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REVIEW

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Nurse-led interventions to manage hypertension in general practice: A systematic review and meta-analysis

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Abstract

To evaluate the impact of general practice nurse-led interventions for blood pressure control and cardiovascular disease risk factor reduction in patients with hypertension. Systematic review and meta-analysis of randomized control trials. CINAHL, Medline and Scopus databases were searched to identify peer-reviewed studies published between 2000 and 2021. A systematic review of randomized control trials was conducted using a structured search strategy. The Meta-Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI) was used to appraise study quality. Meta-analysis and narrative synthesis were performed to determine the effectiveness of the included interventions. Eleven trials comprising of 4454 participants were included in the review. Meta-analysis showed significant reductions in both systolic and diastolic blood pressure in trials with 6 months or less follow-up. Improvements were also demonstrated in reducing blood lipids, physical activity, general lifestyle measures and medication adherence. Evidence for dietary improvements and reduction in alcohol and smoking rates was inconclusive. Nurse-led interventions for patients with hypertension are heterogeneous in terms of the nature of the intervention and outcomes measured. However, nurse-led interventions in general practice demonstrate significant potential to improve blood pressure and support cardiovascular disease risk factor reduction. Future research should be directed towards elucidating the successful elements of these interventions, evaluating cost-effectiveness and exploring translation into usual care. This review provides evidence that nurses in general practice could enhance current hypertension management through nurse-led interventions.

KEYWORDS
cardiovascular risk, hypertension, lifestyle risk, nursing intervention, general practice nurse

1 | INTRODUCTION

Hypertension is a key risk factor for cardiovascular disease (CVD) (World Health Organisation, 2013) which, despite being preventable and treatable, is often poorly controlled (Unger et al., 2020). The rising global prevalence of hypertension is a grave concern given that elevated blood pressure (BP) leads to more CVD morbidity and mortality than any other single biomedical factor (Mills et al., 2020). Hypertension is often present with other known risk factors such as smoking, nutrition, alcohol and physical activity status, thus increasing a person's absolute CVD risk (National Vascular Disease Prevention Alliance, 2012). There is a need to target evidence-based, person-centred interventions towards people with hypertension to prevent CVD events and improve health outcomes in this group (Buawangpong et al., 2020).

Lowering BP in those with hypertension (BP > 140/90 mm Hg) is a well-established strategy for reducing CVD risk (National Heart Foundation of Australia, 2016). Effectiveness is increased if other behavioural CVD risk factors are acknowledged, targeted and modified (National Heart Foundation of Australia, 2016). Empowering individuals to modify risk in their lifestyle is complex, requiring a multifaceted approach that matches intrinsic motivation to change with support from healthcare professionals (Prochaska and Velicer, 1997; James et al., 2019). Nurse-led interventions offer a feasible model to support people with hypertension to achieve CVD risk reduction in primary care (Chiang et al., 2018; Himmelfarb et al., 2016) . General practice offers an acceptable and accessible location for this activity (James et al., 2019).

1.1 | Background

While models of primary care provision vary globally, in Europe and Australia, general practice is usually located in the community as the first point of health care service contact. General Practice manages both acute and chronic health issues and preventive health, with an emphasis on building continuing relationships over time (Baird et al., 2018).

The growth of multidisciplinary team-based models of care in general practice presents an opportunity to manage BP and lifestyle risk factors to optimize health outcomes (Zwar et al., 2017). Improvements in information systems such as e-health records, decision support and web resources have facilitated a systematic approach to such proactive care in general practice (Baird et al., 2018).

General practice nurses (GPNs) play an essential role in multidisciplinary, team-based care, collaborating with GPs to coordinate patient care through the identification, assessment and direction of brief interventions and follow-up for individuals at risk of morbidity and mortality (Heywood & Laurence, 2018). The prolonged engagement with consumers over time and the capacity to identify and support individuals at risk, who are ready for change, indicates great potential for GPN-led interventions for lifestyle risk reduction (Halcomb et al., 2008; James et al., 2019; Stephen et al., 2018).

While models of care to reduce lifestyle risk factors that involve nurses in general practice are conceptually alluring (Halcomb et al., 2004), there have been few attempts to explore the impact of these interventions. Halcomb et al. (2007) published a systematic review of the effectiveness of GPN interventions in cardiac risk factor reduction among healthy adults and those with known risk factors. This review highlighted that there was variable evidence to support the efficacy of these interventions for the reduction of various risk factors and identified that further research was required to provide evidence to support these models of care (Halcomb et al., 2007). Therefore, this paper seeks to systematically review randomized controlled trials (RCTs) that investigate the effectiveness of GPN-led interventions in reducing BP and modifying other CVD risk factors in patients with known hypertension. If effective, such improvements in the management of patients with hypertension would be expected to decrease CVD related morbidity and mortality.

2 | THE REVIEW

2.1 | Aim

This review seeks to examine the impact of GPN-led interventions for BP control and CVD risk factor reduction in adult patients with hypertension.

2.2 | Design

This is a systematic review of RCTs. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) were used to direct the conduct and reporting of the review (Page et al., 2021). The systematic review protocol was registered on the PROSPERO database (registration no CRD42020139932) (Chowdhury et al., 2020).

2.3 | Search methods

A search was conducted to identify peer-reviewed papers that reported RCTs of GPN-led interventions to reduce BP and other CVD risk factors in adults with hypertension. CINAHL, Medline and Scopus databases were searched from January 2000 to September 2021. This period was chosen given the changes in hypertension screening and management protocols. Resource constraints precluded translation, therefore, only papers published in English language were included. Keywords allowed for international variation of terms (e.g., general practice and family practice) and were developed by experts in primary care and an academic librarian (Box 1).

2.4 | Inclusion and exclusion criteria

This review included RCTs of interventions undertaken in general practice by registered (baccalaureate or equivalent prepared) nurses to reduce BP in adults with hypertension. Trials that included other health professionals, such as doctors or allied health professionals, as part of the broader intervention (e.g., medication review) were included if the intervention was predominately nurse-led. The outcomes of interest were BP and CVD risk outcomes such as body mass index (BMI), smoking, physical activity, cholesterol, alcohol or medication use.

Studies were excluded if the intervention was delivered by a nurse practitioner or specialist cardiac nurse. Interventions that included a Registered Nurse educational and supportive role in

1. 'general practice' OR 'primary care' OR 'community' OR 'family practice'
2. 'smoking cessation' OR 'cholesterol' OR 'diet', 'exercise' OR 'alcohol' OR 'physical activity' OR 'BP,
3. 'nursing intervention' OR 'nursing' OR nurs* OR office nurs*
4. Clinical Trial OR Comparative Study OR Randomised controlled trial OR Evaluation Research OR Prospective Study OR random*
5. Limit to English language
6. Limit to published in or after 2000
7. Limit to peer reviewed

BOX 1 Search strategy

medication management were included, however, nurse prescribing represents advanced practice, therefore trials on medication titration and dispensing were excluded.

2.5 | Search outcomes

Database searches identified 936 records after the removal of duplicates (Figure 1). Results of all searches were imported into Endnote V8 (The EndNote Team, 2013) and titles were reviewed for relevancy. Abstracts of the remaining papers were assessed against the inclusion criteria independently by two reviewers (CS and EH). Where uncertainty existed, the full paper (n = 56) was retrieved for evaluation against the selection criteria. Reference lists of relevant retrieved papers were examined to identify further trials. Recently published protocols were also checked to see if trials had commenced and were suitable for inclusion. A total of 11 papers met the inclusion criteria and were included in the review.

2.6 | Quality appraisal

The 11 included papers were subjected to critical appraisal (Supplementary Material S1). Two independent reviewers (CS and SM) critically appraised the papers using the Meta-Analysis of Statistics Assessment and Review Instrument MAStARI (Joanna Briggs Institute, 2014). This 10-item tool scores each item on a 3-point scale (Yes = 1, Unsure = 2 or No = 3), giving a maximum total score of 30.

Following independent appraisal, discrepancies were resolved by discussion and consensus was reached. As all included papers scored above 12, indicating limited methodological flaws (Joanna Briggs Institute, 2014), no paper was excluded due to methodological quality.

2.7 | Data extraction

Data were extracted relating to intervention components, mode of delivery, follow-up periods and outcome measures by the first author. These data were extracted into summary tables, constructed using the Cochrane Collaboration and Centre for Reviews and Dissemination as a guide (Table 1). Where trials contained multiple, distinct arms, the intervention that was contained the most GPN contact was selected for inclusion.

2.8 | Data synthesis

Due to the heterogeneity between studies, meta-analysis was only conducted on BP outcomes. This meta-analysis was undertaken using Review Manager 5.2 software (The Cochrane Collaboration, 2014). Analysis of continuous data was undertaken using the mean and standard deviation values to derive weighted mean differences (WMD) and their 95% confidence intervals (CIs). Odds ratios and 95% CI were calculated for dichotomous data. Data unable to be pooled in a meta-analysis were extracted and presented in tabulated and narrative form. A narrative synthesis was conducted to gain insight into the impact of interventions on other CVD risk factors.

3 | RESULTS

3.1 | Summary of included studies

All studies included hypertensive patients who had high BP at baseline, except Cicolini et al. (2014) who included participants with a previous diagnosis of hypertension (Table 1).

Sample sizes ranged from 51 (Tonstad et al., 2007) to 1492 (Carrington et al., 2016) patients. The specific interventions

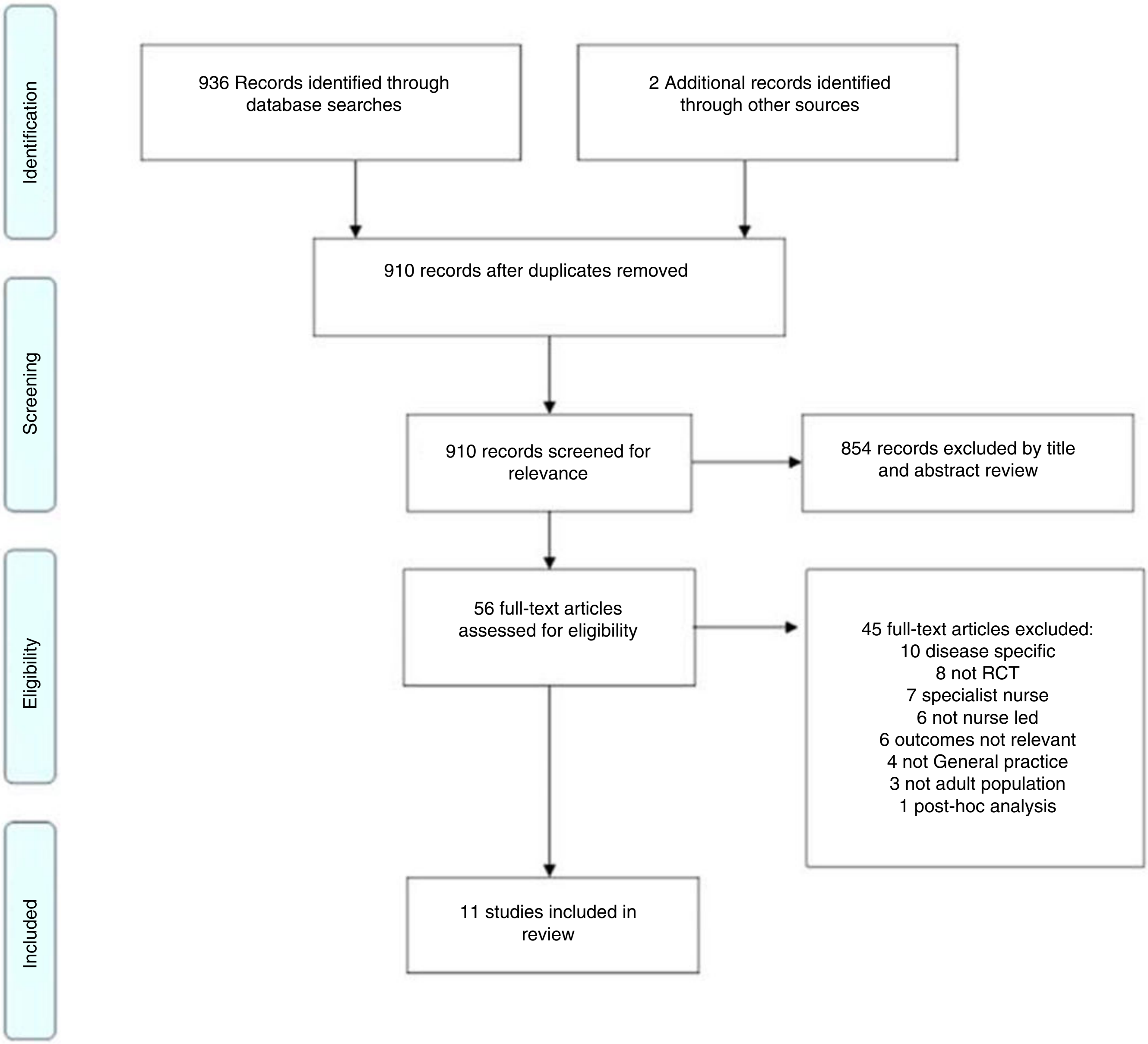

FIGURE 1 PRISMA flow diagram

reported across studies were varied and multifaceted. All interventions were delivered primarily by GPNs, however, several trials involved additional GP consultation (Cicolini et al., 2014; Zhu et al., 2018) and referral to community support facilities (Beune et al., 2014). Nurse consultations were delivered either face-to-face (Beune et al., 2014; Carrington et al., 2016; Hacihasanoğlu & Gözüm, 2011; Kastarinen et al., 2002; Sen et al., 2013; Tonstad et al., 2007; Ulm et al., 2010; Zhu et al., 2018), exclusively via telephone (Bosworth, Olsen, Dudley, et al., 2009, Bosworth, Olsen, Grubber, et al., 2009) or through a combination of email and telephone reminders (Cicolini et al., 2014). Additionally, several studies augmented face-to-face consultation with telephone follow-up (Sen et al., 2013, Zhu et al., 2018; Hacihasanoğlu and Gözüm 2011). The duration and intensity of interventions also varied greatly, with several studies opting for brief contacts lasting 4 (Zhu et al., 2018) or 6 months (Beune et al., 2014; Cicolini et al., 2014; Hacihasanoğlu & Gözüm, 2011; Carrington et al., 2016; Tonstad et al., 2007) to longer studies over 12 (Ulm et al., 2010; Sen et al., 2013) and 24 months (Bosworth, Olsen, Dudley, et al., 2009; Bosworth, Olsen, Grubber, et al., 2009).

Nurses measured BP in seven studies (Carrington et al., 2016; Cicolini et al., 2014; Hacihasanoğlu & Gözüm 2011; Sen et al., 2013; Tonstad et al., 2007; Ulm et al., 2010; Zhu et al., 2018), while four studies used blinded research assistants (Beune et al., 2014; Bosworth, Olsen, Dudley, et al., 2009; Bosworth, Olsen, Grubber, et al., 2009; Kastarinen et al., 2002). Only Ulm et al. (2010) combined 24-hour ambulatory BP monitoring with automated office BP monitoring.

TABLE 1 Characteristics of included studies

Author/country	Sample size	Inclusion criteria	Intervention components	Duration	Outcomes
Beune et al. (2014) Netherlands	146	• Self-identified Surinamese or Ghanian • ≥20 years old • Treated for hypertension (SBP ≥140 mm Hg)	1. Intervention ($n = 75$) • 3 × 30 min counselling sessions • Culturally appropriate education • Referrals to local facilities 2. Usual care ($n = 71$)	6 months	• BP • Adherence to lifestyle advice • Medication adherence • BMI
Bosworth, Olsen, Dudley et al. (2009) America	588	• Diagnosis of hypertension recorded AND • Prescription of antihypertensive medication in previous 12 months	1. Tailored nurse telephone behavioural intervention ($n = 144$) 2. Computerized provider medication support system ($n = 151$) 3. Combined group- computerized medication support AND nurse-led patient behavioural intervention ($n = 150$) 4. Control group ($n = 143$) Hypertension clinical reminder system as per National Guidelines	24 months	• % patients at target BP
Bosworth, Olsen, Grubber et al. (2009) America	636	• Hypertension diagnosis >12 months • Prescription of hypertensive medication previous 12 months • Enrolled participating primary care physician for 12 months prior to study • Residing in pre-specified zip-codes.	1. Tailored behavioural telephone intervention ($n = 160$) • Nurse phoned every month providing education. 2. Home BP monitoring ($n = 158$) • Patients measured BP 3 × weekly. 3. Combined intervention 1&2 ($n = 159$) • Nurse telephone behavioural intervention plus home BP monitoring. 4. Usual care ($n = 159$)	6,12,18, 24 months	• BP • Adherence to advice • Cost analysis • Use of resources
Carrington et al. (2016) Australia	1492	• Aged >18 years • Hypertension requiring antihypertensive medication.	1. Usual care ($n = 348$) 2. Nurse-mediated usual care ($n = 156$) • Routine management with GPN 3. Standard intervention ($n = 705$) • Valsartan mono or combination therapy without GPN support 4. Nurse-mediated intervention ($n = 283$) • Valsartan mono or combination therapy with structured GPN support.	26 weeks	• BP at individual target
Cicolini et al. (2014) Italy	203	• Hypertensive (active antihypertensive treatment) Or • SBP ≥140 mm Hg or DBP ≥90 mm Hg	1. Nurse-led intervention ($n = 102$) • Daily self - assessment, weekly email and phone lifestyle reminders • An educational program 2. Usual care ($n = 101$)	3 and 6 months	• BP • Weight • Waist circumference • Smoking • Alcohol • Sodium intake/Fruit/ vegetable. • Physical activity • Medication adherence • Blood glucose • Lipids

TABLE 1 (Continued)

Author/country	Sample size	Inclusion criteria	Intervention components	Duration	Outcomes
Hacihasanoğlu and Gözüm (2011) Turkey	130	• Age ≥ 35 years • Hypertension (≥140/90 mm Hg) • Antihypertensive medication ≥12 months	1. Group A (n = 43) • Monthly nurse education—four clinic and two home visits (30 min) focussed on medication adherence. Monthly phone calls. 2. Group B (n = 43) • Intervention A and nurse-led healthy lifestyle education (45 min). 3. Control group (n = 44) • BP and weight measurements at centre and in home • Telephone appointment reminders	6 months	• BP • Weight • Medication adherence • Lifestyle behaviours
Kastarinen et al. (2002) Finland	715	• Aged 25–74 years. • SBP between 140 and179 mm Hg and/or • DBP between 90 and 109 mm Hg or • Currently on antihypertensive medication	1. Nurse-led lifestyle counselling (n = 360) • Seven individual visits and two group meetings. Nurses monitored, counselled and provided feedback on lifestyle behaviours. • Written action plan • Feedback on 4-day food record 2. Usual care (n = 355)	12 and 24 months	• BP • BMI/Weight • Physical activity • Waist and hip circumference • Lipids • Salt intake • Alcohol • Smoking
Sen et al. (2013) Sweden	166	• Age ≥ 18 years • Uncontrolled hypertension on doctors visit	1. BP card (n = 57) • BP self-measurement and target card 2. BP card and pedagogic nursing intervention (n = 59) • Individualized planning and written information • Nurse phone calls/visits 3. Usual care (n = 50)	12 months	• BP – proportion of patients achieving target
Tonstad et al. (2007) Norway	51	• Aged 30–69 years • SBP 140–169 mm Hg • DBP between 90 and 99 mm Hg at ≥3 readings	1. Intervention (n = 31) • Monthly nurse counselling x 30 min for 6 months • Stage matched behavioural counselling and education 2. Control (n = 20) • Brief advice • Recommended to visit primary care physician	6 months	• BP • BMI/Weight • Waist and Hip circumference • Triglycerides/Lipid/ Cholesterol • Glucose concentration
Ulm et al. (2010) Germany	200	• Diagnosis of hypertension • SBP ≥140 mm Hg	1. Intensive nurse care (n = 102) • Hypertension booklet • Clinic BP every 6 weeks • Advice on lifestyle and medication management. 2. Usual care (n = 98)	6 and 12 months	• BP • Weight • Physical activity • Smoking • Alcohol
Zhu et al. (2018) China	134	• SBP ≥140 mm Hg and/or DBP ≥90 mm Hg for 3 visits • >18 years	1. Structured Nurse-led hypertension management (n = 67) • 12-week individualized self-management support including initial home visits, biweekly phone follow-ups and referrals by nurses. • Goal setting and plan development. 2. Control group (n = 67) usual care	12 and 16 weeks	• BP • Self-care behaviours • Self-efficacy • Quality of life • Satisfaction

3.2 | Blood pressure

Although all 11 studies measured BP, due to the heterogeneity in terms of reporting and timing of BP measurement, only nine could be pooled in a meta-analysis. Six studies had a follow-up of six months or less, ranging from three (Zhu et al., 2018) to six months (Beune et al., 2014; Carrington et al., 2016; Cicolini et al., 2014; Hacihasanoğlu & Gözüm, 2011; Tonstad et al., 2007). The other three studies had follow-up for over six months, ranging from 12 (Sen et al., 2013; Ulm et al., 2010) to 24 months (Bosworth, Olsen, Dudley, et al., 2009). The statistical tests on which each *p*-value is based are presented in Table S2.

3.2.1 | Mean systolic BP at follow-up

Overall pooled data demonstrated a statistically significant reduction in mean systolic BP (4.7 mm Hg) in the intervention group compared with the control group (95% CI −8.68, −0.71) (Figure 2) (Bosworth, Olsen, Dudley, et al., 2009; Beune et al., 2014; Carrington et al., 2016; Cicolini et al., 2014; Hacihasanoğlu & Gözüm, 2011; Sen et al., 2013; Tonstad et al., 2007; Ulm et al., 2010; Zhu et al., 2018). However, subgroup analysis demonstrated this statistically significant reduction in mean systolic BP was only in the six month or less follow-up group (MD −6.29; 95% CI −11.44, −1.14) and not in the greater than six month follow-up group (MD −1.34; 95% CI −4,42, 1.75).

3.2.2 | Mean change in systolic BP from baseline to follow-up

A statistically significant mean change in systolic BP from baseline to follow-up in the intervention group compared with the standard care group (MD 4.84; 95% CI 2.62, 7.06) was demonstrated by pooled data from four studies (Carrington et al., 2016; Cicolini et al., 2014; Hacihasanoğlu & Gözüm, 2011; Zhu et al., 2018). Subgroup analysis demonstrated that this change was only apparent in the six months or less follow-up group (MD 5.06; 95% CI 2.58, −7.53) and not in the greater than six month follow-up group (MD 3.96; 95% CI −1.07, 8.98). In the remaining two studies, one (Kastarinen et al., 2002) reported no statistically significant difference and the other (Bosworth, Olsen, Grubber, et al., 2009) demonstrated a significant reduction in systolic BP of 3.3 mmHg from baseline to follow-up in the intervention group compared with standard care at the greater than six month follow-up period.

3.2.3 | Mean diastolic BP at follow-up

A statistically significant reduction in diastolic BP (3.01 mm Hg) in the intervention group compared with the standard care group (95% CI −5.58, −0.44) was demonstrated by pooled data from eight studies (Figure 3) (Beune et al., 2014; Carrington et al., 2016; Cicolini et al., 2014; Hacihasanoğlu & Gözüm, 2011; Sen et al., 2013; Tonstad et al., 2007; Ulm et al., 2010; Zhu et al., 2018). Subgroup analysis revealed that this reduction was present only in the six month or less follow-up group (MD −4.15; 95% CI −7.01, −1.29) and not in the greater than six month follow-up group.

3.2.4 | Mean change in diastolic BP from baseline to follow-up

Pooled data from four studies demonstrated a statistically significant mean change in diastolic BP from baseline to follow-up in the intervention group compared with the standard care group (MD

Study or Subgroup	Nurse led intervention Mean	SD	Total	Standard care Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
1.1.1 SBP at 6 months or less								
Beune 2014	146.78	16.23	71	148.93	13.25	68	11.1%	-2.15 [-7.07, 2.77]
Carrington 2016	135	15	283	139	15	348	12.7%	-4.00 [-6.35, -1.65]
Cicolini 2014	135	8	100	143	6	98	12.9%	-8.00 [-9.97, -6.03]
Hacihasanoglu 2011	133.5	12.25	40	156	11.5	40	10.9%	-22.50 [-27.71, -17.29]
Tonstad 2006	147	9	31	143	10	20	10.7%	4.00 [-1.41, 9.41]
Zhu 2018	139.53	16.05	67	144.55	19.1	67	10.3%	-5.02 [-10.99, 0.95]
Subtotal (95% CI)			**592**			**641**	**68.5%**	**-6.29 [-11.44, -1.14]**
Heterogeneity: Tau² = 36.21; Chi² = 60.55, df = 5 (P < 0.00001); I² = 92%								
Test for overall effect: Z = 2.39 (P = 0.02)								
1.1.2 SBP at greater than 6 months								
Bosworth 2009	136.3	19.2	144	136.8	19.1	144	11.4%	-0.50 [-4.92, 3.92]
Sen 2013	140	23	59	139	14.1	50	9.4%	1.00 [-6.05, 8.05]
Ulm 2010	136.6	14.4	78	140.6	17.7	62	10.7%	-4.00 [-9.44, 1.44]
Subtotal (95% CI)			**281**			**256**	**31.5%**	**-1.34 [-4.42, 1.75]**
Heterogeneity: Tau² = 0.00; Chi² = 1.48, df = 2 (P = 0.48); I² = 0%								
Test for overall effect: Z = 0.85 (P = 0.40)								
Total (95% CI)			**873**			**897**	**100.0%**	**-4.70 [-8.68, -0.71]**
Heterogeneity: Tau² = 31.09; Chi² = 70.80, df = 8 (P < 0.00001); I² = 89%								
Test for overall effect: Z = 2.31 (P = 0.02)								
Test for subgroup differences: Chi² = 2.61, df = 1 (P = 0.11), I² = 61.7%								

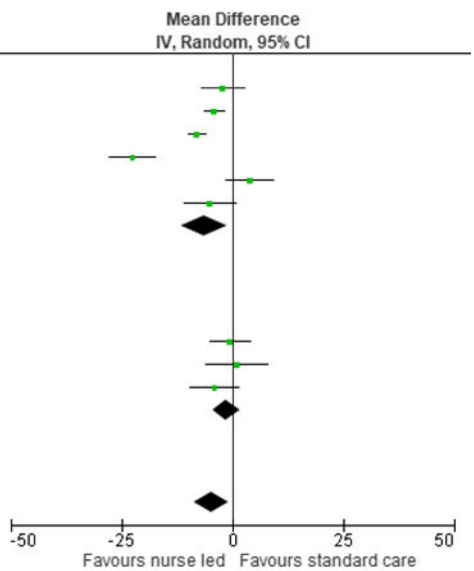

FIGURE 2 Mean difference in systolic BP at ≤6 and at >6 months

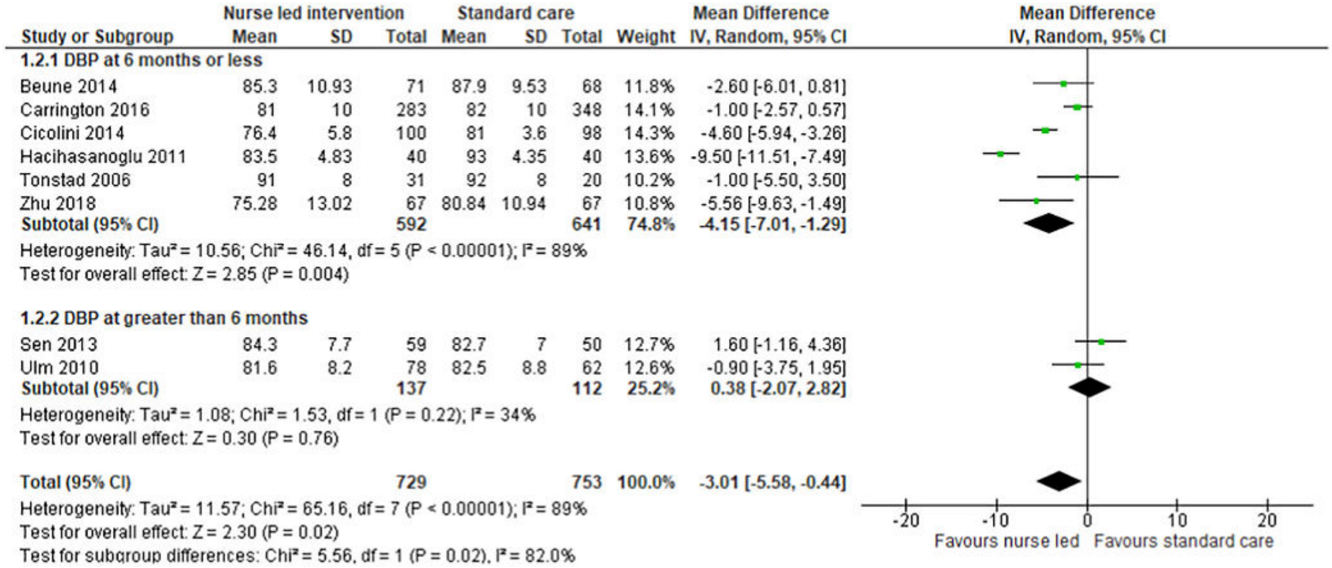

FIGURE 3 Mean difference in diastolic BP at ≤6 and at >6 months [Correction added on 19 April 2022, after first online publication: The correct image for Figure 3 has been inserted.]

2.06; 95% CI 0.84, 3.27)(Beune et al., 2014; Cicolini et al., 2014; Hacihasanoğlu & Gözüm, 2011; Zhu et al., 2018). However, subgroup analysis demonstrated that the change in diastolic BP from baseline to follow-up in the intervention group compared with the standard care group was only in the six month or less follow-up group (MD 2.86; 95% CI 1.49, −4.22) and not in the greater than six month follow-up group (MD −0.91; 95% CI −3.55, 1.73).

3.3 | CVD risk factor reduction

Seven papers reported CVD risk factors as secondary outcomes (Beune et al., 2014; Cicolini et al., 2014; Hacihasanoğlu & Gözüm, 2011; Kastarinen et al., 2002; Tonstad et al., 2007; Ulm et al., 2010; Zhu et al., 2018) (Table 2). The variations in outcomes and outcomes measures between studies make comparison difficult and precluded meta-analysis.

3.3.1 | Diet

Of the four studies that reported dietary outcomes (Beune et al., 2014; Cicolini et al., 2014; Kastarinen et al., 2002; Ulm et al., 2010), only one demonstrated a significant between-group increase in self-reported fruit consumption (Cicolini et al., 2014) ($p < .001$). No significant changes were found in blood glucose, serum insulin, sodium excretion or sodium consumption in any study.

3.3.2 | Anthropometry

Six studies investigated anthropomorphic data, measuring weight (Kastarinen et al., 2002; Tonstad et al., 2007; Ulm et al., 2010), BMI (Beune et al., 2014; Cicolini et al., 2014; Hacihasanoğlu & Gözüm, 2011), waist circumference (Kastarinen et al., 2002; Tonstad et al., 2007) and obesity prevalence (Cicolini et al., 2014).

Kastarinen et al. (2002) reported net reductions in weight (intervention vs. usual care) at both 12 and 24 months with −1.5 kg intervention versus −0.03 control difference in change (95% CI −1.2 kg −1.7, −0.7) at 24 months. Of the three studies that measured BMI, both Cicolini et al. (2014) and Hacihasanoğlu and Gözüm (2011) demonstrated statistically significant between-group reductions. Although improvements were seen in the intervention groups in two studies measuring waist circumference (Kastarinen et al., 2002; Tonstad et al., 2007), no significant between-group differences were found. Additionally, Tonstad et al. (2007) reported that all participants increased waist circumference, however, the overall gain was significantly smaller in the intervention group ($p = .04$). The only study which measured obesity prevalence reported a statistically significant between-group reduction in obesity ($p < .01$) (Cicolini et al., 2014).

3.3.3 | Physical activity

Three studies demonstrated improved physical activity (Cicolini et al., 2014; Kastarinen et al., 2002; Ulm et al., 2010). At six months, Cicolini et al. (2014) reported a significant between-group increase in mean minutes of daily physical activity ($p \le .01$). Despite a modest higher increase in physical activity in the intervention group at 12 months in Ulm et al.'s (2010) study (1 vs. 0.2 h/week) this was not statistically significant. Similarly, Kastarinen et al. (2002) reported that significantly more intervention participants achieved recommended physical activity levels in comparison with the control group at 24 months (difference in change [95% CI] 11.3 [1.8, 20.8]), however, this was not statistically significant.

TABLE 2 Secondary outcomes

Outcome	Outcome measure	Reference	Follow-up (months)	Result[a]
Diet	Daily fruit servings (Mean)	Cicolini et al. (2014)	6	↑consumption $p \le .001$*
	Blood glucose (Mean)	Cicolini et al. (2014)	6	n/s $p = .076$
		Tonstad et al. (2007)	6	n/s
	Serum insulin (Mean)	Kastarinen et al. (2002)	24	n/s
	spoons daily salt (Mean)	Cicolini et al. (2014)	6	$p = .078$
	Sodium excretion (Mean)	Beune et al. (2014)	6	n/s
		Kastarinen et al. (2002)	24	n/s
Alcohol	Weekly alcohol units	Kastarinen et al. (2002)	24	n/s
	Alcohol per day (Mean units)	Cicolini et al. (2014)	6	↓consumption $p \le .05$*
	<1 Alcoholic drink daily	Ulm et al. (2010)	12	n/s
Blood lipids	Total cholesterol (Mean)	Cicolini et al. (2014)	6	$p < .05$*
		Kastarinen et al. (2002)	24	↓0.10 (−0.20, −0.01) (95% CI)
		Tonstad et al. (2007)	6	n/s
	LDL cholesterol (Mean)	Cicolini et al. (2014)	6	$p < .001$*
		Kastarinen et al. (2002)	24	↓0.15 (−0.23, −0.05) (95% CI)
	Triglycerides (Mean)	Cicolini et al. (2014)	6	$p < .001$*
		Kastarinen et al. (2002)	24	n/s
		Tonstad et al. (2007)	6	$p = .03$
Anthropometry	BMI (Mean)	Beune et al. (2014)	6	↓0.016 $p = .10$ n/s
		Cicolini et al. (2014)	6	$p \le .001$*
		Hacihasanoğlu and Gözüm (2011)	6	$p \le .05$*
	Weight (Mean)	Kastarinen et al. (2002)	24	↓1.2 kg
		Ulm et al. (2010)	12	n/s
		Tonstad et al. (2007)	6	n/s
	Waist circumference (Mean)	Kastarinen et al. (2002)	24	↓1.4
	Prevalence of obesity	Cicolini et al. (2014)	6	↓16%
Smoking	Cigarettes per day (Mean)	Cicolini et al. (2014)	6	↓Daily cigarette consumption $p \le .01$
	Smoking status (%)	Ulm et al. (2010)	12	↓14.7%–7% p = n/s
Physical Activity (PA)	Daily PA (Mean mins)	Cicolini et al. (2014)	6	↑ PA $p \le .01$*
	PA hours weekly	Ulm et al. (2010)	12	↑1 h
	Target PA (%)	Kastarinen et al. (2002)	24	Diff. in change 95% CI 11.3 (1.8, 20.8)
General Lifestyle	Self-reported lifestyle behaviours	Beune et al. (2014)	6	↑Lifestyle adherence $p = .003$
	Health promotion lifestyle profile scale	Hacihasanoğlu and Gözüm (2011)	6	↑Healthier lifestyle behaviours $p \le .001$*
	Adherence to non-pharmacological advice	Zhu et al. (2018)	4	$p < .001$*
	% of adherence to therapy hours	Cicolini et al. (2014)	6	91% $p = .082$
Medication	Self-reported MMAS-8	Beune et al. (2014)	6	$p = .74$ n/s
	MASES score	Hacihasanoğlu and Gözüm (2011)	6	$p \le .001$*
	Compliance with medication (%)	Cicolini et al. (2014)	6	100% $p = .9$
	Compliance with therapy dose (%)	Cicolini et al. (2014)	6	100% $p = .078$
	Adherence to antihypertensive medication (%)	Zhu et al. (2018)	4	$p \le .01$*

*indicates satistically significant values.

[a]The statistical tests on which each *p*-value is based are presented in (Table S2).

3.3.4 | Smoking

Only two papers investigated smoking status (Cicolini et al., 2014; Ulm et al., 2010). At six months, Cicolini et al. (2014) demonstrated a statistically significant between-group difference in self-reported daily cigarette consumption ($p \leq .01$). At 12 months, Ulm et al. (2010) reported a reduction in the percentage of self-identified 'smokers' in the intervention group from 14.7% to 7.0%, however, when compared with a change of 9.2%–8.8% in usual care participants, the between-group difference was not statistically significant.

3.3.5 | Alcohol

Alcohol consumption was investigated in three studies (Cicolini et al., 2014; Kastarinen et al., 2002; Ulm et al., 2010). In their study, Cicolini et al. (2014) found a statistically significant between-group reduction in the mean units of alcohol consumed daily ($p < 0.005$). In contrast, studies of longer duration did not report significant changes in alcohol consumption. At 12 months, Ulm et al. (2010) reported a reduction in alcohol consumption among both the intervention participants and control group. While Kastarinen et al. (2002) found that alcohol consumption fell significantly among intervention participants at 12 months, this was not maintained in the second year. These data raise questions about the sustainability of reduced alcohol consumption over time.

3.3.6 | Blood lipids

Three studies measured the effect of GPN interventions on blood lipids with mixed outcomes (Cicolini et al., 2014; Kastarinen et al., 2002; Tonstad et al., 2007). At six months, Cicolini et al. (2014) found a statistically significant reduction in LDL and total cholesterol in the intervention group versus usual care, but no between-group difference in serum triglycerides. Despite no change in mean total cholesterol, Tonstad et al. (2007) reported significantly reduced serum triglycerides in intervention participants ($p = .03$) at six months. In contrast, Kastarinen et al. (2002) demonstrated at 24 months intervention participants had greater net reductions in total cholesterol (−0.10 mmol/L) and LDL-C (−0.15 mmol/L) compared with usual care.

3.3.7 | General lifestyle measures

Four studies reported general lifestyle changes using various outcome measures (Hacihasanoğlu & Gözüm, 2011; Beune et al., 2014; Zhu et al., 2018; Cicolini et al., 2014). Significant improvements were seen in the intervention group in terms of adherence to non-pharmacological advice at three ($p < .001$) and four months ($p = .023$)(Zhu et al., 2018), self-reported lifestyle behaviours ($p = .003$) (Beune et al., 2014) and average scores on the health promotion lifestyle profile scale ($p < .001$)(Hacihasanoğlu & Gözüm, 2011).

Although Cicolini et al., (2014) reported a 91% compliance to therapy hours at six months, this was not significant when compared with the high rates of therapy compliance seen in the usual care group.

3.3.8 | Adherence to medication

Adherence to antihypertensive medication was measured in four studies (Beune et al., 2014; Cicolini et al., 2014; Hacihasanoğlu & Gözüm, 2011; Zhu et al., 2018). Only one of these studies included a General Practitioner medication review in the intervention (Zhu et al., 2018). Although other studies incorporated pharmacotherapy optimization (Carrington et al., 2016) and nurse education about medication use (Bosworth, Olsen, Grubber, et al., 2009) these studies did not report medication adherence outcomes (Bosworth, Olsen, Grubber, et al., 2009; Carrington et al., 2016).

Two studies demonstrated significant improvements in medication adherence in the intervention group compared with usual care (Hacihasanoğlu & Gözüm, 2011; Zhu et al., 2018), while the other two studies showed non-significant improvements due to high rates of medication adherence across both groups Cicolini et al. (2014) and Beune et al. (2014). In their three-arm trial, Hacihasanoğlu and Gözüm (2011) found a significant increase in medication use at six months ($p < .001$). Zhu et al. (2018) also demonstrated a statistically significant increase in adherence to antihypertensive medication ($p < .01$).

4 | DISCUSSION

This meta-analysis demonstrated that GPN-led interventions are effective in reducing both systolic and diastolic BP in studies with follow-up periods of up to six months. The positive effect on both systolic and diastolic BP was less in those studies with more than six months of follow-up. The narrative review of the impact of GPN-led interventions on other CVD risk factors showed mixed results. Improvements were generally seen in blood lipids, physical activity, general lifestyle measures and medication adherence. Despite promising results, the evidence on dietary and alcohol outcomes remains unclear. However, the relatively small number of heterogeneous studies identified in this review demonstrates the limitations in the current evidence around the impact of nurse-delivered interventions to reduce BP and CVD risk in adults with hypertension.

This review is consistent with previous literature in identifying some evidence of improved outcomes with nurse-led intervention for CVD risk reduction (Halcomb et al., 2007). A previous meta-analysis by Clark et al. (2011) found improved outcomes in nurse-led management of BP in people with diabetes. Similarly, in Crowe et al.'s (2019) review of nurse-led intervention for diabetes management, significant improvements in BP were demonstrated. However, this literature also highlights the heterogeneity of the existing evidence and variation between some studies (Halcomb et al., 2007; Clark et al., 2011; Crowe et al., 2019). As such, further investigation is required to specifically elucidate the successful elements of the interventions and the outcomes for which they can achieve significant impact.

Despite this varied evidence base, the previous investigation of nurse-led interventions with populations at high CVD risk reported improvements in smoking (Halcomb et al., 2015), alcohol (Platt et al., 2016; Clossick & Woodward, 2014), weight (Sargent et al., 2012), physical activity (Chudowolska-Kiełkowska & Małek, 2020) and medication adherence (Georgiopoulos et al., 2018). The limited evidence on dietary interventions to improve nutritional quality and anthropomorphic outcomes compares to previous reviews which found some, yet inconsistent effect in both nurse (McElwaine et al., 2016) and multidisciplinary nutritional interventions in primary care (Mitchell et al., 2017). Given the variable results, intervention delivery could be a factor as GPNs perceive their role to include nutritional advice, yet express the need to extend their nutritional knowledge, confidence and motivational counselling skills (Cass et al., 2014, Stephen et al., 2018) Furthermore, uncertainties around knowledge translation may hinder effective lifestyle risk communication (James et al., 2019).

Patient satisfaction and economic analysis were largely missing from the included studies, however, existing literature associates nurse-led intervention with good levels of patient satisfaction (Edelman et al., 2015; Crowe et al., 2019; Stephen et al., 2018), cost-effectiveness (Crowe et al., 2019; Odnoletkova et al., 2016; Doherty et al., 2018) and potential to reach wide population base through digital/telehealth delivery (Odnoletkova et al., 2016; Young et al., 2014). As the economic impact and patient experience represent multifactorial and nuanced variables of nurse-led intervention, further investigation of these issues is warranted.

4.1 | Limitations

While this is the first review of GPN-led interventions focussed on reducing BP and CVD risk in adults with hypertension, there are several limitations. Despite a comprehensive search strategy informed by an academic librarian and checking of reference lists of included papers, a limited number of studies were identified. This highlights the paucity of high-quality evidence in this area. In addition, limiting the search to English language may have resulted in missing studies published in other languages.

Meta-analysis of BP outcomes is a significant strength of this review, however, variation in outcome measures and reporting across included studies precluded meta-analysis of additional CVD risk factors. As these data were unable to be pooled, a narrative synthesis was conducted to gain insight into the intervention effect. Overall heterogeneity of included studies makes it difficult to elucidate the individual intervention elements that contribute to the specific outcomes. Additionally, the interaction between GPNs and other health professionals in the delivery of multidisciplinary care was not clearly described. Given the complexity of some interventions, it is possible that the impact of these individual elements was not apparent. The variation in outcomes measured and reported both between and within groups requires caution in the interpretation of findings.

4.2 | Implications for research and practice

The challenges facing general practice are significant in terms of chronic conditions and population ageing. Finding ways to effectively reduce BP and CVD risk represents an important strategy to prevent or delay the onset of CVD and reduce exacerbation in people with existing CVD. Nurses play a key role in the multidisciplinary management of BP, especially in terms of lifestyle counselling and supporting behaviour change.

Evidence from this review highlights the potential to leverage GPN-delivered interventions to reduce CVD risk and improve health outcomes. However, further research is required to explore the specific elements of these interventions that are most effective, evaluate the economic impact of the intervention and patient satisfaction levels, as well as looking at how to translate these interventions into usual care.

4.3 | Conclusions

GPN-led interventions to manage BP in patients with hypertension are heterogeneous in terms of the scope and style of intervention. This review establishes that nurse intervention in general practice is associated with improvements in BP and additional positive impacts on some CVD risk factors. GPN-led interventions show significant potential to improve BP control and support people to reduce CVD risk factors. There is a clear need to direct future research towards elucidating the successful elements of these interventions and evaluating the wider economic impact of translation to usual care.

AUTHORS' CONTRIBUTIONS

CS, EH, MB and SM completed the data extraction and quality assessment of included papers. CS and RF conducted the meta-analysis. All authors participated in the manuscript preparation, providing critical feedback and approved the final manuscript.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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REFERENCES

Baird, B., Reeve, H., Ross, S., Honeyman, M., Nosa-Ehima, M., Sahib, B., & Omojomolo, D. (2018). *Innovative models of general practice*. The Kings Fund.

Beune, E. J. A. J., Moll van Charante, E. P., Beem, L., Mohrs, J., Agyemang, C. O., Ogedegbe, G., & Haafkens, J. A. (2014). Culturally adapted hypertension education (CAHE) to improve blood pressure control and treatment adherence in patients of African origin with uncontrolled hypertension: Cluster-randomized trial. *PLoS One*, *9*(3), e90103.

Bosworth, H. B., Olsen, M. K., Dudley, T., Orr, M., Goldstein, M. K., Datta, S. K., McCant, F., Gentry, P., Simel, D. L., & Oddone, E. Z. (2009). Patient education and provider decision support to control blood pressure in primary care: A cluster randomized trial. *American Heart Journal*, *157*(3), 450–456.

Bosworth, H. B., Olsen, M. K., Grubber, J. M., Neary, A. M., Orr, M. M., Powers, B. J., Adams, M. B., Svetkey, L. P., Reed, S. D., Li, Y., Dolor, R. J., Oddone, E. Z., Bosworth, H. B., Olsen, M. K., Grubber, J. M., Neary, A. M., Orr, M. M., Powers, B. J., Adams, M. B., & Svetkey, L. P. (2009). Two self-management interventions to improve hypertension control: A randomized trial. *Annals of Internal Medicine*, *151*(10), 687–695.

Buawangpong, N., Pinyopornpanish, K., Jiraporncharoen, W., Dejkriengkraikul, N., Sagulkoo, P., Pateekhum, C., & Angkurawaranon, C. (2020). Incorporating the patient-centered approach into clinical practice helps improve quality of care in cases of hypertension: A retrospective cohort study. *BMC Family Practice*, *21*(1), 108.

Carrington, M. J., Jennings, G. L., Harris, M., Nelson, M., Schlaich, M., Stocks, N. P., Burrell, L. M., Amerena, J., de Looze, F. J., Swemmer, C. H., Kurstjens, N. P., & Stewart, S. (2016). Impact of nurse-mediated management on achieving blood pressure goal levels in primary care: Insights from the valsartan intensified primary carE reduction of blood pressure study. *European Journal of Cardiovascular Nursing*, *15*(6), 409–416.

Cass, S., Ball, L., & Leveritt, M. (2014). Australian practice nurses' perceptions of their role and competency to provide nutrition care to patients living with chronic disease. *Australian Journal of Primary Health*, *20*(2), 203–208.

Chiang, C.-Y., Choi, K.-C., Ho, K.-M., & Yu, S.-F. (2018). Effectiveness of nurse-led patient-centered care behavioral risk modification on secondary prevention of coronary heart disease: A systematic review. *International Journal of Nursing Studies*, *84*, 28–39.

Chowdhury, S., Stephen, C., McInnes, S., & Halcomb, E. (2020). Nurse-led interventions to manage hypertension in general practice: A systematic review protocol. *Collegian*, *27*(3), 340–343.

Chudowolska-Kiełkowska, M., & Małek, Ł. A. (2020). A nurse-led intervention to promote physical activity in sedentary older adults with cardiovascular risk factors: A randomized clinical trial (STEP-IT-UP study). *European Journal of Cardiovascular Nursing*, *19*, 638–645.

Cicolini, G., Simonetti, V., Comparcini, D., Celiberti, I., Di Nicola, M., Capasso, L. M., Flacco, M. E., Bucci, M., Mezzetti, A., & Manzoli, L. (2014). Efficacy of a nurse-led email reminder program for cardiovascular prevention risk reduction in hypertensive patients: A randomized controlled trial. *International Journal of Nursing Studies*, *51*(6), 833–843.

Clark, C. E., Smith, L. F., Taylor, R. S., & Campbell, J. L. (2011). Nurse-led interventions used to improve control of high blood pressure in people with diabetes: A systematic review and meta-analysis. *Diabetic Medicine*, *28*(3), 250–261.

Clossick, E., & Woodward, S. (2014). Effectiveness of alcohol brief interventions in general practice. *British Journal of Nursing*, *23*(11), 574–580.

Crowe, M., Jones, V., Stone, M.-A., & Coe, G. (2019). The clinical effectiveness of nursing models of diabetes care: A synthesis of the evidence. *International Journal of Nursing Studies*, *93*, 119–128.

Doherty, M., Jenkins, W., Richardson, H., Sarmanova, A., Abhishek, A., Ashton, D., Barclay, C., Doherty, S., Duley, L., Hatton, R., Rees, F., Stevenson, M., & Zhang, W. (2018). Efficacy and cost-effectiveness of nurse-led care involving education and engagement of patients and a treat-to-target urate-lowering strategy versus usual care for gout: A randomised controlled trial. *The Lancet*, *392*(10156), 1403–1412.

Edelman, D., Dolor, R. J., Coffman, C. J., Pereira, K. C., Granger, B. B., Lindquist, J. H., Neary, A. M., Harris, A. J., & Bosworth, H. B. (2015). Nurse-led behavioral management of diabetes and hypertension in community practices: A randomized trial. *Journal of General Internal Medicine*, *30*(5), 626–633.

Georgiopoulos, G., Kollia, Z., Katsi, V., Oikonomou, D., Tsioufis, C., & Tousoulis, D. (2018). Nurse's contribution to alleviate non-adherence to hypertension treatment. *Current Hypertension Reports*, *20*, 65.

Hacihasanoğlu, R., & Gözüm, S. (2011). The effect of patient education and home monitoring on medication compliance, hypertension management, healthy lifestyle behaviours and BMI in a primary health care setting. *Journal of Clinical Nursing*, *20*(5/6), 692–705.

Halcomb, E., Davidson, P., Daly, J., Yallop, J., & Tofler, G. (2004). Australian nurses in general practice based heart failure management: Implications for innovative collaborative practice. *European Journal of Cardiovascular Nursing*, *3*(2), 135–147.

Halcomb, E., Furler, J., Hermitz, O., Blackberry, I., Smith, J., Richmond, R., & Zwar, N. (2015). Process evaluation of a practice nurse-led smoking cessation trial in Australian general practice: Views of general practitioners and practice nurses. *Family Practice*, *32*(4), 468–473.

Halcomb, E., Moujalli, S., Griffiths, R., & Davidson, P. (2007). Effectiveness of general practice nurse interventions in cardiac risk factor reduction among adults. *International Journal of Evidence-Based Healthcare*, *5*(3), 269–295.

Halcomb, E. J., Davidson, P. M., Griffiths, R., & Daly, J. (2008). Cardiovascular disease management: Time to advance the practice nurse role? *Australian Health Review*, *32*(1), 44–55.

Heywood, T., & Laurence, C. (2018). The general practice nurse workforce. *Australian Journal for General Practitioners*, *47*, 788–795.

Himmelfarb, C. R. D., Commodore-Mensah, Y., & Hill, M. N. (2016). Expanding the role of nurses to improve hypertension care and control globally. *Annals of Global Health*, *82*(2), 243–253.

James, S., Halcomb, E., Desborough, J., & McInnes, S. (2019). Lifestyle risk communication by general practice nurses: An integrative literature review. *Collegian*, *26*(1), 183–193.

Joanna Briggs Institute. (2014). *Joanna Briggs Institute Reviewers' Manual*. Joanna Briggs Institute University of Adelaide.

Kastarinen, M. J., Puska, P. M., Korhonen, M. H., Mustonen, J. N., Salomaa, V. V., Sundvall, J. E., Tuomilehto, J. O., Uusitupa, M. I., & Nissinen, A. M. (2002). Non-pharmacological treatment of hypertension in primary health care: A 2-year open randomized controlled trial of lifestyle intervention against hypertension in eastern Finland. *Journal of Hypertension*, *20*(12), 2505–2512.

McElwaine, K. M., Freund, M., Campbell, E. M., Bartlem, K. M., Wye, P. M., & Wiggers, J. H. (2016). Systematic review of interventions to increase the delivery of preventive care by primary care nurses and allied health clinicians. *Implementation Science*, *11*(1), 50.

Mills, K. T., Stefanescu, A., & He, J. (2020). The global epidemiology of hypertension. *Nature Reviews Nephrology*, *16*(4), 223–237.

Mitchell, L. J., Ball, L. E., Ross, L. J., Barnes, K. A., & Williams, L. T. (2017). Effectiveness of dietetic consultations in primary health care: A systematic review of randomized controlled trials. *Journal of the Academy of Nutrition & Dietetics*, *117*(12), 1941–1962.

National Heart Foundation of Australia. (2016). *Guideline for the diagnosis and management of hypertention in adults - 2016*. National Heart Foundation of Australia.

National Vascular Disease Prevention Alliance. (2012) *Guidelines for the management of absolute cardiovascular disease risk*. National Stroke Foundation.

Odnoletkova, I., Ramaekers, D., Nobels, F., Goderis, G., Aertgeerts, B., & Annemans, L. (2016). Delivering diabetes education through nurse-led telecoaching. Cost-effectiveness analysis. *PLoS ONE*, *11*(10), 1–18.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, n71.

Platt, L., Melendez-Torres, G. J., Donnell, A., Bradley, J., Newbury-Birch, D., Kaner, E., & Ashton, C. (2016). How effective are brief interventions in reducing alcohol consumption: Do the setting, practitioner group and content matter? Findings from a systematic review and metaregression analysis. *BMJ Open*, *6*(8), e011473.

Prochaska, J. O., & Velicer, W. F. (1997). The transtheoretical model of health behavior change. *American Journal of Health Promotion*, *12*(1), 38–48.

Sargent, G. M., Forrest, L. E., & Parker, R. M. (2012). Nurse delivered lifestyle interventions in primary health care to treat chronic disease risk factors associated with obesity: A systematic review. *Obesity Reviews*, *13*(12), 1148–1171.

Sen, M., Rasjö Wrååk, G., Rönmark, P., Carlsson, A. C., Törnkvist, L., Wändell, P., & Hasselström, J. (2013). Lack of long-term effects from a pedagogical intervention upon blood pressure control–a randomized primary care study. *Scandinavian Cardiovascular Journal*, *47*(5), 289–296.

Stephen, C., Halcomb, E., McInnes, S., Hermiz, O., & Zwar, N. (2018). Feasibility and acceptability of a nurse-led hypertension management intervention in general practice. *Collegian*, *25*(1), 38–33.

The Cochrane Collaboration. (2014). *Review manager (RevMan) (Computer program)*. The Nordic Cochrane Centre.

The EndNote Team. (2013). *EndNote*. Clarivate.

Tonstad, S., Alm, C. S., & Sandvik, E. (2007). Effect of nurse counselling on metabolic risk factors in patients with mild hypertension: A randomised controlled trial. *European Journal of Cardiovascular Nursing*, *6*(2), 160–164.

Ulm, K., Huntgeburth, U., Gnahn, H., Briesenick, C., Puerner, K., & Middeke, M. (2010). Effect of an intensive nurse-managed medical care programme on ambulatory blood pressure in hypertensive patients. *Archives of Cardiovascular Diseases*, *103*(3), 142–149.

Unger, T., Borghi, C., Charchar, F., Khan Nadia, A., Poulter Neil, R., Prabhakaran, D., Ramirez, A., Schlaich, M., Stergiou George, S., Tomaszewski, M., Wainford Richard, D., Williams, B., & Schutte Aletta, E. (2020). 2020 International Society of Hypertension Global Hypertension Practice Guidelines. *Hypertension*, *75*(6), 1334–1357.

World Health Organisation. (2013). *Global brief on hypertension. WHO/DCO/WHD/2013.2*. World Health Day 2013.

Young, H., Miyamoto, S., Ward, D., Dharmar, M., Tang-Feldman, Y., & Berglund, L. (2014). Sustained effects of a nurse coaching intervention via telehealth to improve health behavior change in diabetes. *Telemedicine and e-Health*, *20*(9), 828–834.

Zhu, X., Wong, F. K. Y., & Wu, C. L. H. (2018). Development and evaluation of a nurse-led hypertension management model: A randomized controlled trial. *International Journal of Nursing Studies*, *77*, 171–178.

Zwar, N., Hermiz, O., Halcomb, E., Davidson, P., & Bodenheimer, T. (2017). Improving blood pressure control in general practice: A pilot study of the ImPress intervention. *Australian Family Physician*, *46*(5), 306–311.

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