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MEDICINE

Patient Empowerment Through Community-Based Hypertension Educational Programme in the West of Ireland

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Abstract

Hypertension is an increasingly prevalent condition in Ireland, affecting in excess of 50% of those over 50 years of age. While many of them undergo adequate clinical treatment, the standard of blood pressure control still remains sub-optimal mainly due to poor medication adherence fuelled by poor awareness level. The main objective of the study was to explore the impact of a structured hypertension educational intervention on patient knowledge, lifestyle behaviours and blood pressure control. Subjects for this study were recruited from disadvantaged/underserved communities in Mayo, Ireland. A multidisciplinary team comprising of specialist nurses, physiotherapist, dietitian, cardiovascular consultants and research assistants were responsible for screening and recruiting participants, collecting patient data and delivering the educational programme. Eligible participants (adults of 40 years and older) with high blood pressure were randomly assigned to either a control group or an intervention group. The control group were given standard care which included blood pressure and body mass index (BMI) measurements, lifestyle guidance and referral to general practitioner in accordance with European Society of Cardiology (ESC) guidelines. The interventional group received an educational session to improve knowledge and understanding of hypertension. A follow-up assessment was conducted for all participants 4–6 months after the educational interventional programme. A total of 102 participants were included in this study. Baseline records showed no significant difference in gender proportion, mean age, mean BMI, mean systolic blood pressure (SBP) and diastolic blood pressure (DBP) between control and intervention groups. At the follow-up assessment, a statistical reduction of mean SBP (p=0.007) and mean DBP (p=0.004) was observed in the intervention group in comparison to baseline records along with a significant increase in self-reported weekly exercise time, reduction in the number of active smokers and units of alcohol consumed weekly. Intervention group subjects had greater blood pressure reductions (mean decrease in mmHg and absolute percentage reduction) compared to control group subjects for each of the four blood pressure indicators. Providing a tailored education to individuals with hypertension can positively impact on hypertension control, knowledge and self-care management within community-based settings.

Keywords Community-based education · Hypertension · Patient empowerment · Blood pressure

This article is part of the Topical Collection on *Medicine*

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Introduction

Blood pressure (BP) is the force applied on the arterial walls by blood circulating in the body. Hypertension, a common clinical disorder, is caused when the pressure exerted by circulating arterial blood against the arterial wall is higher than normal. The measured blood pressure value is indicated by the pressure on the blood vessels during contraction of the heart and the pressure on the blood vessels between each contraction of the heart known as systolic pressure and diastolic pressure, respectively [1]. Hypertension is defined as a systolic blood pressure (SBP) of 140 mm Hg or more or a diastolic blood pressure (DBP) of 90 mm Hg or more, or taking antihypertensive medication [2]. Excessive arterial pressure caused due to high blood pressure hardens the arterial walls and decreases blood and oxygen flow to the heart which poses as a major threat for angina, heart attack, heart failure, stroke and other cardiovascular and renal diseases [3]. The majority of patients with hypertension remain unaware of the impending threat due to lack of symptoms. Often the signs and symptoms are misunderstood, hence why hypertension is also known as the 'silent killer' [4].

Currently, hypertension presents a substantial challenge towards public health worldwide and is accountable for 10.7 million deaths worldwide in 2015 alone which is a 50% increase over the estimations from 1990. It has been predicted that the number of people affected by hypertension will increase up to 1.5 billion by 2025. As the third leading cause of mortality, the risk of death by stroke increases by 6.6% in young adults with hypertension [5–9]. Surveys conducted by EUROASPIRE on 22 European counties demonstrate hypertension as the underlying cause in 42% of deaths in Europe per year and responsible for 25% of myocardial infarctions per year in Europe [10]. In Ireland, several studies have recorded the prevalence of hypertension in the community. The Survey of Lifestyle, Attitudes and Nutrition in Ireland (SLÁN) 2007 found that around 60% of the people, 45 years and older had high blood pressure. 'Heart Smart', a study with a sample of 1491 individuals, identified that more than 40% of 50-year-old adults were hypertensive [11]. Furthermore, the TILDA study estimated 64% of the community of age > 50 years have elevated BP in Ireland. It was also revealed from this study that 50% of the population with hypertension are aware of their medical condition, out of which 50% do not meet their targeted blood pressure levels even with medications [12].

Previously conducted knowledge intervention randomised trials analysed patient's choice of a healthy lifestyle when sensitised about symptoms and risks associated with hypertension. A trial carried out in England from 2003 to 2006 revealed significant positive improvements regarding hypertension awareness as well as healthy lifestyle choices [13]. Another randomised trial conducted in 2010 aiming to determine the effect of BP control amongst patients when using clinic and nurse versus telephone follow-up concluded that nurse clinic had an increased positive effect on patients attempting to control high blood pressure and adhering to healthy lifestyle choices compared to follow-ups conducted over the telephone [14]. Croi Heart and Stroke Foundation recently conducted an observational study in Galway to assess the effect of knowledge and awareness on hypertension on blood pressure control and patient style of living. Results from this study showed a significant improvement in patient knowledge, patient weight and reduction of blood pressure levels where applicable [11]. However, there is a deficit of study and trial data revealing increased patient consciousness and patient blood pressure control in response to educational interventions within the European context. This study aims to assess the impact of a structured hypertension educational intervention on patient knowledge, lifestyle behaviours and blood pressure (BP) control. The main objectives of this study are to identify and target high-risk individuals with hypertension and obtain a baseline risk factor profile of individuals living in the West of Ireland; to empower individuals to take control over their health thus reducing their risk of cardiovascular disease; and to ascertain the impact of the educational intervention on both lifestyle and risk factors amongst high-risk individuals at a 6-month follow-up.

Methods

This study focused on identifying individuals with a pre-existing diagnosis of hypertension who were not achieving the recommended targets for blood pressure control (<140/90mmHg). The inclusion criteria for the screening were adults of 40 years and older. Participants were required to have a proficiency in the English language, so they could understand and answer the questionnaire (this was assessed subjectively during the first contact with the investigator). Adults <40 years old or those whose BP could not be measured in either arm with an automated blood pressure monitor due to a medical contraindication, such as bilateral lymphoedema, were excluded from the study. Those who met the eligibility criteria were recruited to an observational study and randomly divided into control and intervention groups to determine the influence of a novel hypertension educational programme on patient awareness, healthy lifestyle choices and blood pressure control.

Settings

This observational study was conducted by Croi Heart and Stroke Foundation, a charitable organisation primarily located in the west of Ireland to recruit individuals from disadvantaged/underserved communities. The target population for the programme included males/females over 40 years

with one or more risk factors for heart disease, with a special emphasis being placed on those from the lower socioeconomic groups, which have little income or wealth to buffer against the negative impacts of an adverse health event (health shock) amongst adult household members. These individuals were targeted through a variety of community-based settings which involved advertising through local media, community pharmacies and collaboration with local community organisations such as the traveller support groups, farming communities, women's groups, active retirement groups and migrant population to identify eligible individuals. A free community-based BP screening event was conducted by cardiovascular nurse specialists and research assistants in local pharmacies and Family Resource Centres (15 events).

Screening Procedure for Participants

Screening included BP assessment and a detailed individualised risk assessment supported by education and advice. A personal record card, baseline questionnaire, lifestyle advice and educational literature were provided to each participant. Referral to GP was in accordance with European Guidelines for Cardiovascular Disease Prevention 2016 [15].

Participants were asked to complete a short questionnaire designed to assess their current knowledge of blood pressure, associated risk factors and general lifestyle behaviours. Questions for this study were custom designed based on previously approved questionnaires [16–18].

More than 200 participants were screened, and 151 individuals met the study criteria and consented to participate, with a total of 102 participants completing initial and follow-up stages of the study. Men and women receiving medical treatment for hypertension were eligible for this study. Inclusion criteria included males and females >40 years and proficiency in the English language. Exclusion criteria were simply individuals not receiving medical treatment for hypertension. English proficiency was included as an exclusion criterion in the screening procedure in order to ensure that selected participants were capable of understanding and answering the questionnaire that would determine recruits knowledge regarding hypertension.

Randomisation

The eligible individuals were recruited and randomly allocated control and intervention groups to determine the influence of a novel designed educational programme on hypertension, patient awareness, healthy lifestyle choices and patient's blood pressure control. Using machine-generated random numbers, eligible participants were randomly divided into control and intervention groups. Intervention group includes educational intervention delivered within 3 months after screening and follow up BP assessment and questionnaire at 4–6 months later. Control group includes no educational intervention delivered until after the research project was completed and follow up BP assessment and questionnaire at 4–6 months later.

Clinical Parameters

Participant's blood pressure was measured initially on the day of screening by cardiovascular nurse specialists using previously validated Automatic Blood Pressure Monitor (Omron M6). A reference blood pressure was considered after measuring the blood pressure on both arms. For patients with recorded reference blood pressure ≥ 140 mmHg, blood pressure measurement was repeated after an interval of 5 min. For participants whose second recorded blood pressure measurement was also ≥ 140 mmHg, these were considered as high blood pressure in reference with European Guideline for the Management of Arterial Hypertension 2013 [19] and referred to GP as required for further management.

Height and weight of all participants recruited for this study were measured during the screening process and supervised by clinical nurses. Heights were measured without head wear and shoes with the help of Seca Leicester Height Measure. TANITA BWB-800S is an approved weight scale used to measure recruited participants weights without any heavy objects like jackets, watch, and wallet. BMI was calculated using measured height and weight of the recruits. Participants with BMI ≥25–29.9 kg/m^2 were marked as overweight, and those with BMI ≥ 30–35 kg/m^2 were marked as obese [18].

Educational Intervention

The educational intervention was led by a Croí Cardiovascular Nurse Specialist and a Consultant Cardiologist. Participants from the interventional group (n=54) were invited to attend the structured interactive educational programme on lifestyle management of hypertension. The aim of this 3-hour interactive session was to create knowledge and awareness on hypertension and was delivered by a multidisciplinary group including specialist nurse, dietician, physiotherapist and cardiologist. Educational topics included understanding and taking control of BP, the effects of exercise and diet on BP, smoking cessation, stress management and current medication updates and adherence. Role and benefit of antihypertensive medication along with the importance of continuing medication when prescribed by GP was discussed by a cardiologist consultant. Every participant received booklets on health issues related to unmanaged hypertension at the end of the session. All participants of both control and intervention groups were called back for a follow-up assessment of their blood pressure, weight and height after 4–6 months from the educational

interventional session and were also required to complete the same questionnaire used for screening.

Statistical Analysis

SPSS package version 22 was used to perform most of the statistical analysis including estimation of sample size, sample paired *t*-tests and Chi-square tests. Frequency and percentiles were used to report categorical variables, and non-categorical variables were reported using mean and standard deviations. *t*-test was used to compare various variable means between control and intervention groups, and Pearson likelihood ratio was used to inspect any significant changes caused by the educational session, and the comparison value was reported as *p*-value. *p*-value < 0.05 was considered as statistically significant.

Results

General Baseline Profile

A total of 102 adult participants over 40 years of age were eligible to be included in this observational study and were randomly divided into control and intervention groups with 48 and 54 participants in each group, respectively. Only those who participated in both stages to completion were included so comparison could be made. Figure 1 shows the number of participants based on gender in individual groups until the end of the study. Male participants dominated both control and intervention groups with 54.1% (*n*=26) and 59.2% (*n*=32) in control and intervention groups respectively.

Table 1 displays the clinical characteristic and demographics collected at the baseline of this study and shows no major variation between control and intervention groups of participants. Overall mean age and standard deviation of all participants was reported as 67±5 years with mean ± SD in individual control and intervention groups were calculated as 68.0 ± 9.2 and 67.5 ± 8.9, respectively. Calculated mean ± SD for BMI in kg/m^2 for participants at baseline was reported as 29.6 ± 4.7 and 30.9 ± 4.6 for control and intervention groups. Table 2 demonstrates other collected information from the participants during the screening process considered as the baseline for this study. Twenty-two and 30 participants from control and intervention groups reported regular consumption of alcohol with a weekly estimate of consumed alcohol units of 9.2 ± 9.9 and 7.2 ± 5.6, respectively. Two participants from each group affirmed as smokers, and all participants from both the groups confirmed to be on anti-hypertensive medications. During the screening procedure, 34% and 49.1% participants from control and intervention groups recalled not consuming additional salt during meals. The mean of systolic and diastolic blood pressure measured at baseline from both right and left arms of participants shows no significant difference between control and intervention groups. Table 3 shows the mean systolic pressure of control and intervention groups as 147.63 and 149.36, and the mean diastolic pressures of both control and intervention groups were 80.83 and 79.2, respectively.

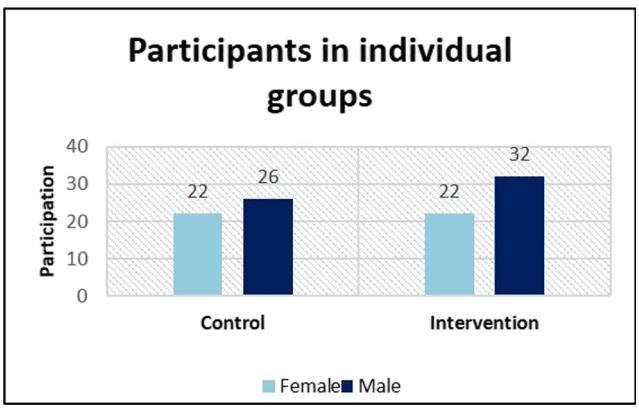

Fig. 1 Number of participants in individual groups based on gender

Knowledge and Awareness of Hypertension

At screening, the level of knowledge and awareness of hypertension among the participants of both groups was moderate as shown in Table 4. 74.5% of the participants of the control group marked the correct meaning of the term 'hypertension', and 63% of the participants of the intervention group answered the same question correctly. The remaining 13 participants of the control group and 20 participants of the intervention group had inaccurate knowledge and believed hypertension to be high-stress level or high blood sugar. However, 87% and 73.1% of the control and intervention group were unaware regarding the normal range of blood pressure, and only a handful of participants were aware of the desirable blood pressure range from both the groups. A greater part of both groups believed changing lifestyle results in lowering blood pressure level, and 69.8% and 51.1% of the participants in intervention and control groups respectively were unaware of the side effects and risks to hypertension. Overall participants at baseline had less than desired knowledge and awareness regarding hypertension and risks associated with it along with roles of anti-hypertensive medications and regular exercise in controlling blood pressure level. Compared to baseline profile, participant's knowledge and awareness regarding hypertension in both the groups, a considerable improvement can be noticed among the participants, especially of the intervention group at the end of the study. More participants knew the correct meaning of the term 'hypertension', risks associated with hypertension, normal range of blood pressure and the importance of anti-hypertensive medications and regular exercise in maintaining the desired range of blood pressure. The participants were advised to visit their general practitioners

Table 1 Clinical and demographic parameters collected at baseline of the study

Variables	*Control*		*Intervention*	
	n (%)	Mean ± SD	*n* (%)	Mean ± SD
Gender (male)	26 (54.1%)		32 (54.23%)	
Gender (female)	22 (45.8%)		22 (40.74%)	
Age in years (male)		68.4 ± 8.0		65.9 ± 8.8
Age in years (female)		67.6 ± 10.6		69.8 ± 8.9
Age in years (all)		68.0 ± 9.2		67.5 ± 8.9
BMI in kg/m^2		29.6 ± 4.7		30.9 ± 4.6

(GP) at baseline assessment. They were asked about attendance to GP as advised at baseline assessment (see Table 4).

Blood Pressure Level Variation from Baseline Until End of Study

Throughout this observational study, blood pressure measured during the screening procedure was considered as baseline, and measurements recorded 4–6 months after conducting the knowledge intervention session were considered as end-of-study recording. From Tables 5 and 6, an overview of the mean systolic and diastolic blood pressure measured both on right and left arm of participants along with the changes in the blood pressure measurement from baseline until end of study are presented. There were minor statistically significant mean differences between the two groups prior and post to the educational intervention session as indicated in Fig. 2. However, through paired *t*-tests for each BP indicators (SBP-R, SBP-L, DBP-R and DBP-L) between control and intervention groups, a favourable improvement in both systolic and diastolic pressure was noticed among the intervention group subjects when compared to subjects of the control group. Intervention participants underwent favourable improvements in terms of both systolic and diastolic blood pressure; however, control group subjects showed improvements only in diastolic pressure and not in systolic pressure. The bar plot in Fig. 2 clearly shows the mean systolic and diastolic measurements obtained from both baseline and end of the study. The figure also compares the statistical mean change in all four blood pressure indicators between the control and intervention groups, and better improvement in the interventional group can be clearly observed in contrast with the control group.

Lifestyle Choices and Clinical Parameters After Awareness Session

No statistically significant difference was noticed in terms of BMI and weight from baseline until the end of the study in either interventional or control group as seen from Table 7 parts a and b. In regards to the minutes of exercises per week, subjects from both the groups underwent an increase in the self-reported weekly exercise minutes as shown in Table 7 part c. Participants of the control group underwent a statistically significant mean increase in weekly exercise minutes with a *p*-value 0.004. Mean weekly exercise minutes of the intervention group also show minor improvements from the baseline until the end of the study but hold no statistical significance.

Medication Use at Baseline and End-of-Study Assessment

Table 8 indicates the cardiovascular medications taken by intervention group patients at the baseline and end-of-study assessment periods. The changes in use over the course of the research study are also shown. Most notable amongst the

Table 2 Demographic parameters collected from participants at baseline of the study

Variables	Control		Intervention	
	n (%)	Mean ± SD	*n* (%)	Mean ± SD
Days of exercise per week		3.9 ± 2.5		4.5 ± 2.5
Alcohol intake (yes)	22 (48.9%)		30 (58.8%)	
Alcohol units per week		9.2 ± 9.9		7.2 ± 5.6
Smoker (yes)	2 (4.5%)		2 (3.8%)	
Additional salt intake (no)	16 (34.0%)		26 (49.1%)	
On anti-hypertensive medication	48 (100%)		54 (100%)	

Table 3 Calculated mean blood pressure of both groups (control and intervention) measure during screen process from both the right and left arms of recruited participants

Mean	Systolic control base (R) 147.89 *147.635*	Systolic control base (L) 147.38	Diastolic control base (R) 80.81 *80.83*	Diastolic control base (L) 80.85
Mean	Systolic intervention base (R) 148.57 *149.36*	Systolic intervention base (L) 150.15	Diastolic intervention base (R) 79.89 *79.2*	Diastolic intervention base (L) 78.51

observed changes in medication use is the reduction in ACE inhibitors for seven patients, followed by the increase in taking ARBs by four patients.

Overall, there was a reduction of two medications being taken by the intervention group patients. However, it merits pointing out that information on cardiovascular medications was not available for four patients at the end-of-study assessment compared to such information not having been collected for only two subjects at the outset of the study.

Discussion

This observational study was conducted to determine the level of knowledge of hypertension and awareness of the risks posed due to high blood pressure as well as ways of controlling blood pressure among rural underserved Irish community. A similar observational study with the educational intervention was conducted on a segment of the Irish population in Galway in 2017 [11] which resulted in considerable

Table 4 Baseline and the end-of-study knowledge and awareness profile for all participants in both the control and intervention groups

Correct answers to questionnaire	Control *n* (%)		Intervention *n* (%)	
	Start	End	Start	End
Meaning of the term 'HTN' * High blood pressure	35 (74.5)	33 (70.2)	34 (63.0)	39 (72.2)
Would lowering high BP improve a person's health? * Yes	43 (91.5)	46 (95.8)	54 (100)	52 (96.3)
Recommended BP target? * <140 / 90	6 (13.0)	6 (13.0)	14 (26.9)	16 (30.2)
Which BP number is important? * Both numbers (top and bottom)	11 (23.4)	12 (25.0)	12 (22.2)	16 (29.6)
Can lifestyle changes help lower BP? * Yes	44 (93.6)	43 (89.5)	53 (98.1)	53 (98.1)
Most people can tell when their BP is high? * False	24 (51.1)	23 (47.9)	24 (44.4)	28 (52.8)
Uncontrolled BP can lead to which of the following? * Kidney failure	23 (48.9)	13 (27.7)	16 (30.2)	25 (46.3)
Individuals who are taking BP medications do not need to exercise regularly? * False	40 (85.1)	42 (87.5)	51 (94.4)	47 (87.0)
Most people with high BP need more than one medicine to control their BP? * True	30 (63.8)	28 (58.3)	23 (42.6)	30 (55.6)
Advised to visit GP at 'baseline assessment'?				
* Yes	16 (34)		21 (38.9)	
* Yes, in near future	4 (8.5)		0 (0.0)	
* No	27 (57.4)		29 (54)	
Did you visit GP as advised at 'baseline assessment'?				
* Yes	8 (17)		13 (24.1)	
* No	4 (8.5)		7 (13)	

Table 5 Change in blood pressure measurements for control subjects from baseline to end-of-study assessment periods

	Control						
	Baseline		End-of-study		Mean change	Percentage change in blood pressure (mmHg)	Paired *t*-test
	Mean	SD	Mean	SD	mmHg	%	*p*-value
Systolic blood pressure-R (SBP-R) in mmHg	147.89	20.675	145.81	19.871	↓ 2.08	−1.4	0.489
Diastolic blood pressure-R (DBP-R) in mmHg	80.81	10.664	77.74	9.451	↓ 3.07	−3.8	0.027
Systolic blood pressure-L (SBP-L) in mmHg	147.38	20.274	146.06	22.149	↓ 1.32	−0.9	0.642
Diastolic blood pressure-L (DBP-L) in mmHg	80.85	11.44	76.68	9.705	↓ 4.17	−5.2	0.018

improvement of community knowledge and awareness. In this study, the baseline awareness levels regarding health risks and symptoms of hypertension comparable with a number of similar studies conducted previously in Ireland [11, 20] and in other countries like Thailand and Jordan [21, 22] where the community having sufficient knowledge was less than 50%. The results of this study reveal that more than 75% of the participants were unaware of the significance of both systolic and diastolic blood pressure. Almost 80% of this study subjects did not know the normal levels of blood pressure with less than 50% of the participants having a clear understanding of the health risks caused by hypertension. Such findings indicate substandard knowledge regarding hypertension among the community in contrast to similar studies conducted in the USA and China [23, 24] which reports a much higher awareness level among its community. Such a difference among community awareness regarding rising blood pressure which currently possesses a substantial challenge in public health could be due to lack of prior publicity and promotional efforts taken by health care professionals and institutions along with governmental bodies on health issues related to rising blood pressure. However, a chance to improve public knowledge still exits as studies like this distribute basic knowledge which may create a path to public awareness in due course of time.

At baseline, a total of 70.5% of our subjects were screened with blood pressure higher than 140/90 mmHg. The mean systolic pressure was 148.49 mmHg, which was relatively higher than the observed systolic pressure of 135mmHg in other Irish National Studies conducted in 2007 [25], however, lower than the mean (153 mmHg) observed in a similar study carried out in Galway [11]. The mean diastolic blood pressure observed in our study of Mayo community was 80.01 mmHg which was again quite higher than mean diastolic pressure observed in other Irish studies [25] (80.01 mmHg v/s 77 mmHg) and slightly lower than that observed in the Galway Study (84 mmHg v/s 80.01 mmHg). These observations draw attention to an underlying issue with controlling blood pressure within the Mayo community despite the minimal sample size which along with the low awareness level among the Mayo population calls for prompt preventive actions to address this issue.

Lifestyle parameters taken into consideration at the beginning of this study were not favourable considering previous Irish studies [25, 26]. Mean BMI and weight of participants recorded at the baseline of this study were 30.26 kg/m^2 and 84.24 kg which indicated insignificant differences between the control and intervention. At the end of this study, no significant improvement was noticed in the mean BMI or weight when compared with the baseline mean values (mean weight reduction was 0.32 and 0.79 kg in control and intervention groups, respectively). However, weekly exercise minutes logged by participants at EOS increased significantly in comparison with the baseline numbers which indicates a rise in awareness level among study subjects regarding the benefits of exercise in controlling BP. End-of-study measurements was conducted approximately 4–6

Table 6 Summary of change in blood pressure measurements for intervention subjects from baseline to end-of-study assessment periods

	Intervention						
	Baseline		End-of-study		Mean change	Percentage change in blood pressure (mmHg)	Paired *t*-test
	Mean	SD	Mean	SD	mmHg	%	*p*-value
Systolic blood pressure-R in mmHg	148.57	19.74	143.74	21.439	↓ 4.83	−3.3	0.052
Diastolic blood pressure-R in mmHg	79.89	12.87	75.3	12.37	↓ 4.59	−5.7	0.002
Systolic blood pressure-L in mmHg	150.15	18.9	143.26	21.75	↓6.89	−4.6	0.007
Diastolic blood pressure-L in mmHg	78.51	14.118	73.25	13.062	↓ 5.26	−6.7	0.004

Table 7 (a) Change in BMI for control and intervention subjects from baseline to end-of-study assessment periods, (b) change in weight for control and intervention subjects from baseline to end-of-study assessment periods, and (c) change in minutes of exercise for control and intervention subjects from baseline to end-of-study assessment periods

a

	Baseline		End of study		Change from baseline to EOS	Percentage change in BMI units	Paired *t*-test
Body mass index (Kg/m^2)	*Mean*	*SD*	*Mean*	*SD*	*BMI units*	*%*	*p-value*
Control (*n*=48)	29.60	4.67	29.44	4.50	↓ 0.16	−0.54	0.282
Intervention (*n*=54)	30.92	4.57	30.66	4.69	↓ 0.26	−0.84	0.141

b

	Baseline		End of study		Change from baseline to EOS	Percentage change in Kg body weight	Paired *t*-test
Weight (kg)	*Mean*	*SD*	*Mean*	*SD*	*Kg*	*%*	*p-value*
Control (*n*=48)	81.87	17.17	81.55	16.70	↓ 0.32	−0.39	0.427
Intervention (*n*=54)	86.61	14.95	85.82	15.92	↓ 0.79	−0.91	0.063

c

	Baseline		End of study		Change from baseline to EOS	Percentage change in minutes/week	Paired *t*-test
Exercise (minutes/week)	*Mean*	*SD*	*Mean*	*SD*	*Minutes/week*	*%*	*p-value*
Control (*n*=28)	154.11	100.78	222.50	152.45	↑ 68.39	44.38	0.004
Intervention (*n*=31)	255.32	273.87	294.68	217.08	↑ 39.36	15.42	0.453

months after completion of the knowledge intervention sessions which is a relatively short time frame for any significant weight reduction [25].

Results from this study show a considerable decrease in alcohol consumption among participants at EOS when compared to alcohol consumption at baseline. Baseline records of alcohol consumptions of male participants in the control group were 11.3 units/week and 9.6 units/week among male participants in the intervention group. Recorded consumption of alcohol among female participants was <5 units/week in both groups. Considerable reduction in self-reported weekly alcohol consumption was noticed among the male participants at the end

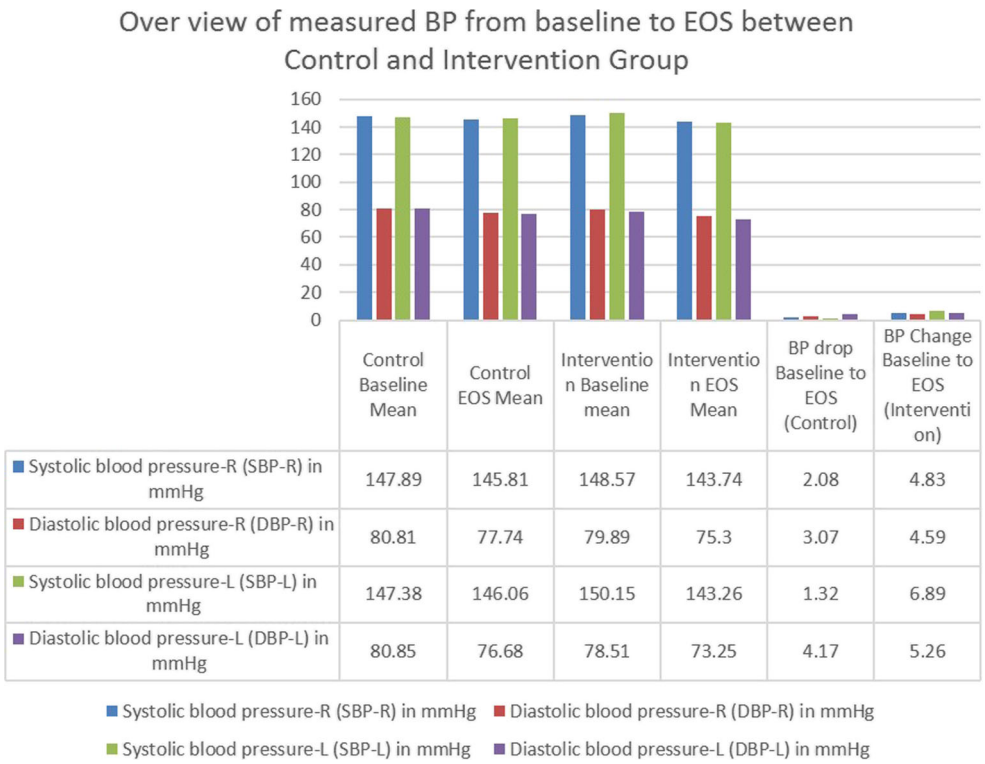

Fig. 2 Summary of the statistical mean of all four BP-related indicators (SBP-R, SBP-L, DBP-R, DBP-L) between both control and intervention groups. Mean reductions in all the four indicators until the end of the study are also shown for both control and intervention groups

Table 8 Medication use at baseline and end-of-study assessment

Baseline		End of study (EOS)		Change from baseline to EOS	
Medications	Frequency	Medications	Frequency	Medications	Frequency
ACEi	18	BB	17	ARB	+4
BB	16	ARB	15	BB	+1
CaCB	15	CaCB	15	Diuretic	+1
ARB	11	ACEi	11	CaCB	0
Diuretic	8	Diuretic	9	ARB + diuretic	0
ARB + diuretic	4	ARB + diuretic	4	Other	0
Other	4	Other	4	ARB + CaCB	0
ARB + CaCB	2	ARB + CaCB	2	ACEi + diuretic	0
CaCB + ARB + diuretic	2	ACEi + diuretic	2	ACEi + diuretic + CaCB	0
ACEi + diuretic	2	CaCB + ARB + diuretic	1	ACEi + CaCB	0
ACEi + diuretic + CaCB	1	ACEi + Diuretic + CaCB	1	CaCB + ARB + diuretic	−1
ACEi + CaCB	1	ACEi + CaCB	1	ACEi	−7
Total$^{\infty}$	84	Total$^{\Omega}$	82	Total	−2

∞Information on medications for two patients was not available

$^{\Omega}$ Information on medications for four patients was not available

of this study (9.2 vs 6.6 units/week in control, 9.6 vs 6.6 units/week in intervention), which further demonstrates an upsurge in health awareness level among participants. Even though the percentage of smokers among the participants was very low, a similar positive trend was noticed among them too. At baseline two individuals from each group self-reported as smokers which reduced by 50% in both the groups by EOS.

In this study, inclusion criteria necessitated a known diagnosis of hypertension, and careful attention was given in order to recruit only participants with existing hypertension solely to avoid recruiting individuals suffering from 'white-coat hypertension' syndrome. Most variables used in this study other than blood pressure, height, weight and BMI were self-reported by participants which may be influenced by inaccurate recall. Following a more focused evaluation procedure would have reduced the influence caused by such on the EOS results. Short-term follow-up phase on a small sample was used to increase the effectiveness of the knowledge interventional sessions. However, only one follow-up phase 4–6 months after a 3-hour knowledge interventional session might have too short of a time to accurately access lifestyle changes adopted by participants. Incorporating a second intervention knowledge session with a second follow-up phase could have meticulously captured the long term effects of adopted healthy lifestyle changes among the participants.

Conclusions

This study provides a short-term educational interventional and analyses the effects caused by such interventions on the lifestyle habits and awareness levels of the participants along with measures adopted by participants to achieve targeted blood pressure levels. At baseline, no differences in gender proportions, mean age, mean systolic and diastolic blood pressure (SBP; DBP) or years since being diagnosed with hypertension were identified between the intervention and control group. Participants from the intervention group showed higher blood pressure reduction (mean decrease in mmHg and absolute percentage reduction) by end of study (EOS) on each of the four measured blood pressure indicators, compared to participants from the control group. The educational session provided to intervention subjects also raised their awareness level regarding hypertension and the importance of exercise in controlling hypertension along with reduction in alcohol consumption and avoiding smoking altogether. With upward trends for hypertension and cardiovascular disease across Ireland, the need for a new model to effectively treat and control hypertension among the Irish community becomes indispensable.

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Author Contribution HZ, IG, PH, RS and FS drafted the manuscript. PH and AH performed the data collection. IG, PH, HZ and FS conceived and designed the study. HZ, RS and BD performed the statistical analysis. All authors have read and approved the final version of the manuscript.

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Declarations

Ethical Statement The ethical approval was granted from Galway University Hospitals Clinical Research Ethics Committee. The written informed consents were provided by all the subjects who participated in the study.

Conflict of Interest The authors declare no competing interests.

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