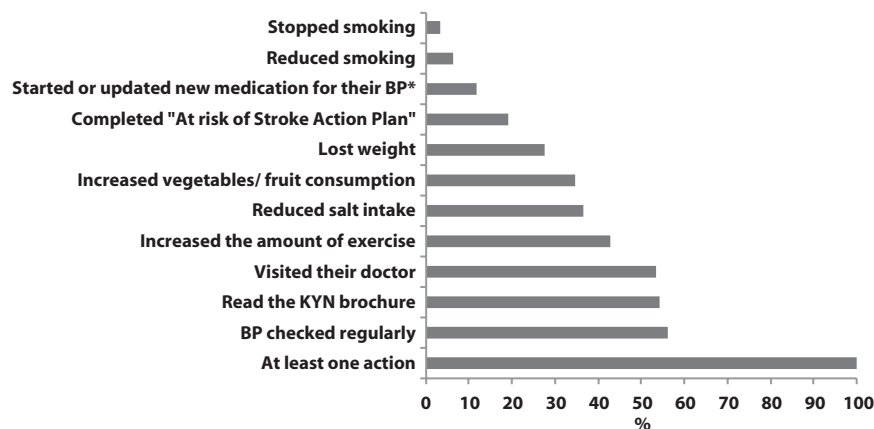


Fig. 3 Actions reported since participation in a 'Know your numbers' program#. #In total, 2044 actions were reported by the 510 participants because more than one action could be selected. The graph provides the overall summary results for each individual action as a proportion of the total actions reported. *Refers to either treatment participant is receiving or initiation of new treatment in undiagnosed participants.

Table 2 Baseline characteristics of the sample of registrants

Registrant sample characteristics	n (%)
Completed a participant questionnaire*	2 044
Female	1 327 (65)
Age 55 years or more	1 012 (50)
Born in Australia	1 597 (78)
Medical history†	
Hypertension (high BP)	668 (33)
Diabetes mellitus	167 (8)
Previous stroke/transient ischemic attack	72 (4)
Atrial fibrillation	64 (3)
Current smoker	269 (13)
Ex-smoker	495 (24)
Hyperlipidemia (high cholesterol/dyslipidemia)	419 (20)
Previous carotid endarterectomy	22 (1)
Previously told by a doctor that you have high blood pressure (hypertension BP > 140/90 mmHg)	729 (36)
Blood pressure category on day of KYN event	
Normal	432 (24)
High-normal	733 (40)
High	659 (36)

*In 2008, participants were recruited from Victoria and Queensland. In 2009 and 2010, funding was only available to obtain sample participants from Queensland; therefore, participants are not a 10% sample of all registrants.

†Medical history was self-reported based on the definitions shown and it is unknown whether the diagnosis was provided by a doctor or whether the participant was receiving any treatment for that condition.

common actions included having their BP checked regularly (56%); reading the KYN brochure (54%); and visiting their doctor (53%).

Overall, 28% reported that a KYN staff advised them to see their doctor and the majority did (Table 4). Among those with a 'high-normal' or 'high' reading found at baseline, about half reported being advised by KYN staff to see a doctor. Most respondents (75%) reported having their BP measured again following a KYN program and this was measured mostly by doctors (75%), followed by nurses (14%). Over 40% of respondents had commenced new BP-lowering medication after visiting their doctor

Table 3 Change in knowledge regarding risk factors for hypertension

Risk factors	Day of KYN N = 482 n (%)	Three-months N = 482 n (%)	P value
Excess weight	410 (85)	432 (90)	0.022
Stress	378 (79)	407 (84)	0.010
Lack of exercise	353 (73)	408 (85)	<0.001
Hypertension in family	328 (68)	374 (78)	<0.001
Eating too much salt	290 (60)	363 (75)	<0.001
Smoking	304 (63)	324 (67)	0.13
Excessive alcohol drinking	275 (57)	335 (70)	<0.001
Getting older	246 (51)	270 (56)	0.045
Some medicines	202 (42)	236 (49)	0.016
Lack of fruits and vegetables	154 (32)	212 (44)	<0.001
Being male	67 (14)	77 (16)	0.33

McNemar's test was used to estimate the *P* values.

Table 4 Health promotion actions following referral to a doctor after the 'Know your numbers' program

Health promotion actions from three-month follow-up respondents	N = 510 n (%)
Advised to see doctor	141 (28)
Sought advice from doctor	114 (81)
Reported actions following visit to doctor	
Commenced a new medication to lower blood pressure	50 (44)
Take medication to lower cholesterol	27 (24)
Take medication to thin my blood (e.g. aspirin)	17 (15)
Follow a healthy lifestyle (e.g. exercise, low salt diet)	62 (54)
No treatment advised for blood pressure	12 (11)

following a recommendation from a KYN pressure station volunteer.

Discussion

Little is known about the outcomes of opportunistic assessment of stroke risk factors in community-based settings. The current

UK KYN program does not collect follow-up information. An important contribution of this study was to demonstrate the impact of the Australian KYN program on knowledge attainment and health promotion in a sample of registrants over a three-month period. The findings from the follow-up surveys provided evidence that the Australian KYN program improved community knowledge of risk factors for high BP within three-months of attending a KYN program. About half of the respondents had visited their doctor and most had undertaken health promotion actions following participation in KYN. More than two thirds understood that high BP is a risk factor of stroke and needs to be treated. New medication for BP was commenced in 44% of people advised to see a doctor who then visited their doctor.

Overall, the KYN program provides an opportunity for people to have their BP measured, better understand their BP results, and obtain health promotion information about BP and stroke prevention. In the total registrant sample, a large number of potentially undetected or uncontrolled cases of high BP in the community were found and, worryingly 9% of self-reported hypertensives were not performing any actions to lower their BP. These findings suggest important health promotion opportunities and demonstrate the need for improved knowledge, detection, and management of BP in Australia.

There are several potential limitations of this study. Although the pressure stations were located in convenient locations in the community to reach people who may not usually have their BP checked, the registrants may be considered a convenience sample and are not representative of the general Australian population. The KYN program tended to attract older people (>55 years of age: KYN 57% vs. Australian population 34%) and women (KYN 62% vs. Australian population 50%) (16), which was partly influenced by the venues in which the program is undertaken. Most participants were registered in pharmacies, so they may already have health conditions relevant to stroke and hypertension, potentially overestimating our results. Moreover, people who nominated to have had their BP checked may have some interest in their health and may be more likely to act on advice or seek to understand more about their health. It is also likely that the total number of people tested is underestimated, as not all pressure stations returned registration logs. Missing data cannot be excluded. It is also not possible to know how many registrants have participated more than once, as personal identifying information is not recorded, with the exception of those who gave consent to a follow-up survey.

Our findings are consistent with some recent similar studies. A cardiovascular screening program was undertaken in 14 Australian community pharmacies and 655 individuals were screened (17). The program was different to the KYN program in several ways. First, trained research pharmacists were used in a convenience sample of pharmacies where workflow would not be impacted on; second, these research pharmacists performed a 45-min screening assessment with a range of tests to assess 10-year cardiovascular risk based on the Framingham absolute risk equations; and third, individuals who had diagnosed hypertension, hyperlipidemia, or preexisting cardiovascular disease and age younger than 30 years were excluded. Similar to our study, these authors assessed knowledge of cardiovascular risk factors at

the time of screening and at three-months. The authors reported a similar median age (54 years), but a greater proportion of female participants (71%) than in our study and about one third had high BP. The follow-up response rate of 54% was less than in our study (17). Although our populations were somewhat different, these authors also showed a small (< 1%) statistically significant improvement in the mean risk factor knowledge score at three-months following provision of standardized education materials and health promotion information directly to participants. Also, 83% of respondents that were followed-up had discussed their results with their doctor (17).

Several smaller studies have also been conducted in different countries. In the Sacramento community stroke screening education study ($n = 400$), 78 high-risk subjects were followed-up, but only modest effects in knowledge transfer and retention were found at three-months and 73% of respondents did not change their health practices (18). In another study, 107 participants were followed up at one, three, and six-months. These authors showed that about half of the participants reported undertaking a health promotion action at six-months following their community-based screening program (19). Kleindorfer *et al.* showed that a program to increase knowledge about stroke and risk factors in beautician settings had negligible effects on knowledge of risk factors, with the main benefits observed for increasing knowledge about stroke warning signs (20). Other investigators have found health promotion programs to be effective at modifying risk, but these have been much more intensive in terms of exposure to a range of educational strategies over a much longer period of contact (21). In contrast to these other studies, the KYN program has been shown to be effective in a large sample without restrictions on participation, among a large number of community-based venues, and without having to provide additional resources to support data collection. For the first time, we demonstrated the feasibility and benefits of undertaking a large-scale, low-cost community-based health promotion program for stroke.

Conclusions

We have provided evidence to show that the Australian KYN program is a successful model for increasing knowledge about risk factors for high BP and the health conditions associated with hypertension, while also prompting participants to take action to modify their cardiovascular risk. In 2011, the program was modified to include a pilot study on the feasibility of adding an assessment for diabetes risk.

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