EVALUATING THE ROLE OF DIGITAL HEALTH AND CHATBOTS IN HYPERTENSION MANAGEMENT: A SCOPING LITERATURE-BASED REVIEW

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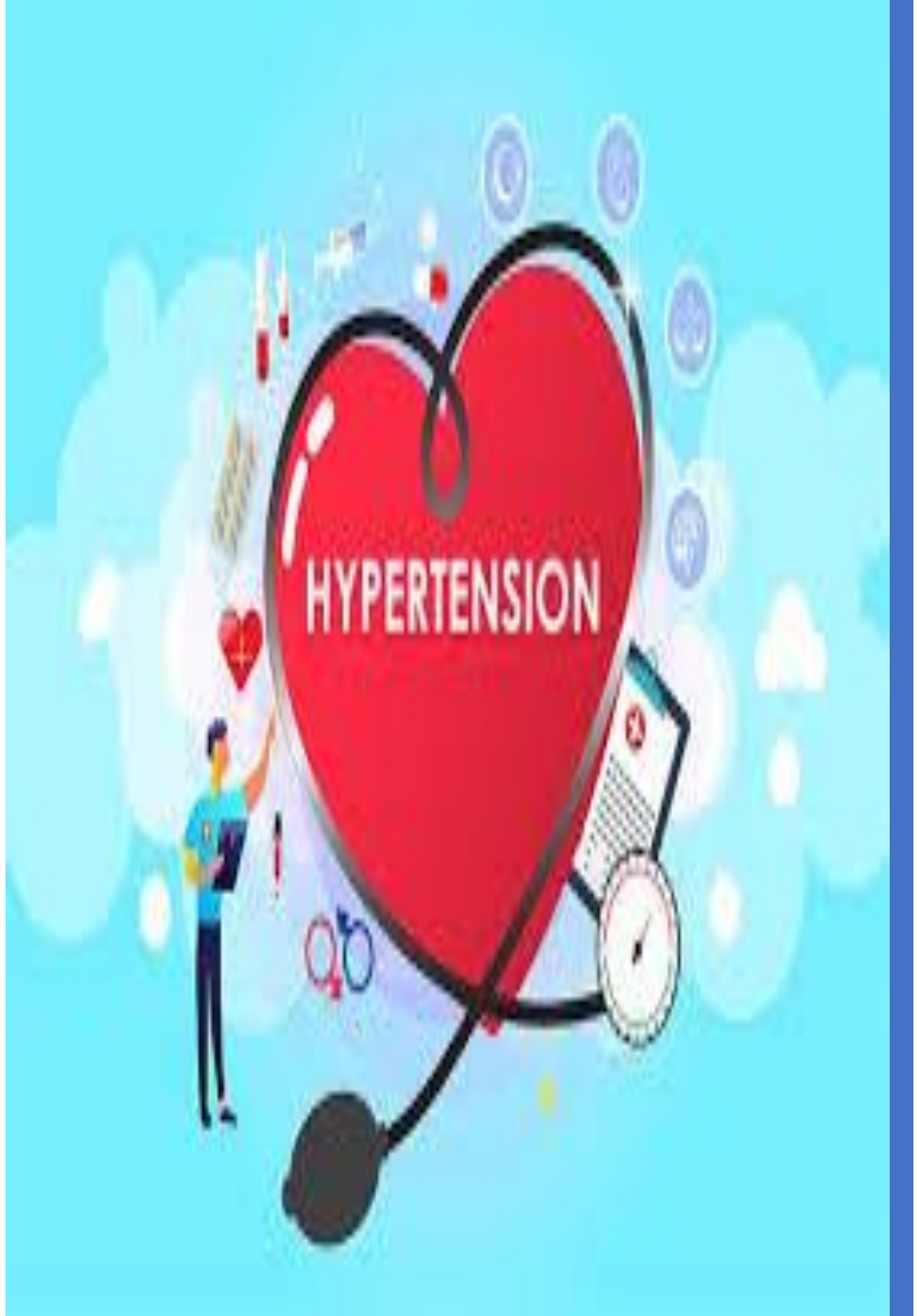
Introduction



Introduction

Background of the Study

- Hypertension affects over 1.3 billion people worldwide
- Leading risk factor for cardiovascular disease, stroke, kidney failure, premature death
- Major barriers to control:

i. Poor medication adherence

ii. Irregular blood-pressure monitoring

iii. Limited healthcare access in resource-constrained settings

Introduction

Digital Health & Chatbots in Hypertension Care

- **Digital health tools**: mHealth apps, wearables, telemonitoring, AI platforms
  - Enhance engagement, adherence, remote monitoring
- **Chatbots** (AI-powered conversational agents):
  - Simulate human-like conversation
  - Medication reminders & refill alerts
  - BP tracking & self-monitoring guidance
  - Education & lifestyle coaching
- **Advantages**: 24/7 availability, cost-efficient, scalable

Research objective

Effectiveness of chatbot-based interventions in hypertension care remains under-researched.

Evaluate impact of chatbot on:

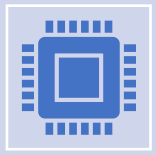
Blood pressure control, Medication adherence, Patient engagement

Analyze usability and acceptability of chatbot interventions

Research Questions

1. **Medication adherence:** How do chatbots affect adherence in hypertensive patients?

2. **Clinical outcomes:** What is the impact on blood pressure control?



3. **Usability factors:** Which elements drive sustained use and user satisfaction with chatbots?

Methodology

Study Design

- Scoping literature review
- Followed PRISMA guidelines for transparent selection

Search Strategy

- **Databases Searched**
  - PubMed, MEDLINE, Cochrane Library
  - PsycINFO
  - JSTOR, EBSCOhost
  - Google Scholar (grey literature)
- **Search Terms & MeSH**
  - Hypertension: “hypertension” OR “high blood pressure” OR “HTN”
  - Chatbot: “chatbot” OR “conversational agent” OR “virtual assistant” OR “AI health coach”
  - Intervention: “management” OR “self-care” OR “adherence” OR “behavioral intervention”
  - Technology: “mHealth” OR “digital health” OR “telemedicine”
- **Example Query**
  - (“hypertension” OR “high blood pressure”) AND (“chatbot” OR “AI assistant”) AND (“self-management” OR “adherence”)

Inclusion & Exclusion Criteria

- **Inclusion**
  - Peer-reviewed studies (2015–2024) on chatbot interventions for hypertension
  - Evaluated efficacy, usability, or patient outcomes (BP reduction, adherence)
  - Study types: RCTs, quasi-experimental, systematic reviews
- **Exclusion**
  - Non-English publications
  - Non-human or non-hypertension focus
  - Duplicates and low-quality preprints

Screening Process

- **Title & Abstract Screening**
  - Exclude irrelevant populations (e.g., diabetes-only) and non-chatbot studies
- **Full-Text Review**
  - Assess methodological rigor (sample size, control groups)
  - Exclude protocols or studies lacking outcome data
- **Final Selection**
  - 15–20 high-impact studies included


Key Findings

Thematic Analysis

Five Pillars of Chatbot Impact:

- Medication Adherence
- Self-Monitoring & Data Logging
- Lifestyle Education & Behaviour Support
- Communication & Clinical Integration
- Trust, Usability & Personalization

Medication Adherence

- **Problem:** Non-adherence remains a barrier in hypertension care
- **Key Methods & Findings:**
  - **Chatbot-integrated mobile app** (Volpi et al., 2021): adherence ↑ from 28 % → 92 %
  - **Pill reminders + pharmacist coaching** (Morawski et al., 2018) via chatbot platform
  - **Automated timing alerts** (Echeazarra et al., 2021): improved dose timing & BP-logging accuracy
  - **Refill-alert requests** (Griffin et al., 2021): users actively engaged scheduling features

Self-Monitoring & Data Logging

- **Goal:** Empower home BP tracking with structure and feedback
- **Key Methods & Findings:**
  - **Structured self-monitoring tools** (Zha et al., 2020): significant SBP reduction & ↑ confidence
  - **SMS + app-based nudges** (Baek et al., 2022; Nichols et al., 2019): higher logging frequency
  - **NLP-driven entry bots** (Han et al., 2021): flexible, conversational BP input
  - **High task-completion chatbot** (Hall et al., 2023): 98 % success rate, strong usability scores

Lifestyle Education & Health Behavior Support

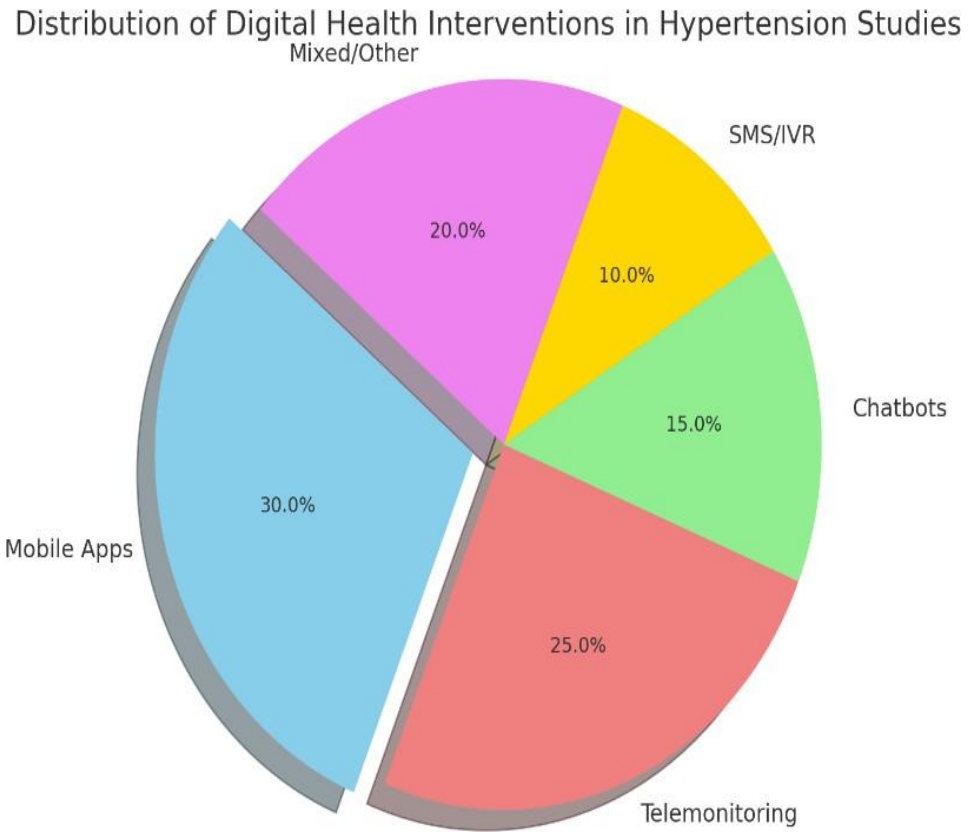
- **Aim:** Facilitate lasting behavior change through coaching & goal setting
- **Key Methods & Findings:**
  - **KENPO health-behavior bot** (Sakane et al., 2023): drove weight loss and routine improvements
  - **Visual learning interface** (Bhandari et al., 2020): enhanced understanding of hypertension risks
  - **Salt-reduction chatbot** (Yoshida et al., 2020): guided lower-sodium dietary choices
  - **DASH-diet support bot** (Miller et al., 2021): promoted dietary adherence and education

Communication Support & Clinical Integration

- **Function:** Streamline patient–provider workflows via automated triage & collaboration
- **Key Methods & Findings:**
  - **Automated message triage** (Lee et al., 2022): 99 % accuracy; clinician workload ↓ 75 %
  - **Pharmacy-integrated system** (Nelissen et al., 2018, Nigeria): bridged pharmacists & cardiologists
  - **Real-time escalation** (Griffin et al., 2023): chatbot-enabled requests routed to providers

Trust, Usability & Personalization

- **Focus:** Ensure long-term engagement through secure, inclusive, user-centered design
- **Key Methods & Findings:**
  - **Privacy & security audits** (Liang et al., 2018; Goldberg & Levy, 2016): highlighted data concerns
  - **Cultural & language adaptation** (Nichols et al., 2017): local-language support, intuitive UX
  - **Usability testing** (Smith & Hall, 2023): high usability scores; flagged navigation & persona credibility gaps



Distribution of Digital Health Interventions

Mobile Apps (30 %)

Most commonly studied intervention

Offers rich interfaces for logging, reminders, and education

Telemonitoring (25 %)

Remote transmission of BP readings to clinicians

Enables timely feedback and clinical oversight

Chatbots (15 %)

AI-driven conversational agents for reminders, education, and self-management

Growing interest but still underrepresented compared with apps

SMS/IVR (10 %)

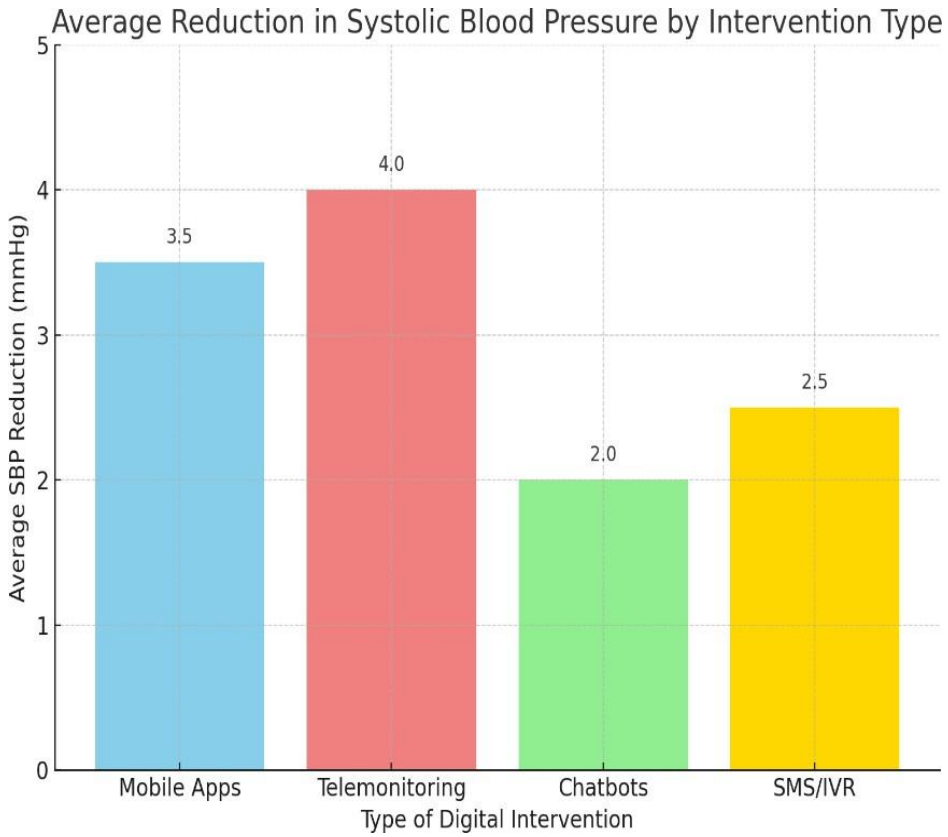
Low-tech, broad-reach approach via text messages or automated voice calls

Useful in low-resource settings and among populations with limited smartphone access

Mixed/Other (20 %)

Multi-modal interventions combining two or more technologies (e.g., app + chatbot, telemonitoring + SMS)

Reflects trend toward integrated digital health ecosystems



Average SBP Reduction by Intervention

Telemonitoring (4.0 mmHg)

Highest impact via clinician-guided remote monitoring.

Mobile Apps (3.5 mmHg)

Strong self-management support with logging and feedback.

SMS/IVR (2.5 mmHg)

Moderate benefit from simple text/voice reminders.

Chatbots (2.0 mmHg)

Emerging tool with modest BP reductions; potential for growth.

CONCLUSION

- Digital tools (apps, telemonitoring, chatbots) yield modest BP reductions and better medication adherence than usual care.
- Chatbots stand out for usability and patient satisfaction, easing reminder delivery and educational support.
- Evidence gaps remain: few long-term RCTs on clinical outcomes and high variability across studies.
- Chatbots should complement—not replace—human-led care, boosting engagement when integrated into broader programs.
- Future priorities: standardized endpoints, extended trial durations, and exploration of cost-effectiveness, equity, and data security.

RECOMMENDATIONS:

Blend Tech & Human Support

- Pair chatbots with clinician or coach involvement to reinforce guidance and trust

Expand Research Rigor

- Conduct large, long-term RCTs with clinical endpoints and standardized outcome measures

Address Equity & Safety

- Test chatbot reach in underserved populations and enforce privacy/data-security standards

Foster Interdisciplinary Collaboration

- Engage developers, clinicians, and behavioral scientists in co-design and evaluation

Establish Implementation Guidelines

- Health systems should create frameworks for assessing and integrating AI-driven tools responsibly

Thank You