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***Original Research Article***

# EFFECTIVENESS OF NURSE-LED INTERVENTIONS IN MANAGING HYPERTENSION AMONG OLDER ADULTS

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## ABSTRACT

***Background:*** *Hypertension is highly prevalent among older adults and remains a major contributor to cardiovascular morbidity and mortality, particularly in low and middle-income countries. In Pakistan, inadequate blood pressure control among older adults is frequently observed due to poor medication adherence, insufficient lifestyle modification, and limited continuity of care. Nurse-led interventions have emerged as a practical approach to address these gaps through structured education, regular follow-up, and patient empowerment.* ***Objective:*** *To evaluate the effectiveness of a structured nurse-led intervention in improving blood pressure control, medication adherence, and lifestyle behaviours among older adults with hypertension in a tertiary care hospital setting in Pakistan.* ***Study Design:*** *Prospective two-arm controlled clinical evaluation.* ***Settings:*** *Tertiary care hospital in Pakistan.* ***Duration of Study:*** *January to July 2025.* ***Methods:*** *A total of 90 hypertensive adults aged 60 years or older were enrolled and allocated into an intervention group (n = 45) and a control group (n = 45). The intervention group received structured nurse-led hypertension management in addition to usual care, while the control group received usual care alone. The nurse-led program comprised individualised education, medication counselling, lifestyle modification guidance, home blood pressure monitoring support, and scheduled follow-up visits with telephone reinforcement. Blood pressure was measured at baseline and at 12 weeks. Medication adherence was assessed using the 8-item Morisky Medication Adherence Scale. Between-group comparisons were performed using appropriate statistical tests, and multivariable logistic regression analysis was conducted to identify independent predictors of blood pressure control.* ***Results:*** *Baseline demographic and clinical characteristics were comparable between the two groups. At 12 weeks, the intervention group demonstrated significantly greater reductions in systolic blood pressure (−15.2 ± 9.4 mmHg vs −6.1 ± 8.8 mmHg) and diastolic blood pressure (−7.8 ± 6.2 mmHg vs −2.9 ± 5.9 mmHg) compared with the control group ($p < 0.001$ for both). Blood pressure control, defined as <140/90 mmHg, was achieved in 68.9% of participants in the intervention group versus 40.0% in the control group ($p = 0.006$). Medication adherence scores improved significantly in the intervention arm, accompanied by favourable changes in dietary salt intake and physical activity. Nurse-led intervention independently predicted blood pressure control at 12 weeks (adjusted OR 3.18, 95% CI 1.30–7.79).* ***Conclusion:*** *Structured nurse-led hypertension management significantly improves blood pressure control, medication adherence, and lifestyle behaviours among older adults. Integration of nurse-led interventions into routine clinical practice may offer a scalable and cost-effective strategy to enhance hypertension outcomes in resource-limited settings.*

**Keywords:** Hypertension, Nurse-Led Intervention, Older Adults, Blood Pressure Control, Medication Adherence

## INTRODUCTION

Hypertension remains a leading global health concern, particularly among older adults who face unique challenges in managing their condition. The increasing prevalence of hypertension in this population necessitates effective management strategies that account for their specific healthcare needs. Current literature suggests that nurse-led interventions can significantly enhance the management of hypertension, enabling older adults to achieve better blood pressure control and improve overall health outcomes (1-3). This assertion is supported by various studies demonstrating the effectiveness of comprehensive, nurse-led programs that incorporate education, lifestyle modifications, and individualised care plans (4, 5).

Research indicates that nurse-led interventions not only improve medication adherence but also empower older patients with hypertension to engage in self-management practices (6). One significant systematic review highlighted that these interventions can lead to substantial reductions in systolic and diastolic blood pressure, with nurses playing a crucial role in promoting lifestyle changes among older adults (1, 3, 4). Additionally, innovative approaches such as telehealth and mobile health applications have been integrated into nurse-led strategies, enabling remote monitoring and support, which have shown promise in enhancing patient engagement and compliance (7, 8).

A notable randomised controlled trial found that nurse-supervised physical activity interventions successfully lowered the mean systolic blood pressure of older adults while also improving their perceived quality of life (9). Furthermore, the implementation of nurse-led telephone support systems has been shown to foster feelings of social support, thereby increasing patients' self-efficacy in managing their hypertension (7, 8). These findings underline the importance of incorporating multifaceted strategies into hypertension management, particularly for older patients who often grapple with comorbidities such as diabetes and heart disease.

The existing evidence demonstrates that nurse-led interventions can enhance adherence to therapeutic regimens and reduce healthcare costs, making them a valuable asset in the management of hypertension in older adults (4, 6). The integration of such interventions into healthcare systems may thus lead to improved clinical outcomes, including reductions in cardiovascular morbidity and mortality associated with uncontrolled hypertension.

In Pakistan, the burden of hypertension among older adults is exacerbated by a combination of factors, including limited access to healthcare resources, a lack of public awareness regarding hypertension management, and cultural barriers that hinder effective self-care practices (1, 4, 5). The country's ageing population faces significant challenges in controlling hypertension due to these systemic issues, necessitating targeted interventions tailored to the local context. Nurse-led initiatives that focus on education, lifestyle

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modifications, and ongoing support can empower older adults in Pakistan to take charge of their health, ultimately leading to better hypertension management and improved quality of life. As the healthcare landscape in Pakistan evolves, integrating nurse-led interventions into routine practice could potentially transform the management of hypertension in this vulnerable demographic, fostering a sustainable approach to health promotion and disease prevention (8, 10).

## METHODOLOGY

This study was conducted at a tertiary care hospital in Pakistan over six months from January to July 2025. A prospective, two-arm controlled clinical trial was conducted to assess the effectiveness of nurse-led interventions in improving blood pressure outcomes among older adults with hypertension. Participants were recruited from medical outpatient clinics and follow-up services using a consecutive sampling approach until the required sample size was achieved.

Adults aged 60 years and older with a physician Diagnosis of hypertension and baseline clinic blood pressure at or above 140/90 mmHg, or currently receiving antihypertensive medication with uncontrolled readings, were eligible. Participants were required to be able to communicate effectively and provide informed consent. Exclusion criteria included hypertensive emergency, recent acute coronary syndrome or stroke within the previous three months, decompensated heart failure requiring urgent admission, end-stage renal disease on dialysis, severe cognitive impairment limiting participation, and any condition judged by the treating physician to preclude safe follow-up.

A sample size of 90 participants was used to ensure adequate precision for estimating clinically meaningful differences in systolic blood pressure between groups within the study timeframe. Participants were randomly assigned to two groups (45 per arm). The intervention group received nurse-led hypertension management in addition to usual physician care, while the control group received usual care delivered through routine clinic processes.

The nurse-led intervention was standardised and delivered by trained registered nurses, using a structured protocol aligned with evidence-based principles of hypertension management. The package included individualised education on hypertension and its complications, medication counselling with a focus on dosing schedules and side-effect management, lifestyle counselling emphasising salt restriction consistent with local dietary patterns, physical activity guidance tailored to older adults, weight management advice, and smoking cessation counselling where relevant. Participants received instruction in home blood pressure monitoring, where feasible, including technique demonstration, recording readings, and recognizing warning signs. Follow-up contacts were conducted at prespecified intervals, combining clinic visits and telephone reinforcement to address adherence barriers, review BP logs, encourage behaviour change, and facilitate physician review for medication adjustment when indicated.

Blood pressure was measured using a calibrated automated sphygmomanometer with an appropriately sized cuff after at least five minutes of seated rest, avoiding caffeine and smoking prior to measurement when possible. Two readings were obtained one to two minutes apart, and the average was recorded for analysis. Baseline blood pressure was recorded at enrollment and repeated at the 12-week endpoint; interim measurements were used clinically for counselling and referral, but the primary analysis focused on baseline-to-week-12 change and control status. Hypertension control was operationally defined as clinic BP <140/90 mmHg at 12 weeks; subgroup analyses evaluated control among participants with diabetes mellitus or chronic kidney disease using the same pragmatic target to reflect routine practice in the study setting.

Medication adherence was assessed using the 8-item Morisky Medication Adherence Scale (MMAS-8) administered at baseline and at 12 weeks. Lifestyle and self-management indicators were evaluated using a structured questionnaire that captured salt-reduction behaviour, physical activity frequency, missed-dose occurrence in the previous week, and smoking status. Comorbidity status and antihypertensive regimens were documented from patient records and verified through participant interviews. All study tools were administered in an interview-based format to accommodate varying literacy levels.

Data were entered and analysed in SPSS. Continuous variables were summarised using the mean and standard deviation, or the median and interquartile range, depending on the distribution; categorical variables were summarised as frequencies and percentages. Between-group comparisons at baseline were conducted using independent sample t-tests or Mann–Whitney U tests for continuous variables and chi-square or Fisher's exact tests for categorical variables. The primary effectiveness analysis compared the mean change in SBP and DBP from baseline to 12 weeks between groups, supplemented by adjusted analyses using analysis of covariance with baseline BP as a covariate. Hypertension control proportions were compared using chi-square tests with estimation of absolute risk differences. Multivariable logistic regression was performed to identify independent predictors of BP control at 12 weeks, including clinically relevant covariates such as age, sex, baseline SBP, diabetes or CKD status, number of antihypertensive drug classes, and adherence. Statistical significance was set at $p < 0.05$, and 95% confidence intervals were reported where appropriate.

Ethical approval was obtained from the study site's institutional ethics committee. Written informed consent was taken from all participants prior to enrollment. Confidentiality was maintained by anonymising data and restricting access to study records. Participants in both groups continued to receive standard medical care, and those with persistently elevated BP or symptoms suggestive of complications were referred promptly to the treating physician for escalation in accordance with routine hospital protocols.

## RESULTS

A total of 90 older adults with diagnosed hypertension were enrolled at a tertiary care hospital between July and December and were analysed (n = 45 in the nurse-led intervention; n = 45 in usual care). The overall mean age was 66.8 ± 5.7 years; 52.2% (n = 47) were female. Most participants were married (72.2%), and 61.1% had no formal education or only primary education. Baseline clinical and demographic characteristics were comparable between groups (all $p > 0.05$) (Table 1).

Baseline clinical profiles, including comorbidities and antihypertensive regimens, were similar across study arms. Diabetes mellitus was present in 41.1% (n = 37), dyslipidemia in 46.7% (n = 42), and chronic kidney disease in 12.2% (n = 11). The mean baseline systolic blood pressure (SBP) and diastolic blood pressure (DBP) were 152.4 ± 10.8 mmHg and 89.6 ± 7.4 mmHg, respectively, with no significant between-group differences (Table 2).

At 12 weeks, the nurse-led intervention produced a clinically meaningful and statistically significant reduction in SBP and DBP compared with usual care. The mean SBP reduction was greater in the intervention group (−15.2 ± 9.4 mmHg) than in the control group (−6.1 ± 8.8 mmHg), with an adjusted mean difference of −8.7 mmHg (95% CI: −12.4 to −5.0; $p < 0.001$). Similarly, DBP decreased more in the intervention group (−7.8 ± 6.2 mmHg) than in the control group (−2.9 ± 5.9 mmHg), with an adjusted mean difference of −4.6 mmHg (95% CI: −6.9 to −2.3; $p < 0.001$) (Table 3).

Blood pressure control rates improved substantially in the intervention arm. At baseline, 17.8% (n = 16) were controlled using a target of <140/90 mmHg, with no between-group difference. By week 12,

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control was achieved by 68.9% (n = 31) in the intervention group versus 40.0% (n = 18) in the control group (absolute difference 28.9%; p = 0.006). Among participants with diabetes or CKD (n = 44), the proportion achieving a blood pressure <140/90 mmHg was also higher in the intervention group (63.6% vs 34.8%; p = 0.03) (Table 4).

Secondary outcomes favored the intervention, particularly medication adherence and lifestyle behaviors. Mean MMAS-8 adherence scores increased from 5.4 ± 1.2 to 7.0 ± 0.9 in the intervention group compared with 5.3 ± 1.1 to 6.0 ± 1.0 in controls (between-group difference in change: +0.9; 95% CI: 0.5 to 1.3; p < 0.001). Dietary sodium reduction and physical activity adherence improved more frequently in the intervention group, and the frequency of missed doses declined. No intervention-related serious adverse events were documented; dizziness consistent with over-treatment was uncommon (4.4% vs 2.2%, p = 0.56) (Table 5).

In multivariable analysis, assignment to the nurse-led intervention independently predicted BP control at 12 weeks after adjusting for age, sex, baseline SBP, diabetes/CKD status, number of antihypertensive drug classes, and baseline adherence. Higher baseline SBP reduced the likelihood of control, while improved adherence increased it (Table 6).

Overall, these findings demonstrate that a structured nurse-led intervention package delivered in a tertiary-care setting in Pakistan over 12 weeks significantly improved BP control, target attainment, and adherence-related behaviours among older adults, supporting scalability in resource-constrained cardiovascular prevention programs.

**Table 1: Baseline socio-demographic characteristics of participants (n = 90)**

| Variable | Total (n=90) | Intervention (n=45) | Control (n=45) | p-value |
|---|---|---|---|---|
| Age (years), mean ± SD | 66.8 ± 5.7 | 66.6 ± 5.9 | 67.0 ± 5.6 | 0.74 |
| **Age group, n (%)** | | | | 0.83 |
| 60–64 | 26 (28.9) | 14 (31.1) | 12 (26.7) | |
| 65–69 | 34 (37.8) | 16 (35.6) | 18 (40.0) | |
| ≥70 | 30 (33.3) | 15 (33.3) | 15 (33.3) | |
| Female, n (%) | 47 (52.2) | 24 (53.3) | 23 (51.1) | 0.84 |
| Married, n (%) | 65 (72.2) | 32 (71.1) | 33 (73.3) | 0.82 |
| **Education, n (%)** | | | | 0.79 |
| No formal or primary | 55 (61.1) | 27 (60.0) | 28 (62.2) | |
| Secondary | 23 (25.6) | 11 (24.4) | 12 (26.7) | |
| Higher secondary or above | 12 (13.3) | 7 (15.6) | 5 (11.1) | |
| Monthly household income < PKR 50,000, n (%) | 57 (63.3) | 28 (62.2) | 29 (64.4) | 0.83 |
| Urban residence, n (%) | 58 (64.4) | 30 (66.7) | 28 (62.2) | 0.66 |
| Current or former smoker, n (%) | 18 (20.0) | 9 (20.0) | 9 (20.0) | 1.00 |

**Table 2: Baseline clinical characteristics and hypertension-related variables (n = 90)**

| Variable | Intervention (n=45) | Control (n=45) | p-value |
|---|---|---|---|
| Duration of hypertension (years), mean ± SD | 7.1 ± 4.2 | 7.4 ± 4.0 | 0.73 |
| Baseline SBP (mmHg), mean ± SD | 152.1 ± 10.7 | 152.8 ± 11.0 | 0.78 |
| Baseline DBP (mmHg), mean ± SD | 89.8 ± 7.3 | 89.4 ± 7.5 | 0.79 |
| Diabetes mellitus, n (%) | 18 (40.0) | 19 (42.2) | 0.83 |
| Dyslipidemia, n (%) | 20 (44.4) | 22 (48.9) | 0.67 |
| CKD (eGFR <60), n (%) | 6 (13.3) | 5 (11.1) | 0.75 |
| BMI (kg/m²), mean ± SD | 28.1 ± 3.6 | 27.8 ± 3.4 | 0.69 |
| Obesity (BMI ≥30), n (%) | 16 (35.6) | 14 (31.1) | 0.65 |
| **Antihypertensive classes, n (%)** | | | 0.88 |
| 1 drug class | 10 (22.2) | 11 (24.4) | |
| 2 drug classes | 22 (48.9) | 20 (44.4) | |
| ≥3 drug classes | 13 (28.9) | 14 (31.1) | |
| Baseline medication adherence (MMAS-8), mean ± SD | 5.4 ± 1.2 | 5.3 ± 1.1 | 0.64 |

**Table 3: Primary outcomes: change in blood pressure from baseline to 12 weeks (n = 90)**

| Outcome | Intervention (n=45) mean ± SD | Control (n=45) mean ± SD | Between-group adjusted difference (95% CI) | p-value |
|---|---|---|---|---|
| SBP at baseline (mmHg) | 152.1 ± 10.7 | 152.8 ± 11.0 | | 0.78 |
| SBP at 12 weeks (mmHg) | 136.9 ± 10.1 | 146.7 ± 11.4 | | <0.001 |
| SBP change (mmHg) | −15.2 ± 9.4 | −6.1 ± 8.8 | −8.7 (−12.4 to −5.0) | <0.001 |
| DBP at baseline (mmHg) | 89.8 ± 7.3 | 89.4 ± 7.5 | | 0.79 |
| DBP at 12 weeks (mmHg) | 82.0 ± 6.8 | 86.5 ± 7.2 | | <0.001 |
| DBP change (mmHg) | −7.8 ± 6.2 | −2.9 ± 5.9 | −4.6 (−6.9 to −2.3) | <0.001 |

**Table 4: Hypertension control rates at baseline and 12 weeks (n = 90)**

| Control outcome | Intervention (n=45) n (%) | Control (n=45) n (%) | p-value |
|---|---|---|---|
| Controlled at baseline (<140/90) | 8 (17.8) | 8 (17.8) | 1.00 |
| Controlled at 12 weeks (<140/90) | 31 (68.9) | 18 (40.0) | 0.006 |
| High-risk subgroup (diabetes or CKD), controlled at 12 weeks (<140/90) | 14/22 (63.6) | 8/23 (34.8) | 0.03 |
| Required medication intensification during follow-up | 9 (20.0) | 16 (35.6) | 0.10 |

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**Table 5: Secondary outcomes at 12 weeks: adherence and lifestyle indicators (n = 90)**

| Outcome | Intervention (n=45) | Control (n=45) | p-value |
|---|---|---|---|
| MMAS-8 score at baseline, mean ± SD | 5.4 ± 1.2 | 5.3 ± 1.1 | 0.64 |
| MMAS-8 score at 12 weeks, mean ± SD | 7.0 ± 0.9 | 6.0 ± 1.0 | <0.001 |
| Improved adherence category (low/moderate to high), n (%) | 28 (62.2) | 14 (31.1) | 0.003 |
| Self-reported low-salt diet adherence at 12 weeks, n (%) | 30 (66.7) | 18 (40.0) | 0.01 |
| ≥150 min/week physical activity at 12 weeks, n (%) | 24 (53.3) | 14 (31.1) | 0.03 |
| Missed doses in past week at 12 weeks (any), n (%) | 10 (22.2) | 19 (42.2) | 0.04 |
| Symptomatic dizziness during follow-up, n (%) | 2 (4.4) | 1 (2.2) | 0.56 |

**Table 6: Multivariable logistic regression predicting BP control at 12 weeks (<140/90 mmHg)**

| Predictor | Adjusted OR | 95% CI | p-value |
|---|---|---|---|
| Nurse-led intervention (vs control) | 3.18 | 1.30–7.79 | 0.01 |
| Baseline SBP (per 5 mmHg increase) | 0.82 | 0.70–0.96 | 0.01 |
| High adherence at 12 weeks (MMAS-8 ≥ 7) | 2.74 | 1.12–6.70 | 0.03 |
| Diabetes or CKD (yes) | 0.71 | 0.29–1.76 | 0.46 |
| ≥3 drug classes at baseline (yes) | 0.78 | 0.31–1.96 | 0.60 |
| Age (per year) | 0.97 | 0.91–1.04 | 0.41 |
| Female sex | 1.10 | 0.46–2.66 | 0.83 |

## DISCUSSION

The findings of our study suggest that nurse-led interventions are significantly effective in managing hypertension among older adults, particularly in a tertiary care setting in Pakistan. The results demonstrate that the intervention group experienced a substantial reduction in both systolic and diastolic blood pressure compared to the control group, with an adjusted mean difference of −8.7 mmHg in SBP and −4.6 mmHg in DBP, both statistically significant at $p < 0.001$ (Table 3). This is consistent with recent literature demonstrating the effectiveness of nurse-led interventions in improving blood pressure control. For instance, Kolcu and Ergün (2020) reported similar outcomes in their randomised trial, indicating that structured nurse-led hypertension management programs significantly enhance blood pressure levels in older adults (11). Additionally, a study found that team-based care approaches, often including nurse-led strategies, yielded comparable reductions in blood pressure among uncontrolled hypertensive patients (12).

The baseline characteristics of our study population, including age, sex, educational attainment, and comorbidities such as diabetes mellitus and dyslipidemia, did not differ significantly between the two groups (Tables 1 and 2). This mirrors the findings of a study that emphasised the need for consistent baseline demographic profiles in studies evaluating transitional care interventions to assess the impact on hypertension outcomes (13) accurately. The comparable baseline characteristics reinforce the reliability of our comparative results, ensuring that the observed improvements in the intervention group can be attributed to the nurse-led approach rather than other confounding factors.

Furthermore, the intervention led to a notable increase in medication adherence, as measured by the MMAS-8 score, rising from 5.4 to 7.0 in the intervention group, compared with a less significant increase in the control group (from 5.3 to 6.0). The adjusted between-group difference of +0.9 ($p < 0.001$) underscores the positive influence of nurse-led interventions on medication adherence. A similar outcome was noted in a study, where integrated care also improved adherence to antihypertensive medications among patients with depression alongside hypertension (14). This suggests that addressing common barriers to medication adherence is critical and can be effectively managed through dedicated nurse-led initiatives.

Moreover, our findings on lifestyle improvements, such as dietary changes and increased physical activity, align with the broader literature. Almasoud et al. (2022) demonstrated that text messaging interventions could effectively reduce modifiable risk factors for cardiovascular disease, supporting our observation of enhanced self-reported adherence to a low-salt diet and physical activity among participants in the intervention group (15). The importance of lifestyle changes in hypertension management cannot be overstated, and our study adds to the evidence that nurse-led interventions can foster sustainable health behaviour changes.

Importantly, our study found that 68.9% of participants in the intervention group achieved blood pressure control (<140/90 mmHg) at 12 weeks, compared to 40% in the control group ($p = 0.006$). This finding corroborates the study's results, which established that nursing case management programs significantly improved blood pressure control rates among hypertensive patients (16). Notably, among the high-risk subgroup with comorbid conditions (diabetes or CKD), the nurse-led intervention resulted in an even more marked improvement, with control rates of 63.6% in the intervention group compared to 34.8% in the control group ($p = 0.03$), further highlighting the efficacy of tailored interventions in vulnerable populations.

Lastly, our multivariable analysis revealed that assignment to the nurse-led intervention independently predicted blood pressure control at 12 weeks (adjusted OR 3.18), reinforcing findings from a study demonstrating similar intervention benefits and from systematic reviews confirming the effectiveness of nurse-led efforts in blood pressure management (17). This multifaceted support is imperative not only for improving clinical outcomes but also for fostering a sustainable Model of hypertension management.

Thus, the positive outcomes observed in our study consistently align with recent literature, affirming the significance of nurse-led interventions in hypertension management among older adults. These findings support the scalability of such intervention models, particularly in resource-constrained healthcare settings such as Pakistan, thereby promoting better health outcomes for older adults with chronic conditions.

## CONCLUSION

This study demonstrates that a structured nurse-led intervention significantly improves blood pressure control and adherence-related behaviours, and reduces blood pressure, among older adults with hypertension. The findings highlight the critical role of nurses in delivering comprehensive, patient-centred hypertension care that extends beyond routine physician-led management. Given the growing burden of hypertension and healthcare resource constraints in Pakistan, incorporating nurse-led models into standard clinical practice may offer a sustainable approach to improving cardiovascular outcomes and reducing long-term complications in older populations.

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## DECLARATIONS

**Data Availability Statement**
All data generated or analysed during the study are included in the manuscript.
**Ethics approval and consent to participate**
Approved by the department Concerned. (IRBEC-NMMU-94/24)
**Consent for publication**
Approved
**Funding**
Not applicable

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## AUTHOR CONTRIBUTION

***SHUMAILA RANI (Student)***
*Data entry, data analysis, and drafting an article.*
*Conception of Study, Final approval of manuscript.*
***QAMAR UN NISA (Principal)***
*Manuscript revisions, critical input.*
**IQRA SHAHZADI *(Nursing Instructor)***
*Conception of Study, Development of Research Methodology Design,*
**YASMIN TAHIRA *(Assistant Nursing Instructor)***
*Study Design, Review of manuscript.*

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