

Impact of Cognitive and Behavioural Psychosocial Interventions on the Effective Management of Hypertension

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ABSTRACT

Hypertension or elevated blood pressure is a chronic non-communicable disease, in which the force of the circulating blood through the major blood vessels and arteries of the body, is consistently high leading to severe health complications. Given the high rates of unawareness of the condition and low rates of detection, diagnosis and treatment of high BP, which has been termed as the “silent killer”, patients tend to be non-adherent to their treatment regimen which lowers their blood pressure control, quality of life and prognosis. A community-based cluster randomized controlled trial, that utilized a 4x3 factorial between-subjects experimental design, was adopted to determine the simultaneous and comparative impact, of three cognitive and behavioural psychosocial interventions on the systolic and diastolic BP control, hypertension knowledge, therapeutic adherence, health beliefs and self-efficacy among hypertensive patients, across the three time points of the study. A sample of 224 hypertensive participants were randomly selected from the four villages of Railapur, Athvelly, Nuthankal, and Rawalkol and were randomly assigned to the Doctor, Video, Community Health Worker and Control conditions respectively. The results showed that the hypertensive patients in the three psychosocial intervention groups showed significantly higher therapeutic adherence, blood-pressure control, hypertension-related knowledge, hypertension-related health beliefs and self-efficacy as compared to the control group after the administration of the interventions. By means of pathway modelling using multiple linear regression analyses, the three psychosocial interventions were found to be direct, significant, and positive predictors of the therapeutic adherence among hypertensive patients, which in turn was the largest, significant and negative contributor to the systolic and diastolic BP reading among them.

KEYWORDS: Hypertension, Interventions, Health Complications, Therapeutic Adherence, Blood Pressure Control, Health Beliefs, Self-Efficacy

INTRODUCTION

Hypertension or high blood pressure is the force exerted by circulating blood, against the walls of the body's arteries and is a condition in which the supply of blood through the vessels is excessive (World Health Organization, 2021; Taylor, 2006, p. 358). The systolic blood pressure is the upper number and represents the pressure in the blood vessels when the heart contracts or beats, whereas the diastolic blood pressure is the lower number representing the pressure in the blood vessels when the heart relaxes or is in between beats. A normal blood pressure reading is defined as a systolic blood pressure of 120 mm Hg and a diastolic blood pressure of 80 mm Hg. Hypertension is defined as a systolic blood pressure equal or

greater than 140 mm Hg and/or a diastolic blood pressure equal to or greater than 90 mm Hg (World Health Organization, 2013). The global prevalence of hypertension, has been found to range from 30% to 45% with high systolic blood pressure being responsible, for a significant burden of disability-adjusted life years (DALY'S) across the world (Forouzanfar et al., 2017). The health complications of untreated and uncontrolled hypertension include cardiovascular diseases, heart failure, brain stroke, kidney failure and target-organ damage. Globally the health complications of hypertension are responsible, for 45% of deaths due to heart disease, 51% of deaths due to stroke, and 57 million disability adjusted life years, accounting for 9.4 million deaths worldwide every year (World Health Organization, 2013).

In light of the low rates of awareness, medication use, sub-optimal BP control among patients, and the silent nature of the disease, wherein patients are prompted to seek treatment only when they develop adverse health complications of untreated and uncontrolled blood pressure, it becomes imperative to facilitate the early detection and treatment of the condition to reduce the associated cardiovascular disease morbidity and mortality rates (Sheilini, Hande, Prabhu, Pai, & George, 2019).

According to the World Health Organization (2013), hypertension has a multi- factorial etiology with the main determinants for the development of hypertension being genetic factors, social factors, and behavioural risk factors. The management of hypertension requires behavioural change comprising of a healthy diet intake, moderation of alcohol use, stopping tobacco use, reduction of salt intake, stress management, and regular physical exercise (World Health Organization, 2013).

India known as the “Diabetic Capital of the World” is undergoing a socio- demographic, economic, and epidemiological transition and is heading towards being recognized as “Hypertension Capital of the World” (Joshi & Parikh, 2007). India is undergoing a rapid epidemiological transition with ageing patterns, urbanization, and improvements in the standards of living accompanied by obesity and its associated cardiovascular risk factors, causing an increase in the proportion of disability-adjusted life years attributed to non-communicable diseases, from 31% of the total DALY's in 1990 to 55% in 2016 (Geldsetzer et al., 2018).

The management of chronic illnesses such as hypertension, poses a significant public health challenge in resource-limited countries like India wherein approximately 70% (700 million) of the Indian population, reside in villages and suffer from the constraints of paucity of health facilities, untrained health care providers and unaffordability of anti-hypertensive medications and medical care (Rao, Rao, Kumar, Chatterjee, & Sundararaman, 2011; World Health Organization, 2005). The prevalence of hypertension in India is increasing astronomically in both rural and urban areas (Gupta & Guptha, 2010; Gupta, Odat, & Gupta, 2016). There is a high prevalence of hypertension in India, with approximately one in three adults living with hypertension and a total of 234 million adults being diagnosed with the condition (Ramakrishnan et al., 2019).

The aim of the present study was to assess the viability, feasibility, and the differential impact of three psychosocial interventions using behavioural and cognitive techniques on the hypertension control, treatment regimen adherence, hypertension-related knowledge, health beliefs, and self-efficacy of hypertensive patients.

METHOD

Design

The study adopted a community based cluster randomized controlled trial, and utilized a 4x3 factorial experimental design to determine the comparative effectiveness, of three cognitive and behavioural

psychosocial interventions, on the level of hypertension control, systolic and diastolic blood pressure measurements, clinical and therapeutic adherence, health beliefs, and self-efficacy among hypertensive patients across the three time points of the study. The study used a between-subjects design to find out the effect of the type of psychosocial intervention (Doctor-led Health Education and Counselling, Patient Health Education Video, Community Health Worker led Health Education and Counselling) on the level of blood pressure control, clinical and therapeutic adherence, hypertension related knowledge, health beliefs, and self-efficacy among hypertensive patients.

Participants and Study Setting

The Medchal district in Telangana, India comprises of a total of 40 villages and 10,176 households with a total population of 49,617 (Dandge, Jeemon, & Reddy, 2019). The sample for this study comprised of 224 hypertensive participants in the age-group of 30 to 75 years, who were randomly selected from the four villages of Railapur, Athveli, Nuthankhol, and Rawalkhol. The necessary permission was obtained from the Society for Health Allied Research and Education, India (SHARE-INDIA) and hence, the hypertensive patients who were a part of the REACH database of SHARE INDIA were recruited for the study. Written informed consent was obtained from all the hypertensive patients who were willing to participate in the study.

Sampling Procedure

A two-stage sampling technique was employed to randomly select four villages from the forty villages in the Medchal district and then to, randomly sample the hypertensive patients from these villages. The villages mapped on the REACH database of SHARE-INDIA constituted the primary sampling unit and the hypertensive patients randomly selected for the study, constituted the second stage of sampling. Each village represented a cluster. From the 40 villages in Medchal district, a total of 4 villages were randomly selected for inclusion in the study, based on a table of random numbers. These 4 villages of Railapur, Athveli, Nuthankhol, and Rawalkhol were randomized to receive the ‘Doctor led Patient Health Education and Counseling’, ‘Hypertension Patient Health Education Video’, ‘the Community Health Worker led Patient Health Education and Counseling’ and the ‘Control Condition’ using a table of random numbers. A convenience sampling method was employed to recruit four community health workers, who were a part of the outreach health program of SHARE INDIA. The community health workers were trained and certified to take the blood pressure measurements, using an automated blood pressure monitor, according to the American Heart Association’s guidelines for blood pressure measurements (Whelton et al., 2018). The Cochran (1977) formula that was used to calculate the representative sample size for proportions is as follows $n_0 = z^2pq/e^2$ where n_0 is the desired sample size, z is the critical value for the given level of confidence, p is the estimated proportion of an attribute that is present in the population, $q = 1 - p$ and e is the desired level of precision.

The sample size was deduced to be 224 hypertensive patients using the Cochran’s (1977) formula. To ensure equal group sizes, the sample size was finalized as 224 hypertensive patients with 56 patients in each group (three interventional and one control group).

Measures

Outcome Variables

The primary outcome variables in this study are – blood pressure control, therapeutic adherence,

hypertension-related knowledge, health beliefs, and self-efficacy.

Blood Pressure - Three blood pressure readings, using a Rossmax (model MJ701f) automated sphygmomanometer were obtained from the right arm of each participant with participants seated comfortably and with the arm at the level of the heart. A gap of one minute was left between consecutive blood pressure readings. The average of the second and third blood pressure measurements constituted the systolic and diastolic blood pressure readings of each of the study participants.

Therapeutic Adherence – Therapeutic adherence was measured using the The Hypertension Therapeutic Adherence Scale for Indian Hypertensive Patients (Oruganti, Paidipati, Anaparti, and Dinaker, 2019). The scale aimed to measure the extent to which the hypertensive patients had adhered to the medication and lifestyle regimen in terms of the frequency of the adherence behavior in the past one week. The scale comprised of 28 positive and negative items that were measured on a 5-point scale, ranging in the degree of agreement (0 = Not Applicable, 4 = None of the time). The HTAS-I was developed based on the Hill Bone Compliance to High Blood Pressure Scale (Kim, Hill, Bone, & Levine, 2000). Example items include “How often do you stop taking your high BP medicines when your BP level is controlled?” and “How often do you eat salty food?” The Cronbach’s alpha internal consistency reliability value for the whole scale was found to be 0.76 and the criterion-related validity of the HTAS-I was established as the overall therapeutic adherence score and its various dimensions were significantly positively correlated with the overall and dimension-wise scores of the Health Beliefs Scale for Hypertensive Patients (HBSHP) and the Chronic Disease Self-Efficacy Scale (CDESES) for hypertensive patients.

Hypertension-related Knowledge – The level of knowledge related to hypertension was measured using the Hypertension Knowledge Test for Indian Hypertensive Patients (HKT-I) (Oruganti, Paidipati, Dandge, Jammy, & Teja, 2020). The HKT-I measured the level of overall hypertension-related knowledge and the extent of knowledge in the dimensions of hypertension-related management and control, general knowledge, lifestyle-related knowledge, health complications and risk factors. The HKT-I comprised of 31 items which were in the form of statements or questions, with each item having five response options, of which the participants were required to choose the one correct response option. Each correct response was accorded a score of 1 and each wrong response was assigned a score of 0. Example items include “What should a high BP patient do when he/she misses taking their medicine on a day?” and “Generally the duration of the condition of high BP is”. The Cronbach’s alpha reliability value for the whole scale was found to be 0.97. The criterion-related validity of the HKT-I was established, as it was correlated with the Hypertension Therapeutic Adherence Scale for Indian Hypertensive patients (HTAS-I), the Health Beliefs Scale for Hypertensive Patients (HBSHP) and the standard blood pressure measurements of the participants.

Health Beliefs – The health beliefs of patients was measured using the Health Beliefs Scale for Hypertensive Patients (Oruganti, Paidipati, & Dinaker, 2018). The scale aimed to measure the health beliefs of the hypertensive patients regarding the condition of high blood pressure. The principles of the Health Belief Model (Hochbaum, 1958; Rosenstock, 1966) were used as the basis for developing the scale. The scale comprised of 34 items in the form of statements that were measured on a 6-point Likert scale, ranging in the degree of agreement (0 = Strongly Disagree, 1 = Moderately Disagree, 2 = Slightly Disagree, 3 = Slightly Agree, 4 = Moderately Agree, 5 = Strongly Agree). Example items include “If I don’t manage my hypertension, I may have a heart attack” and “Having high BP is a serious condition”. The hypertensive patients were given instructions to read each item and indicate how much they agree or disagree with the particular statement and were also told that there were no correct or wrong responses.

The Cronbach's alpha internal consistency reliability value of the whole scale was found to be .79. The criterion-related validity of the Health Beliefs scale was also established.

The Chronic Disease Self-Efficacy Scale (CDESES) - The Chronic Disease Self-Efficacy Scale (Lorig, Stewart, Ritter, González, Laurent, & Lynch, 1996), consisted of 33 items that were measured on a 10-point scale, which ranged between 1 and 10 with 1 indicating "no confidence at all" and 10 indicating "very confident". The items of CDESES were in the form of questions regarding the self-efficacy, related to the confidence in performing certain positive health behaviours and activities for the effective management of hypertension. The participants were given instructions to read each statement and indicate their level of confidence, in performing certain self-management and self-care adherence behaviours on a 10 point scale ranging from 1 to 10, with increasing values indicating a higher level of self-efficacy with regard to the performance of certain activities. The aim of the CDESES was to measure the level of self-efficacy related to the confidence in performing health enhancing behaviours and positive lifestyle modifications. Example items include "How confident are you, that you can do aerobic exercises such as walking, swimming, or bicycling three to four times each week?" and "How confident are you, that you can get information about high BP from community resources?". Previous research has demonstrated satisfactory reliability and validity of the scale across cultures (Cudris-Torres et al., 2023; Chow & Wong, 2014; Kim, Chae, & Yoo, 2012).

Study Procedures

The necessary permissions were obtained for conducting the study, from the management of the Medciti Institute of Medical Sciences and the Society for Allied Health Research and Education, in Medchal, Telangana. The study investigator developed and validated the Health Beliefs Scale for Hypertensive Patients (Oruganti, Paidipati, & Dinaker, 2018c), the Hypertension Therapeutic Adherence Scale (Oruganti, Paidipati, Anaparti, & Dinaker, 2019) and the Hypertension Knowledge Scale (Oruganti, Paidipati, Dandge, Jammy, & Teja, 2020).

The Chronic Disease Self-Efficacy Scale (Lorig, Stewart, Ritter, Gonzalez, Laurent, & Lynch, 1996) was available in the public domain, and hence could be used without seeking permission from the authors. All the scales used for the study, were translated into Telugu and back-translated to ensure the accuracy of the information. The administrative authorities of the Medciti Institute of Medical Sciences and the Society for Health and Allied Research, gave the necessary permission for data collection from the hypertensive patients, mapped on their database in four villages of Medchal district.

The main sites of data collection were finalized to be four villages viz. Railapur, Athvelly, Nuthankal, and Rawalkol in the Medchal district, Telangana. Informed consent was sought from the hypertensive patients in these four villages, who gave their willing consent to participate in the study.

The data for the study was collected from 224 hypertensive participants residing in four villages of Medchal district in Telangana.

Description of Interventions

First Stage of Assessments and Interventions. The first experimental group ($n_1 = 56$), received a culturally sensitive tailored psychosocial intervention, called the 'Doctor and Health Psychologist led Patient Health Education and Counseling'.

The second experimental group ($n_2 = 56$), was shown a hypertension-related health education video, which was termed as the 'Hypertension Patient Health Education Video'.

The third experimental group ($n_3 = 56$), received a culturally contextualized psychosocial intervention delivered by a community health worker and health psychologist, and was labeled the ‘Community Health Worker and Health Psychologist led Patient Health Education and Counseling’. The ‘Control group’ ($n_4 = 56$) did not receive any intervention. After recruiting the hypertensive patients, from the four villages through the method of simple random sampling, the individual administrations of the outcome measures was conducted among them. The first stage of psychosocial intervention was administered to the groups immediately after the baseline assessments. All the tools were translated into the local language of Telugu and were also administered in Telugu to the study participants.

Second Stage of Assessments and Intervention. During the 4th week of the study, the second stage of assessments and interventions were administered to the study participants, in all the intervention groups. During this stage, the outcomes measures were individually administered to the sample. After the administration of the baseline assessments and the measurement of BP, the second stage of psychosocial interventions were administered to the participants.

The control group participants were individually administered primary outcome measures.

During the third stage of the study (8th week), only the psychosocial assessments and blood pressure measurements were taken but no intervention was administered on the study participants. The duration of this stage of assessment was approximately 30-45 minutes.

The participants in all the intervention groups and control group, were thanked for their participation and were debriefed regarding the study following this final assessment.

The psychosocial interventions administered in the present study, adopted a group counselling and patient health education format, to facilitate peer learning and sharing of information as well as to enhance the informational, emotional, social and tangible support from the hypertensive participants in the study.

Doctor and Health Psychologist led Patient Health Education and Counselling Intervention

The doctor and health psychologist led patient health education and counselling intervention was designed in accordance with the clinical principles of the Health Belief Model (Hochbaum, 1958; Rosenstock, 1966), Stages of Change Model of Behaviour Change (Prochaska, 1994; Prochaska, DiClemente, & Norcross, 1992), Information-Motivation-Behavioural skills (IMB) model (Fisher & Fisher, 2000) and the Social Support Theory (Lakey & Cohen, 2000). The doctor and health psychologist led patient health education and counselling intervention was designed in accordance with the clinical principles of the Health Belief Model (Hochbaum, 1958; Rosenstock, 1966), Stages of Change Model of Behaviour Change (Prochaska, 1994; Prochaska, DiClemente, & Norcross, 1992), Information-Motivation-Behavioural skills (IMB) model (Fisher & Fisher, 2000) and the Social Support Theory (Lakey & Cohen, 2000). The study investigator who is a health psychologist teamed up with the doctor to implement the psychosocial intervention in the Railapur village in Medchal district in Telangana. The primary aim of this intervention was to enhance the knowledge, self-efficacy, motivation, positive affect, medication and lifestyle regimen adherence among hypertensive patients. In view of the limited consultation times and poor doctor-patient communication patterns in primary care settings, an integrated home-based doctor led patient health education and counselling intervention was designed to improve self-care adherence behaviours by creating a strong knowledge base and inducing positive affect among patients. The doctor and health psychologist used the cognitive behavioural techniques of self-observation, self-monitoring, self-regulation, goal setting, relaxation training, stimulus control, principles of operant conditioning such as

positive reinforcement, social reinforcement, and self-reinforcement, modelling, the self-control of behaviour, covert self-control, cognitive restructuring, positive self-talk, self-management training, motivation training, behavioural assignments, problem-solving training, coping skills training, and social skills training to facilitate positive health behaviour change among hypertensive patients.

Community Health Worker and Health Psychologist led Patient Health Education and Counselling Intervention

The clinical principles of the Health Belief Model (Hochbaum, 1958; Rosenstock, 1966), the Stages of Change Model of Behaviour Change (Prochaska, 1994; Prochaska, DiClemente, & Norcross, 1992), Information-Motivation-Behavioural skills (IMB) model (Fisher & Fisher, 2000), the Social Cognitive Theory (Bandura, 1977, 1986), the Social Support Theory (Lakey & Cohen, 2000), and the Chronic Care Model (Wagner et al., 1999; Wagner et al., 2001; Wagner, 2004) were used to guide the development of the community health worker and health psychologist led psychosocial intervention. This intervention was jointly implemented by the community health worker and the study investigator who is a health psychologist to facilitate improved health behaviour change and blood pressure control outcomes among hypertensive patients.

Hence, a community health worker and health psychologist led patient health education and counselling intervention was administered to the hypertensive patients in the Nuthankhol village, to enhance their hypertension related knowledge, health beliefs, self-efficacy, medication and lifestyle adherence behaviours and blood pressure outcomes. The community health worker and health psychologist administered the culturally tailored health education intervention in the homes of hypertensive patients in a group counselling session with 5 to 8 patients per session lasting for a duration of approximately 90 minutes. The health education and counselling was delivered in the local language of the participants, which was Telugu. Thus, the community health worker and health psychologist led psychosocial intervention was designed in accordance with the health literacy and educational levels of the hypertensive patients. A biopsychosocial counselling approach was utilized in the administration of this intervention. The community health worker and health psychologist integrated health education, skills training, and motivational training to induce positive health behaviour change and treatment adherence among hypertensive patients. Cognitive Behaviour therapy (Beck, 1976) was used by the community health worker and health psychologist to replace the irrational, self-defeating, and maladaptive thought processes of patients with more realistic and constructive thoughts to facilitate positive health behaviour change.

Hypertension Patient Health Education Video

The design, content, and development of the hypertension related patient health education video were informed by the clinical principles of the Health Belief Model (Hochbaum, 1958; Rosenstock, 1966), the Stages of Change Model of Behaviour Change (Prochaska, 1994; Prochaska, DiClemente, & Norcross, 1992), Information-Motivation-Behavioural skills (IMB) model (Fisher & Fisher, 2000), the Social Support Theory (Lakey & Cohen, 2000), the Social Cognitive Theory (Bandura, 1977, 1986) and the Chronic Care Model (Wagner et al., 1999; Wagner et al., 2001; Wagner, 2004). The patient health education video comprised of a primary care clinical physician, Dr. M. Dinaker providing health education and advice regarding various aspects of hypertension management and care. The clinical physician in the video provided a motivational health talk and advice to patients to induce in them, a state of readiness to practice positive lifestyle modifications and alter their current lifestyle. A standardized script was used in

the design, development, and implementation of the video. The video recording was conducted at the clinic of the practicing clinical physician in the presence of the principal study investigator. The hypertension patient health education video was administered by the study investigator who is a health psychologist in the village of Athveli, in the home of a hypertensive patient. A group patient health education format was adopted, comprising of 5 to 8 hypertensive patients per session. The group health education session was designed to leverage the social support of peer hypertensive patients with similar experiences, problems and challenges. The health education and counselling given by the physician in the video, were supplemented with graphical images and visual depictions of the relevant health behaviours being described by the physician.

Control Condition

The hypertensive participants in the Rawalkhol village were randomly assigned to the control group. The patients in the control group were not administered any health education intervention. The patients in the control group were given hypertension-related health education and counselling, by a community health worker after the administration of the third phase of assessments, at the completion of the study. These patients received their standard hypertension care from their primary care physicians.

Results

Participant Characteristics

In the first stage of analysis, the influence of various demographic and psychosocial variables on the levels of blood control, clinical and therapeutic adherence, hypertension related knowledge, health beliefs and self- efficacy of hypertensive patients. The Chi Square and Fisher’s exact test were used to analyse the between-group differences of categorical variables and the one-way between groups Analysis of Variance was used to evaluate the between-group differences of continuous variables.

Table 1: Observed count, expected count, and χ^2 values for gender, educational qualification and monthly income across groups

	Observed (Expected)				χ^2
	Doctor	Video	CHW	Control	
Gender					
Male	14 (21.3)	25 (21.3)	23 (21.3)	23 (21.3)	5.51 ($p > 0.05$)
Female	42 (34.8)	31 (34.8)	33 (34.8)	33 (34.8)	
Educational Qualifications					
Non-Literate	20 (10.5)	5 (10.5)	11 (10.5)	6 (10.5)	
Literate school drop-out	6 (13.8)	12 (13.8)	19 (13.8)	18 (13.8)	26.33 ($p > 0.05$)
High School Pass	8 (8.5)	8 (8.5)	9 (8.5)	9 (8.5)	
10 th Class Pass	7 (7.3)	10 (7.3)	5 (7.3)	7 (7.3)	

Intermediate Pass	8 (8.5)	10 (8.5)	7 (8.5)	9 (8.5)	
Monthly Income					
Less than Rs.2091	5 (5.8)	5 (5.8)	5 (5.8)	8 (5.8)	
Rs.2092 to Rs.6213	12 (10)	5 (10)	14 (10)	9 (10)	15.62 ($p > 0.05$)
Rs.6214 to Rs.10356	12 (15.5)	21 (15.5)	17 (15.5)	12 (15.5)	
Rs.10357 to Rs.15535	6 (7.3)	7 (7.3)	5 (7.3)	11 (7.3)	
Rs.15536 to Rs.20714	9 (7)	8 (7)	5 (7)	6 (7)	
Rs.20715 to Rs.41429	6 (5.3)	5 (5.3)	5 (5.3)	5 (5.3)	

Table 2: Mean, standard deviation, and F-statistic values for age, systolic and diastolic BP measurements, therapeutic adherence, hypertension-related knowledge, health beliefs and self-efficacy scores before the administration of the interventions across groups

					<i>M (SD)</i>				
							<i>F (3, 220)</i>		
	Doctor		Video		CHW		Control		
Age	59.94	(12.08)	57.89	(10.11)	57.26	(9.69)	61.32	(10.33)	1.74 ($p > 0.05$)
BP Readings									
Systolic BP Reading	153.00	(10)	155.00	(13)	154.00	(12)	153.00	(11)	1.86 ($p > 0.05$)
Diastolic BP Reading	99.33	(8.78)	98.32	(7.06)	99.45	(6.23)	98.12	(7.02)	1.42 ($p > 0.05$)
Therapeutic Adherence									
Total Adherence	50.22	(5.23)	49.32	(4.25)	50.00	(5.10)	49.00	(5.32)	1.45 ($p > 0.05$)
Medication Adherence	20.10	(4.22)	21.22	(5.23)	20.96	(5.12)	21.12	(4.25)	1.42 ($p > 0.05$)
Dietary Adherence	11.00	(1.95)	10.12	(2.31)	11.21	(3.24)	10.00	(5.45)	1.25 ($p > 0.05$)
Avoidance of Harmful Health Behaviors	6.00	(1.27)	5.10	(2.51)	5.79	(1.30)	6.00	(1.57)	1.52 ($p > 0.05$)
Appointment Keeping	6.00	(1.47)	5.24	(2.51)	5.10	(1.31)	6.22	(1.21)	1.55 ($p > 0.05$)
Self-Monitoring	2.76	(1.22)	2.52	(1.46)	2.23	(1.15)	2.21	(1.05)	1.51 ($p > 0.05$)
Stress Management	2.25	(2.34)	1.98	(1.32)	2.00	(1.26)	2.00	(1.15)	1.89 ($p > 0.05$)
Regular Exercise	2.55	(1.30)	2.63	(1.72)	2.73	(1.30)	2.82	(1.35)	2.45 ($p > 0.05$)
Hypertension Knowledge									
Total Knowledge	6.21	(4.64)	6.14	(4.04)	5.82	(3.42)	5.29	(3.09)	1.94 ($p > 0.05$)
Management and Control	2.91	(2.76)	2.73	(1.91)	2.63	(1.91)	2.51	(1.91)	2.26 ($p > 0.05$)
General Knowledge	1.15	(1.36)	1.12	(1.44)	1.13	(1.24)	1.11	(1.12)	1.53 ($p > 0.05$)
Lifestyle Knowledge	1.01	(1.06)	1.17	(1.31)	1.65	(1.04)	1.07	(1.48)	1.42 ($p > 0.05$)

Health Complications	1.25	(1.18)	1.36	(1.15)	1.39 (1.19)	1.42	(1.13)	1.35 ($p > 0.05$)
Risk Factors	0.52	(0.27)	0.60	(0.52)	0.55 (0.25)	0.65	(0.29)	0.89 ($p > 0.05$)

Table 2 (continued): Mean, standard deviation, and F-statistic values for age, systolic and diastolic blood pressure measurements, therapeutic adherence, hypertension-related knowledge, health beliefs and self-efficacy scores before the administration of the interventions across groups

	<i>M</i>		<i>(SD)</i>						
	Doctor		Video		CHW		Control		<i>F</i> (3, 220)
Health Beliefs									
Total Health Beliefs	53.35	(13.15)	54.15	(12.14)	53.78	(12.25)	54.12	(10.35)	2.37 ($p > 0.05$)
Perceived Susceptibility	3.16	(4.03)	3.32	(5.61)	3.05	(2.85)	3.39	(2.95)	2.35 ($p > 0.05$)
Perceived Severity	2.55	(3.19)	2.26	(4.28)	2.78	(2.20)	2.66	(2.16)	2.34 ($p > 0.05$)
Perceived Benefits	8.96	(7.57)	8.79	(6.89)	8.69	(6.53)	8.61	(6.46)	1.25 ($p > 0.05$)
Perceived Barriers	24.71	(5.48)	24.92	(6.15)	24.98	(5.81)	25.11	(2.27)	1.83 ($p > 0.05$)
Self-Efficacy									
Total Self-Efficacy	28.98	(2.95)	28.43	(2.24)	28.67	(2.31)	28.88	(2.36)	1.87 ($p > 0.05$)
Self-Management Behaviors	11.95	(1.32)	11.65	(1.28)	11.73	(1.17)	11.75	(1.29)	1.38 ($p > 0.05$)
General Self-Efficacy	2.72	(.97)	2.50	(.83)	2.61	(.85)	2.81	(.58)	1.32 ($p > 0.05$)
Health Behavior Outcomes	14.31	(1.71)	14.28	(1.56)	14.33	(1.62)	14.32	(1.73)	1.48 ($p > 0.05$)

The results of the Chi-square test of association shown in Table 1, indicated that there was no significant association between the type of intervention group and the gender ($p > .05$), the level of educational qualification ($p > .05$) and the monthly income ($p > .05$), of the hypertensive participants. Further, the one-way analysis of variance or the between subjects analysis of variance (Table 2), revealed that the four groups did not differ significantly ($p > .05$), in their mean age, mean values of systolic and diastolic blood pressure measurements, the mean scores therapeutic adherence, hypertension-related knowledge, health beliefs, and self-efficacy, prior to the administration of the interventions.

The age of the participants in the sample ranged between 30 to 75 years with the mean age being 59 years ($SD = 11$). The mean age of the patients in the doctor group was 60 years ($SD = 12$), in the video group was 58 years ($SD = 10$), in community health worker group was 57 years ($SD = 10$) and in the control condition was 61 years ($SD = 10$). The proportion of men in the sample was found to be 38% and the proportion of women in the sample was found to be 62%.

Effect of Psychosocial Interventions on Blood Pressure Control across Time

The first objective of the study was to compare the effectiveness of the doctor intervention, video intervention and the community health worker intervention, relative to the control group in facilitating enhanced blood pressure control and prognosis, among hypertensive patients across the three time-points (assessment phases) of the study. A 4 X 3 Simple Mixed Design Analysis of Variance comprising of the type of psychosocial intervention (doctor group, video group, community health worker group and control

group) as the between-subjects factor and the three time-points (baseline assessment, second assessment and third assessment) as the within subjects factor was performed. The mean systolic and diastolic blood pressure readings of the hypertensive patients in the three psychosocial intervention groups and the control group across the three time-points are presented in Table 3. A 4 X 3 Mixed Design Analysis of Variance tested the impact of the three psychosocial interventions relative to the control condition on the systolic and diastolic blood pressure control of hypertensive patients across the three time-points. The hypertensive patients in the three psychosocial intervention groups showed significantly higher reductions in their systolic blood pressure levels across the three time-points ($F(2, 440) = 158.18, p = .000, \eta^2 = .418$) than those in the control group (as shown in Table 3).

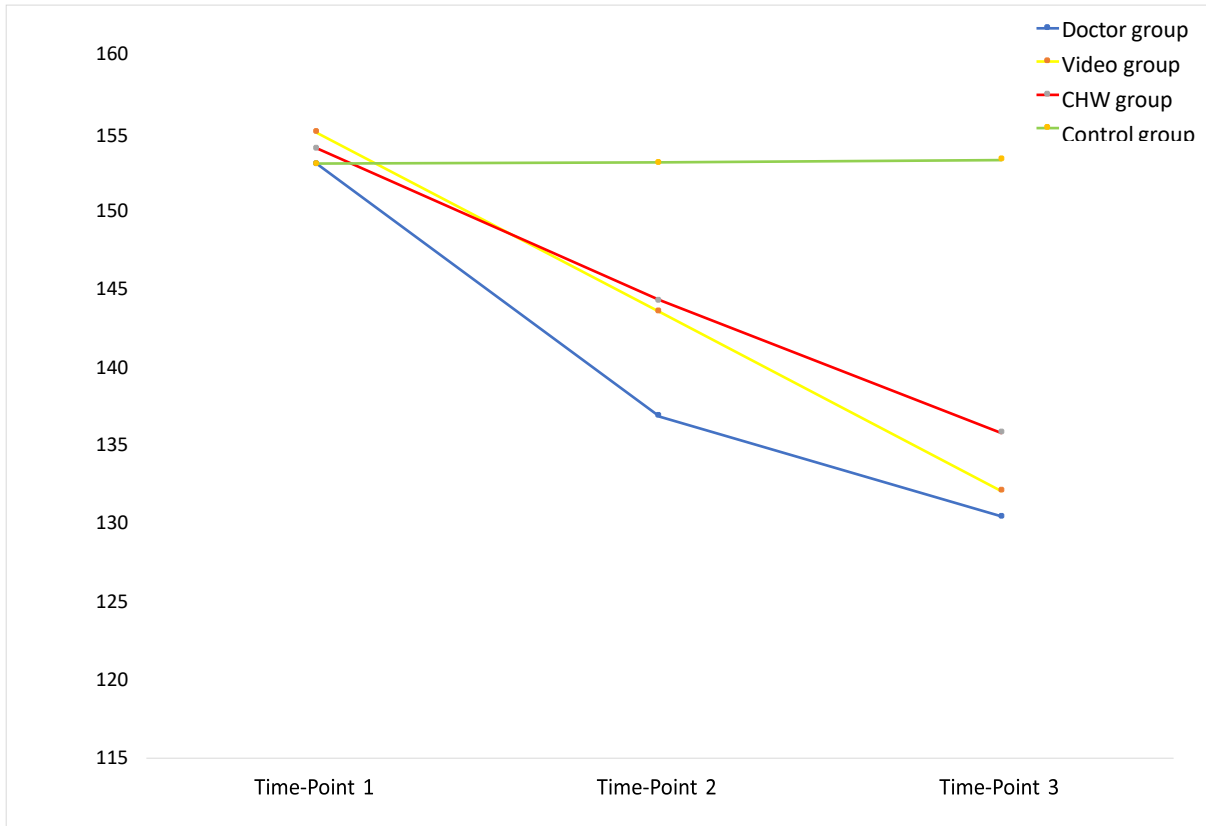
Table 3: Mean, standard deviation, and F values for systolic and diastolic blood pressure readings among the four groups across the three time-points.

BP	Time-Point	Doctor group	Video group	CHW group	Control group	F (Between-Subjects)	F (Within-Subjects)	F (Interaction)			
Systolic BP	1	153.00 (10.00)	155.00 (13.00)	154.00 (12.00)	153.00 (11.00)	10.84***	158.18***	30.19***			
	2	136.87 (10.15)	143.55 (10.21)	144.27 (11.23)	153.08 (12.15)						
	3	130.44 (10.21)	132.10 (10.98)	135.80 (10.65)	153.25 (10.84)						
	1	99.33 (8.78)	98.32 (7.06)	99.45 (6.23)	98.12 (7.02)				19.91***	219.48***	44.26***
	2	85.02 (9.24)	91.01 (8.25)	92.07 (6.44)	98.15 (10.64)						
	3	80.80 (11.27)	81.01 (4.62)	82.41 (3.31)	98.12 (10.52)						

Note. *** $p < .001$

It evident from the Figure 1 in Supplemental Material, that the hypertensive participants in the three psychosocial intervention groups showed substantial reductions in their mean systolic blood pressure readings, across the three assessment phases while the control group had consistently high systolic blood pressure levels across the three time-points. Figure 1 presents a clear visual picture, of the changes in the mean systolic blood pressure readings among the hypertensive patients, in the four groups across the three time-points. It is evident from the Figure 1, that the hypertensive participants in the three psychosocial intervention groups showed substantial reductions in their mean systolic blood pressure readings, across the three assessment phases while the control group had consistently high systolic blood pressure levels across the three time-points.

Figure 1: Means of the four groups for average systolic blood pressure readings across three time-points

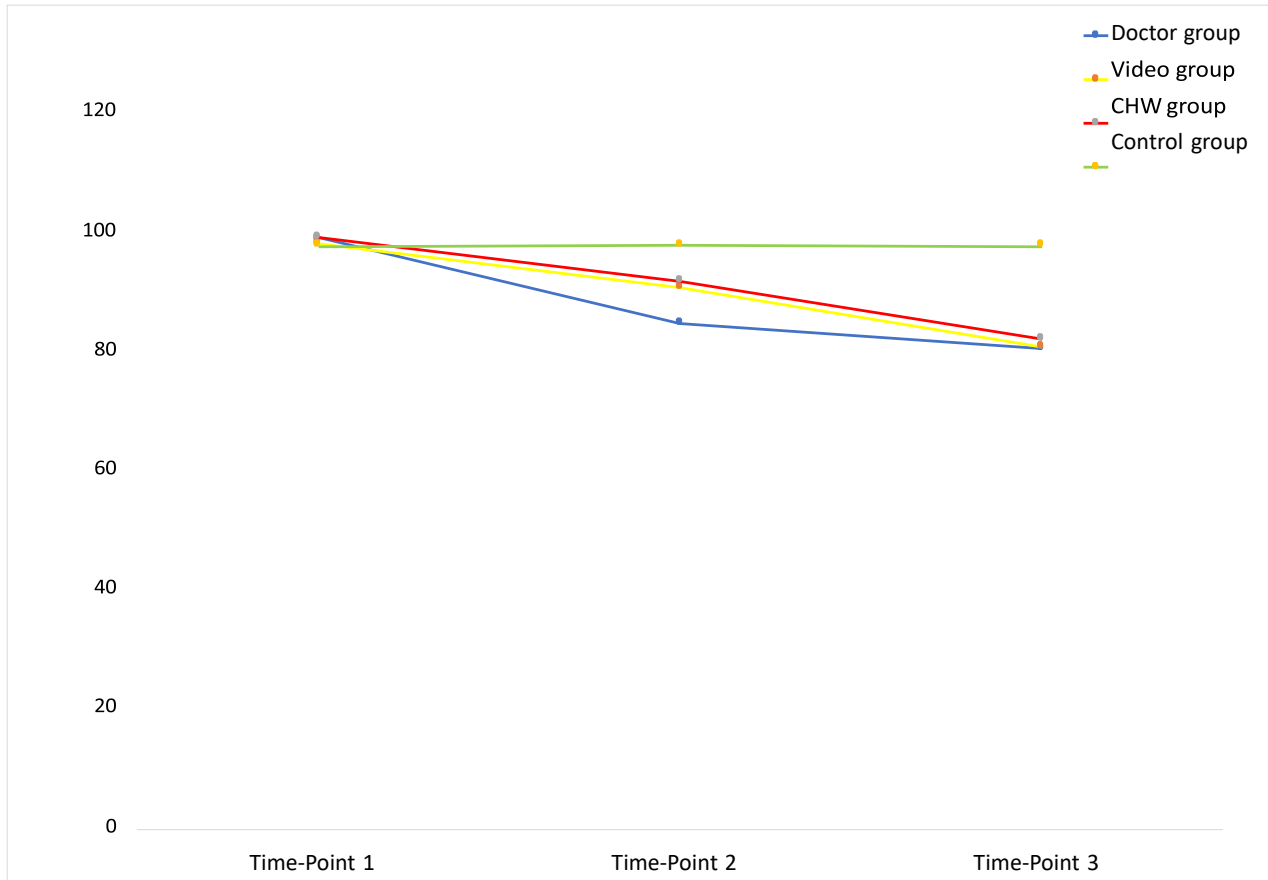


There was a significant interaction between the type of psychosocial intervention and the three assessment phases (time-points) in terms of overall systolic blood pressure readings ($F(6, 440) = 30.19, p = .000, \eta^2 = .292$). It is evident from Table 3, that in the case of hypertensive patients in the doctor intervention group, there is a sharp drop in the mean systolic blood pressure readings from the baseline assessment phase ($M = 153.00, SD = 10.00$) to the second assessment phase ($M = 136.87, SD = 10.15$). The hypertensive patients in the video and community health worker intervention groups, showed sharp reductions in their mean systolic blood pressure readings, from the second to the third assessment phase.

The hypertensive patients in the three psychosocial intervention groups, also showed significantly higher reductions in their diastolic blood pressure readings, across the three time-points, ($F(2, 440) = 219.48, p = .000, \eta^2 = .499$). There were no significant differences in the mean diastolic blood pressure readings of the control group participants from Time 1 ($M = 98.12, SD = 7.02$) to Time 2 ($M = 98.15, SD = 10.64$) and Time 3 ($M = 98.12, SD = 10.52$).

Figure 2 presents a clear visual picture of the changes in the mean diastolic blood pressure readings among the hypertensive patients in the four groups across the three time-points.

Figure 2: Means of the four groups for mean diastolic blood pressure readings across three time-points



It is evident from the Figure 2, that the hypertensive participants in the three psychosocial intervention groups showed substantial reductions in their mean diastolic blood pressure readings across the three assessment phases while the control group had consistently high diastolic blood pressure levels across the three time-points. It is evident from Table 3 that in the case of hypertensive patients in the doctor intervention group, there is a sharp drop in the mean diastolic blood pressure readings from the baseline assessment phase ($M = 99.33$, $SD = 8.78$) to the second assessment phase ($M = 85.02$, $SD = 9.24$). With regard to the hypertensive patients in the video and community intervention groups, a significant reduction in the mean diastolic blood pressure readings was observed from the baseline assessment to the second assessment phase, though the reduction was not as sharp as that observed for the patients in the doctor intervention group.

Effect of Psychosocial Intervention on Therapeutic Adherence across Time

A 4 X 3 Mixed Design Analysis of Variance, tested the impact of the three psychosocial interventions relative to the control condition, on the overall therapeutic adherence of hypertensive patients across the three time-points. The hypertensive patients in the three psychosocial intervention groups showed significantly higher therapeutic adherence ($F(3, 220) = 97.38$, $p = .000$, $\eta^2 = .570$) than those in the control group (as shown in Table 4). The hypertensive patients in the three psychosocial intervention groups, showed significant improvements in their overall therapeutic adherence levels, across the three time-points $F(2, 440) = 426.78$, $p = .000$, $\eta^2 = .660$) as compared to those in the control group (see Table 4).

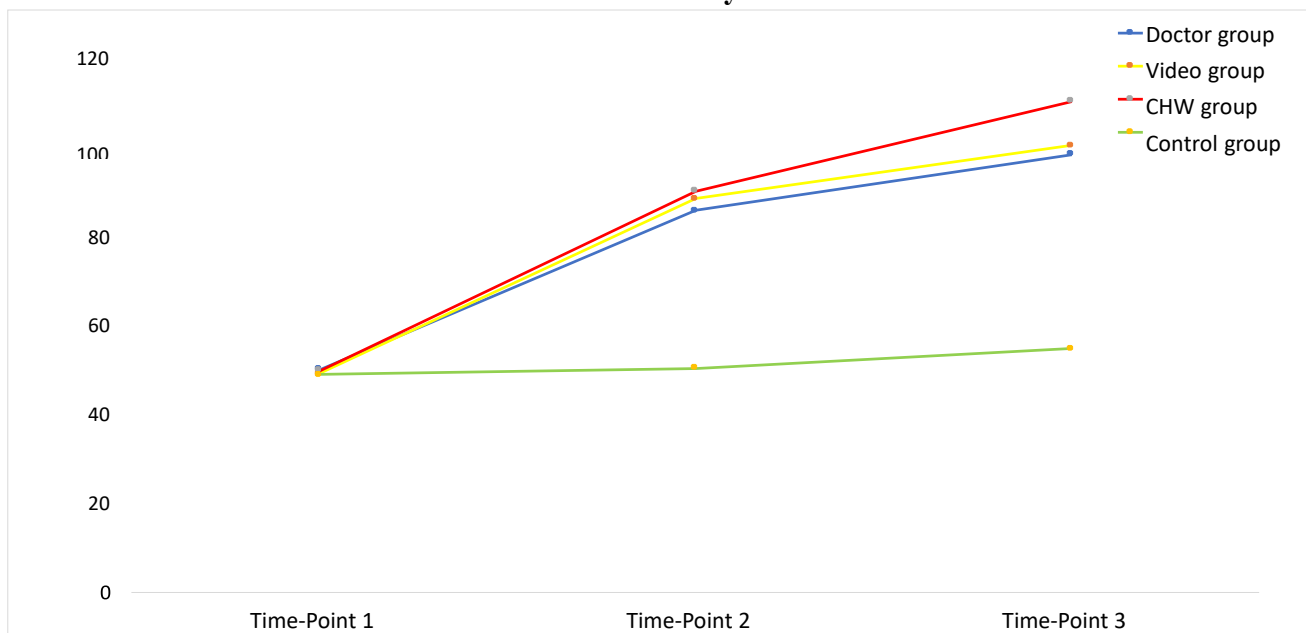
Table 4: Mean, standard deviation, and F values for overall therapeutic adherence among the four groups across the three time-points.

	Time-Point	Doctor group	Video group	CHW group	Control group	F (Between-Subjects)	F (Within-Subjects)	F (Interaction)
Therapeutic Adherence	1	50.22	49.32	50.00	49.00	97.38****	426.78****	124.09****
		(5.23)	(4.25)	(5.10)	(5.32)			
	2	86.02	88.63	90.32	50.50			
		(7.76)	(10.50)	(11.05)	(10.12)			
	3	98.53	100.60	110.56	54.87			
		(6.61)	(12.14)	(3.49)	(8.10)			

Note. **** $p < .001$

Figure 3 presents a clear visual picture of the changes, in the overall mean therapeutic adherence among the hypertensive patients, in the four groups across the three time-points.

Figure 3: Means of the four groups for overall therapeutic adherence across the three time-points of the study



It evident from Figure 3, that the hypertensive participants in the three psychosocial intervention groups showed significantly higher overall therapeutic adherence, across the three assessment phases while the control group had consistently low therapeutic adherence levels across the three time-points.

There was a significant interaction between the type of psychosocial intervention and the three assessment phases (time-points) in terms of overall therapeutic adherence ($F(6, 440) = 124.09, p = .000, \eta^2 = .629$). It is evident from Table 4, that in the case of hypertensive patients in the doctor intervention group, video intervention group and the community health worker intervention group, there was a sharp increase in the overall mean therapeutic adherence from the baseline to the second assessment phase.

Effect of Psychosocial Intervention on Hypertension-related Knowledge across Time

A 4 X 3 Mixed Design Analysis of Variance tested the impact of the three psychosocial interventions relative to the control condition on the overall hypertension-related knowledge of hypertensive patients across the three time-points. The hypertensive patients in the three psychosocial intervention groups showed significantly higher hypertension-related knowledge, ($F(3, 220) = 414.21, p = .000, \eta^2 = .850$) than those in the control group (as shown in Table 5).

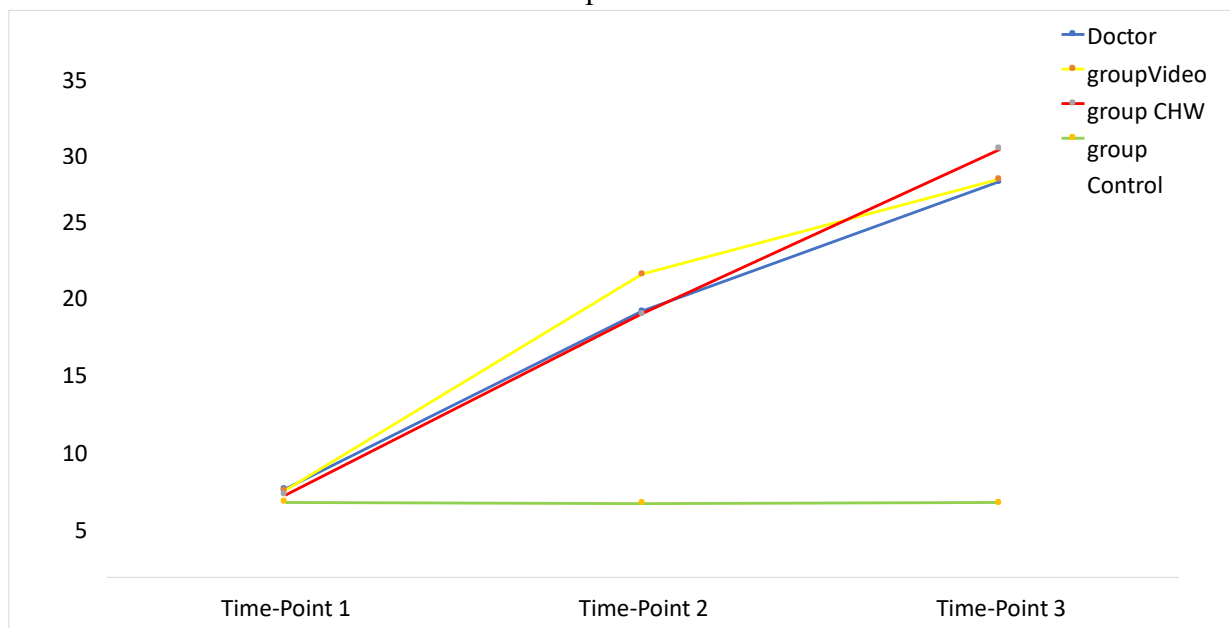
Table 5: Mean, standard deviation, and F values for overall hypertension-related knowledge among the four groups across the three time-points.

	Time-Point	Doctor group	Video group	CHW group	Control group	F (Between-Subjects)	F (Within-Subjects)	F (Interaction)
Hypertension Knowledge	1	6.21 (4.64)	6.14 (4.04)	5.82 (3.42)	5.29 (3.09)	414.21***	1512.88***	210.18***
	2	18.75 (4.70)	21.35 (3.98)	18.56 (2.63)	5.25 (3.03)			
3	27.84 (2.63)	28.00 (3.17)	30.13 (1.17)	5.28 (3.07)				

Note. *** $p < .001$

The hypertensive patients in the three psychosocial intervention groups showed significant improvements in their overall hypertension-related knowledge levels across the three time-points ($F(2, 440) = 1512.88, p = .000, \eta^2 = .873$) as compared to those in the control group as shown in Table 5. Figure 4 presents a clear visual picture of the changes, in the overall mean hypertension-related knowledge among the hypertensive patients, in the four groups across the three time-points.

Figure 4: Means of the four groups for overall hypertension-related knowledge across the three time-points



It evident from the Figure 4, that the hypertensive participants in the three psychosocial intervention groups showed significantly higher overall mean hypertension-related knowledge, across the three assessment phases while the control group had consistently low mean overall hypertension-related knowledge across the three time-points. The interaction effect of the type of psychosocial intervention and the three time- points in terms of mean overall hypertension-related knowledge among hypertensive patients is clearly evident in Figure 4. The hypertensive participants in the three psychosocial intervention groups and the control that the hypertensive patients in the video intervention group, showed a sharp improvement in their overall mean hypertension- related knowledge scores from the baseline to the second assessment phase, as compared to the doctor group and the community health worker intervention group which had a less steep increase in their overall mean hypertension-related knowledge scores from time-point 1 to time-point 2. It can be clearly perceived from Figure 4 that the doctor and community health worker intervention groups showed a significantly sharper increase in their overall mean hypertension-related knowledge scores from time-point 2 to time-point 3 as compared to the video group.

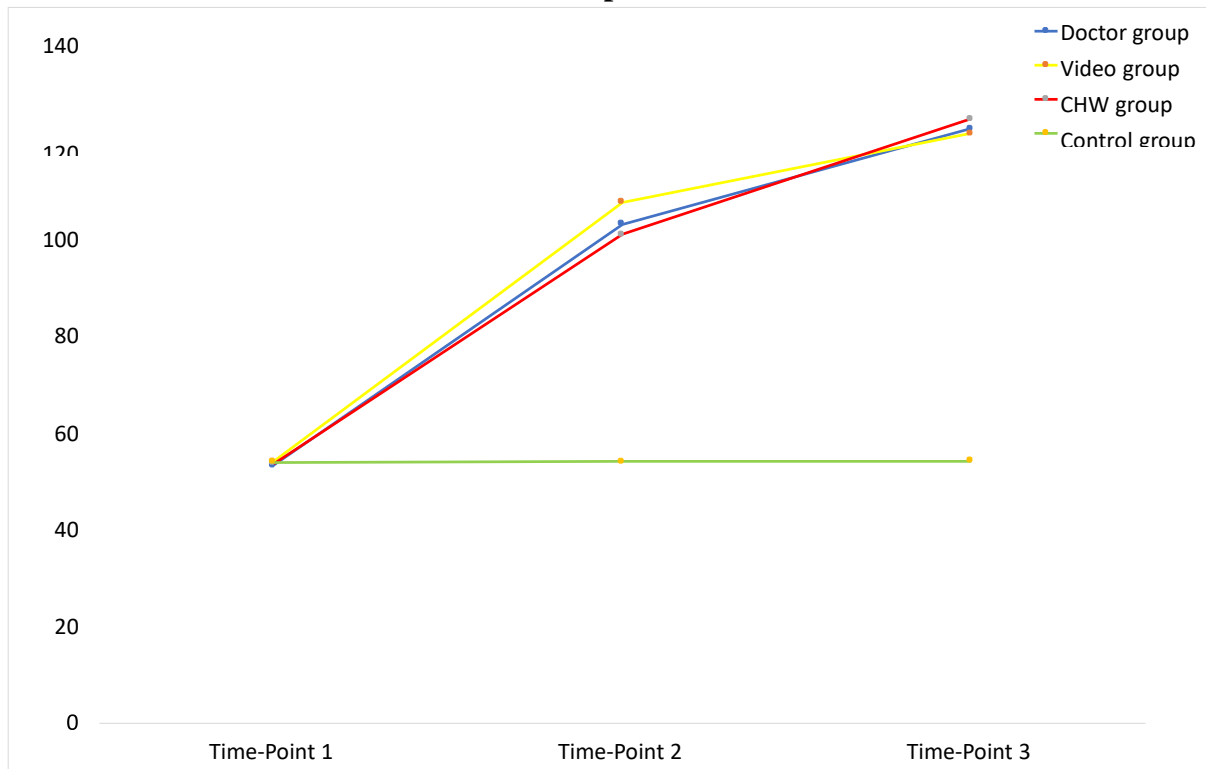
Effect of Psychosocial Intervention on Hypertension-related Health Beliefs across Time

A 4 X 3 Mixed Design Analysis of Variance tested the impact of the three psychosocial interventions, relative to the control condition on the overall hypertension-related health beliefs of hypertensive patients, across the three time- points. The hypertensive patients in the three psychosocial intervention groups showed significantly enhanced hypertension-related health beliefs ($F(3, 220) = 222.50, p = .000, \eta^2 = .752$) as compared to those in the control group (as shown in Table 6). The hypertensive patients in the three psychosocial intervention groups, showed significant improvements in their overall hypertension-related health beliefs, across the three time-points ($F(2, 440) = 663.46, p = .000, \eta^2 = .751$) as compared to those in the control group (see Table 6).

Table 6: Mean, standard deviation, and F values for overall hypertension-related health beliefs among the four groups across the three time-points.

	Time-Point	Doctor group	Video group	CHW group	Control group	F (Between-Subjects)	F (Within-Subjects)	F (Interaction)
Hypertension	1	53.35	54.15	53.78	54.12	222.50***	663.46***	116.98***
		(13.15)	(12.14)	(12.25)	(10.35)			
Health Beliefs	2	103.23	107.82	101.14	54.14			
		(9.02)	(10.26)	(9.04)	(11.21)			
	3	123.05	122.04	125.00	54.23			
		(7.80)	(7.88)	(5.04)	(8.09)			

Figure 5: Means of the four groups for overall hypertension-related health beliefs across the three time-points



It is evident from Figure 5 in Supplemental Material, that the hypertensive participants in the three psychosocial intervention groups showed significantly enhanced overall mean hypertension-related health beliefs scores, across the three assessment phases while the control group had consistently low mean overall hypertension-related health beliefs scores across the three time-points. The interaction effect of the type of psychosocial intervention and the three time-points, in terms of mean overall hypertension-related health beliefs, among hypertensive patients is clearly evident in Figure 5. It can be observed from Figure 5, that the hypertensive participants in the three psychosocial intervention groups and the control group, had significantly lower overall mean hypertension-related health beliefs scores during the baseline assessment phase. After the administration of the psychosocial interventions, there was a significant improvement in the overall mean health beliefs of the hypertensive participants in the doctor, video and community health worker groups, during the second and third assessment phases.

Effect of Psychosocial Interventions on Hypertension-related Self-Efficacy across Time

A 4 X 3 Mixed Design Analysis of Variance, tested the impact of the three psychosocial interventions relative to the control condition, on the overall hypertension-related self-efficacy of hypertensive patients across the three time-points. The hypertensive patients in the three psychosocial intervention groups, showed significantly enhanced hypertension-related self-efficacy, ($F(3, 220) = 358.05, p = .000, \eta^2 = .830$) than those in the control group (as shown in Table 7). The hypertensive patients in the three psychosocial intervention groups, showed significant improvements in their overall hypertension-related self-efficacy, across the three time-points ($F(2, 440) = 266.18, p = .000, \eta^2 = .547$) as compared to those in the control group (see Table 7). There was a significant interaction between the type of psychosocial intervention and the three assessment phases (time-points) in terms of overall hypertension-related self-efficacy ($F(6, 440) = 170.17, p = .000, \eta^2 = .699$). It is evident from Table 7, that

there was a significant improvement in the hypertension-related self-efficacy of hypertensive patients in the doctor, video, and community health worker intervention groups, from the baseline (time-point 1) to the second (time-point 2) and third (time-point 3) assessment phases. In the case of hypertensive patients in the video intervention group, there was a significantly sharper increase in the overall mean hypertension-related self-efficacy score from time-point1 ($M = 28.43, SD = 2.24$) to time-point 2 ($M = 75.09, SD = 2.87$), as compared to the doctor and community health worker intervention groups. There was a significant improvement in the overall mean hypertension-related self-efficacy score, of the hypertensive patients in the doctor intervention group from time-point 1 ($M = 28.98, SD = 2.95$) to time-point 2 ($M = 72.45, SD = 2.96$). Similarly, there was a significant improvement in the overall mean hypertension related self-efficacy score of the hypertensive patients in the community health worker group from time-point 1 ($M = 28.67, SD = 2.31$) to time-point 2 ($M = 71.35, SD = 1.78$).

Table 7: Mean, standard deviation, and F values for overall hypertension-related self-efficacy among the four groups across the three time-points

	Time-Point	Doctor group	Video group	CHW group	Control group	F (Between-Subjects)	F (Within-Subjects)	F (Interaction)
Hypertension Self-Efficacy	1	28.98 (2.95)	28.43 (2.24)	28.67 (2.31)	28.88 (2.36)	358.05***	266.18***	170.17***
	2	72.45 (2.96)	75.09 (2.87)	71.35 (1.78)	28.71 (2.49)			
	3	87.25 (3.31)	87.59 (3.26)	92.64 (1.56)	28.76 (2.56)			

Figure 6: Means of the four groups for overall hypertension-related efficacy across the three time-points

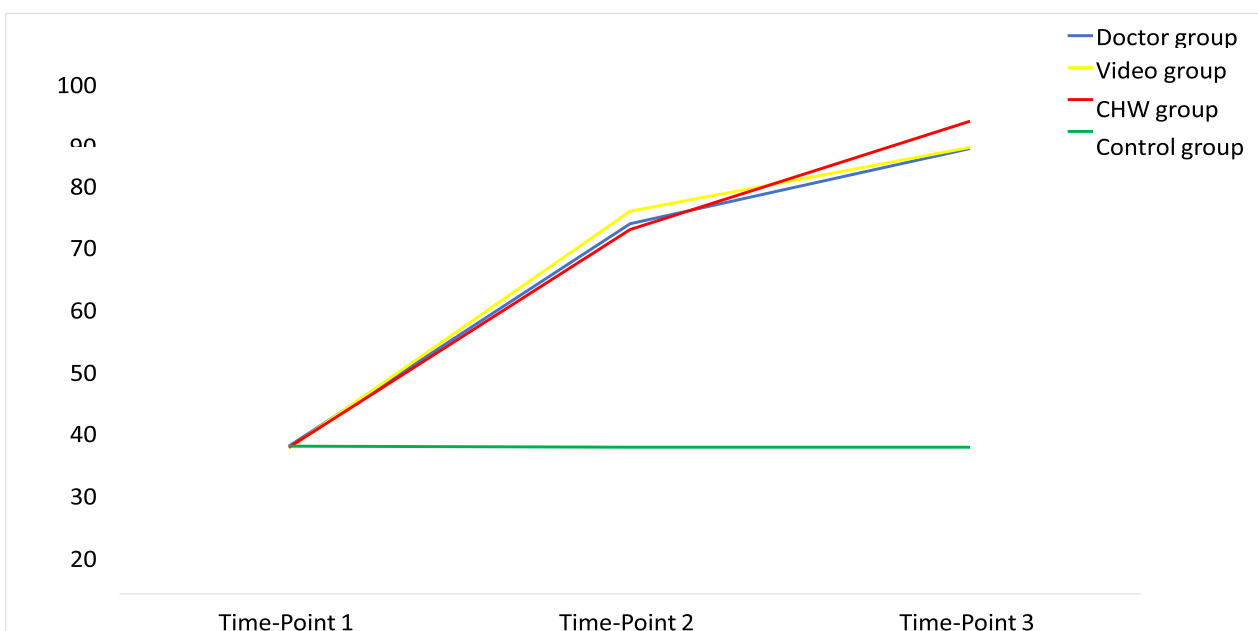


Figure 6 presents a clear visual picture, of the changes in the overall mean hypertension-related self-efficacy, among the hypertensive patients in the four groups across the three time-points. It evident from the Figure 6, that the hypertensive participants in the three psychosocial intervention groups, showed significantly enhanced overall mean hypertension-related self-efficacy scores across the three assessment phases, while the control group had consistently low overall mean hypertension-related self-efficacy scores across the three time-points. There was a significant interaction between the type of psychosocial intervention and the three assessment phases (time-points) in terms of overall hypertension-related self-efficacy ($F(6, 440) = 170.17, p = .000, \eta^2 = .699$). The interaction effect of the type of psychosocial intervention and the three time- points, in terms of the overall mean hypertension-related self-efficacy, among hypertensive patients is clearly evident in Figure 6. It can be observed from Figure 6 that after the administration of the psychosocial interventions, there was a significant improvement in the overall mean self-efficacy scores of the hypertensive participants in the doctor, video and community health worker groups during the second and third assessment phases.

DISCUSSION

The present investigation has its roots in the field of Health Psychology and has been designed to consider the biopsychosocial aspects for the effective treatment, management and control of hypertension. The results have provided support for the five hypotheses which predicted the effectiveness of the Doctor led Patient Health education and Counselling, the Hypertension Health Education Video intervention and the Community Health Worker led Patient Health Education and Counselling interventions in facilitating improvements in blood pressure control, therapeutic adherence, hypertension-related knowledge, health beliefs, and hypertension-related self-efficacy among patients.

The study was conducted among rural hypertensive patients in the Medchal district of Hyderabad. Rural hypertensive patients suffer from the constraints of inaccessibility to proper health care services, long-distance commutes to medical facilities, unaffordability of health care and medicines and a lack of knowledge regarding the lifestyle modifications and treatment recommendations necessary for the management of hypertension leading to high rates of uncontrolled hypertension among them (World Health Organization, 2005; Chow et al., 2013; Gupta, Dhamija, Mohan, & Gupta, 2019; Meelab et al., 2019).

The first hypothesis in the study predicted that exposure to the doctor-led patient health education and counselling, the patient health education video and the community health worker led patient health education and counselling interventions will lead to significant improvements in the systolic and diastolic blood pressure control among hypertensive patients after the administration of the first and second stages of psychosocial interventions. The results of the study indicated that the hypertensive participants in the Doctor intervention group showed significantly higher reductions in their systolic and diastolic blood pressure levels as compared to the Video and Community Health Worker intervention groups after the administration of the first stage of psychosocial intervention. All the three psychosocial intervention groups showed significantly higher systolic and diastolic blood pressure control as compared to the control group after the administration of the first stage of psychosocial intervention. The results of the study indicated that the overall therapeutic adherence to the medication and lifestyle regimen was found to be significantly higher in the Doctor, Video and Community Health Worker intervention groups as compared to the Control group after the administration of the first stage of psychosocial intervention. The Community Health Worker group showed significantly higher overall therapeutic adherence to the

medication and lifestyle regimen as compared to the Doctor and Video intervention groups while the Control group had the lowest therapeutic adherence after the administration of the second stage of psychosocial intervention. These results have been supported by a community-based study which showed that volunteers disseminating health education, in a group counselling format in the homes of patients, on the importance of regular medication adherence, monitoring of high BP and lifestyle modifications such as salt reduction, consumption of a healthy diet rich in fruits and vegetables, weight reduction, abstinence from smoking, reduction of alcohol consumption, stress management and regular physical exercise resulted in improved awareness, treatment and control of hypertension among hypertensive participants in a rural community in Kerala (Thankappan, Sivasankaran, Mini, Daivadanam, Sarma, & Khader, 2013). This finding could be attributed to the personal identification with the community health workers, who disseminate health related information in the local language in the context of one's home and in the presence of peer hypertensive patients, of a similar age, socio-economic and cultural background.

The effectiveness of doctor counselling and health education on blood pressure control, treatment compliance and hypertension-related knowledge has been shown in past research. The doctor patient ratio in India has been found to be 1:1456 which falls short of the WHO recommendation of 1:1000 (Goel, 2020). In resource constrained settings like India, poor doctor patient communication characterized by a lack of empathy, attention and proper medical counselling given to patients from the lower socio-economic strata as well as the lack of affordability and accessibility of proper health care facilities have deleterious consequences in terms of poor treatment adherence and uncontrolled blood pressure levels among hypertensive patients (Chow et al., 2013; Jolles, Clark, & Braam, 2012). The management of chronic illnesses such as hypertension poses a significant public health challenge in resource-limited countries like India, wherein approximately 70% (700 million) of the Indian population reside in villages and suffer from the constraints of paucity of health facilities, untrained health care providers and unaffordability of anti-hypertensive medications and medical care (Rao, Rao, Kumar, Chatterjee, & Sundararaman, 2011; World Health Organization, 2005). The short duration of physician consultations has served to perpetuate poor knowledge and compromised hypertension-related health outcomes in patients. Hence, increasing the duration of physician consultation times has been found to facilitate the dissemination of more health information to patients resulting in enhanced patient satisfaction with treatment, lowered medication non-adherence rates and improved blood pressure control among hypertensive patients (Jolles, Clark, & Braam, 2012).

The finding of the present study that the doctor led patient health education and counselling intervention was effective in improving the overall therapeutic adherence has been corroborated by a multitude of studies which showed that improved physician communication skills characterized by a collaborative style of interaction, the ability to understand the patients' problems, providing increased health information, increased consultation times and involving patients in decisions related to their treatment regimen have been effective in improving treatment adherence, the practice of positive health behaviours and the satisfaction with the treatment among hypertensive patients (Jolles, Clark, & Braam, 2012; Schoenthaler, Knafl, Fiscella, & Ogedegbe, 2017; Schneider, Kaplan, Greenfield, Le, & Wilson, 2004; Piette, Schillinger, Potter, & Heisler, 2003; Heisler, Bouknight, Hayward, Smith, & Kerr, 2002; Stewart, 1995; Kaplan, Greenfield, & Ware, 1989).

The video intervention was designed in accordance with the principles of the Social Cognitive Theory (Bandura, 1977) which posits that observational learning and modelling of health behaviours of similar others results in the adoption and maintenance of positive health behaviours. The video comprised of a

primary care physician disseminating health education and counselling regarding hypertension along with visual depictions of the debilitating health complications of non-adherence to the medication and lifestyle adherence such as heart attack and stroke. The video also showed the practice of positive lifestyle modifications such as health diet, regular physical exercise, stress management techniques such as yoga and meditation and regular BP check-ups by hypertensive patients.

Thus, the video intervention was found to facilitate significant improvements in medication adherence and lifestyle modifications such as dietary adherence, avoidance of health risk behaviours, self-monitoring, appointment keeping, stress management and regular physical exercise among hypertensive patients in the three psychosocial intervention groups as compared to those in the control group after the administration of the first and second stages of psychosocial interventions.

The results of the present study are corroborated by a compelling body of scientific evidence which indicates that videos showing peer hypertensive patients describing living with their disease condition, giving lessons on how to improve communication with their primary care physicians, and disseminating education on the strategies to improve medication adherence and techniques to express their problems and concerns accurately to their physicians have been found to be successful in facilitating health behaviour modification, health seeking behaviours and significant blood pressure reductions among hypertensive patients (Houston, Allison, Sussman, Horn, Holt, & Trobaugh, 2011).

The third hypothesis predicted that the hypertensive patients in the Doctor led Patient Health Education and Counselling, the Hypertension Health Education Video, and the Community Health Worker led Patient Health Education and Counselling psychosocial interventions will show significant improvements in their level of knowledge regarding the management of hypertension and the effective lifestyle modifications to be made as compared to the Control group participants after the administration of the first and second stages of the psychosocial interventions.

The results of the study indicated that the Video intervention group showed significantly higher improvements in their overall hypertension-related knowledge as compared to the Doctor and the Community Health Worker intervention groups after the administration of the first stage of psychosocial interventions. Further, the results of the study indicated that the Community Health Worker intervention group had significantly higher knowledge regarding hypertension and its treatment as compared to the Doctor and Video intervention groups after the administration of the second stage of psychosocial interventions.

The results of the study indicating the effectiveness of the community health worker intervention in improving the hypertension-related knowledge of patients have been supported by a telemedicine-based health intervention delivered by non-physician health workers known as Accredited Social Health Activists (ASHA's) among rural hypertensive patients from two villages in the Medchal district in Telangana which found that health workers equipped with digital health application enabled tablet computers that were connected to the automated sphygmomanometer and facilitated automatic recording of blood pressure readings of patients on the cloud server, creation of an electronic health record for each patient, electronic consultations with the study physician who prescribed and modified the medication regimen of patients via Skype interviews resulted in significantly improved detection, treatment and control of hypertension at the community level (Dandge, Jeemon, & Reddy, 2019). Thus, non-physician health workers trained in data collection and use of technology enabled digital health tools were found to be a feasible and acceptable method to bring medical health care services to the doorstep of hypertension patients through evolving technological mediums such as electronic health platforms. The screening,

detection, treatment, management and control of hypertension can be greatly improved by training community health workers in the use of technology enabled tablet computers and smart phone-based health applications in order to enhance the accessibility and reach of primary health care services to rural areas and isolated geographic areas.

The fourth hypothesis predicted that the hypertensive participants in the Doctor led Health Education and Counselling, the Hypertension Health Education Video and the Community Health Worker psychosocial intervention groups will have enhanced health beliefs as compared to the Control group participants. The results of the study indicated that the hypertensive participants in the Video intervention group had significantly enhanced health beliefs as compared to the community health worker intervention group after the administration of the first stage of psychosocial intervention.

The doctor, video and the community health worker intervention groups had significantly enhanced hypertension-related health beliefs after the administration of the first and second stages of psychosocial intervention. Research evidence has indicated that health education interventions improve the knowledge of hypertensive patients which in turn leads to a positive influence in modifying their health beliefs and dispelling their misconceptions regarding hypertension and its treatment, thereby enhancing treatment adherence and blood pressure control among patients (Ribeiro, Resqueti, & Lima, Dias, Glynn, & Fregonezi, 2015; Saounatsou et al., 2001). The Health Belief Model posits that people are more likely to practice treatment compliance and healthy lifestyle behaviours if they considered the benefits of engaging in these behaviours as substantial and leading to positive health outcomes (Janz & Becker, 1984). The findings of the study pertaining to the effectiveness of patient health education in enhancing hypertension-related health beliefs across time are consistent with a health promotion intervention among hypertensive patients in South Africa which showed that an educational intervention comprising of presentations, regular meetings, and an informational booklet was effective in significantly improving patients' knowledge regarding hypertension and positively influenced their health beliefs regarding medication from the pre-intervention to the post-intervention phase (Magadza, Radloff, & Srinivas, 2009).

The fifth hypothesis predicted that hypertensive participants in the doctor, video and community health worker led psychosocial intervention groups will have higher levels of hypertension related perceived self-efficacy as compared to the control group participants. Specifically, the hypertensive patients in the three psychosocial intervention groups showed significantly higher perceived self-efficacy in the dimensions of self-management behaviours, general self-efficacy, and health behaviour outcomes as compared to the control group after the administration of the first and second stages of psychosocial intervention. Self-efficacy which is a central construct of the Social Cognitive theory (Bandura, 1977), postulates that confidence, that specific actions will result in desired consequences will increase when one observes the positive consequences of others actions. These results have been supported by an interventional study conducted among stroke survivors in Houston, Texas which showed that a culturally tailored stroke-related educational video that comprised of demonstrations of ischemic and hemorrhagic stroke in the form of animations and that provided health education on the definitions of stroke, the symptoms of stroke, the risk factors and prevention of stroke, the rehabilitation of stroke patients resulted in significant improvements in the knowledge regarding stroke, self-efficacy in the identification of stroke related symptoms and enhanced satisfaction among stroke patients (Denny, Vahidy, Vu, Sharrief, & Savitz, 2017).

The findings of the present study clearly show the significant positive impact of designing interventions in accordance with the principles of the Biopsychosocial model (Engel, 1977) on facilitating positive health

behavior modifications, enhanced therapeutic adherence to the medication and lifestyle regimen and controlled blood pressure levels among hypertensive patients. The behavioural and cognitive techniques used by the psychosocial interventions in the study were successful in facilitating significant improvements in the level of knowledge, therapeutic adherence, health beliefs, self-efficacy, and blood pressure control among hypertensive patients in the intervention groups as compared to those in the control group.

CONCLUSIONS

The current study showed that the implementation of community-based psychosocial interventions that integrated psychological, social, and emotional care into the biomedical regimen of hypertensive patients in the context of their socio-cultural milieu significantly enhanced the blood pressure control, overall therapeutic adherence to the medication and lifestyle regimen, hypertension-related knowledge, health beliefs, and self-efficacy among patients. The findings of the study evidenced that frequent behavioural and lifestyle counselling, regular monitoring of high BP, consistent follow-up of patient health and behavioural outcomes by interventionists such as doctors or community health workers led to significant improvements in psycho-behavioural and hypertension control outcomes among rural hypertensive patients.

LIMITATIONS

Certain limitations of the study need to be addressed to inform the future design and implementation of psychosocial interventions for the management of hypertension.

Firstly, the study was conducted over a period of 8 weeks and hence the follow-up of hypertensive patients beyond this time-frame will provide valuable insights into the sustainable impact of psychosocial interventions on key psycho-behavioural and health outcomes over an extended period of time. The limitation of the sustainability of the psychosocial intervention on key health and behavioural parameters over a long period of time can be overcome by mobilizing community health workers such as Accredited Social Health Activists (ASHA) and Auxiliary Nurse Midwife (ANM) in health promotion programs comprising of hypertension-related health education, behavioural counselling, blood pressure checking and monitoring and referrals to primary health care services through door to door screening initiatives and home visits.

Secondly the study showed the effectiveness of a home-based doctor led psychosocial intervention in enhancing the psycho-behavioural and blood pressure control outcomes at the community level. However, the non-availability of doctors for home visits and the short duration of physician consultation times in overcrowded primary care clinics with a doctor-patient ratio of 1:1456 compromises the quality of holistic health care given to hypertensive patients. To maximize resource utilization, reduce the transportation burden of patients and save the time of patients and physicians, telemedicine consultations with doctors offer a viable and feasible solution in the current Indian health care context. Another limitation of the study was that it was conducted among rural hypertensive patients from four villages in the Medchal district of Hyderabad, thereby limiting its generalizability to the rural hypertensive population. Future research should replicate the administration and implementation of the psychosocial assessments and interventions in urban settings and communities to determine the generalizability of the present study to diverse communities and contexts.

The integration of the psychosocial interventions developed in the study in the health care delivery services and evaluation of the impact of these health promotion interventions across socio-economic groups and geographic locations needs to be investigated in detail in future studies. The psychosocial assessments and interventions developed and administered in the present investigation would be practical and feasible only when the importance of psychosocial care and the biopsychosocial treatment and management of hypertension are given their due importance and recognition within the structure of the Indian health care system.

IMPLICATIONS

An important contribution of the present study is the design, development, and administration of the psychosocial interventions that integrated informational, psychological, social, and emotional psychosocial support, to foster the control of modifiable lifestyle-related risk factors of hypertension, positive lifestyle modifications, treatment compliance, and enhanced blood pressure control among hypertensive patients. The positive impact of the psychosocial interventions on the primary outcome measures of the study as compared to the control group indicated that cost-effective, and multi-dimensional psychosocial support interventions are feasible within the context of the current Indian health care system. The rationale underlying the design and development of the psychosocial interventions in the present study was that dismantling the long standing social and cultural beliefs regarding hypertension control will require the involvement of the social group of the individual. The premise was that changing the beliefs, perceptions and attitudes of the family members will facilitate a transition to healthy eating and lifestyle patterns.

The psychosocial interventions in the present study used a biopsychosocial approach that integrated the physical, psychological, social, and emotional aspects into a holistic model of health care service delivery and treatment culminating in the effective management and control of hypertension. The results of the study justify the rationale for a patient-centred approach to health care wherein the mind-body relationship in the development and management of hypertension is duly recognized (Fongwa et al., 2008). Scientific evidence has indicated that a patient-centred model of healthcare involving the collaboration of multi-disciplinary health care professionals comprising of physicians, nurses, pharmacists, clinical staff, patients and their family members and the delivery of home-based medical care has resulted in enhanced satisfaction and optimal health outcomes among chronic disease patients (Zullig, Melnyk, Goldstein, Shaw, & Bosworth, 2013; Rosenthal, 2008).

Research evidence has indicated that psychosocial factors such as stress, anxiety and depression were found to act as significant barriers to positive lifestyle modifications and blood pressure control (Khatib et al., 2014; Iyalomhe & Iyalomhe, 2010). Hence the psychosocial interventions in the study were designed to assess and identify symptoms of psychological distress in patients to facilitate referrals to psychologists and psychiatrists for counselling and treatment.

Considering the paucity of physician consultation times, technology driven interventions based on home BP telemonitoring can leverage the doctors', nurse practitioners', and clinical pharmacists' educational, behavioural and medication management for the effective control of hypertension through various technological mediums such as telephone contact, smart phones with Internet capabilities, emails, laptop enabled software applications, and electronic health platforms (Zullig, Melnyk, Goldstein, Shaw, & Bosworth, 2013). Technology based health education interventions can save long-distance commutes, transportation problems and time of patients as well as improve the reach and access to health-care even

among geographically distant, rural, socio-economically disadvantaged and older populations for the effective management and control of chronic diseases.

Scientific evidence has shown that home BP telemonitoring interventions delivered through telephone contacts and combining nurse- led behavioural counselling, pharmacist led lifestyle counselling, home BP monitoring, and physician led medication management led to significant improvements in the lifestyle modifications, treatment adherence, and blood pressure control among hypertensive patients (Bosworth et al., 2011; Magid et al., 2013). Given the plan of the Indian government to expand Internet facilities and broadband services to cover out of reach rural areas by installing fibre optic cables and creating electronic health records for each individual, leveraging technological mediums such as Internet-based or smart phone software application-based services to deliver health interventions may be a feasible option to improve accessibility of health care services to remote areas and facilitate effective time management by both doctors and patients.

The current study was a multi-dimensional investigation that was cost-effective and easy to administer and quantified the impact of the psychosocial interventions on the primary outcomes of blood pressure control, therapeutic adherence, hypertension-related knowledge, health beliefs and self-efficacy among rural hypertensive patients. The findings of the current study highlight the importance of designing psychosocial interventions that take into account the genetic, biomedical, psychological, social, cultural and emotional aspects for the delivery of holistic health care service delivery and treatment for hypertensive patients.

The present study highlighted the importance of training interventionists such as doctors and community health workers in the principles of cognitive-behavioural approaches to health habit modification, for instituting positive health behaviour change among hypertensive patients. The provision of psychological services delivered by trained psychologists and counsellors within the primary health care setting will greatly enhance the psychological and mental health and well-being, thus bearing a direct impact on the physical health outcomes among hypertensive patients.

Future research should focus on leveraging the evolving medium of technology in delivering quality health care to geographically distant and hard to reach areas in the Indian scenario. The initiation of preventive care clinics in primary health care facilities and implementation of hypertension-related health education in schools, colleges, and workplaces can mitigate the condition of hypertension and reduce the morbidity and mortality accrued from the health complications of hypertension at the community and population levels.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

APPENDICES

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