Team-based Care to Improve Cardiovascular Outcomes with Focus on Hypertension Management

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Overview

1. Rigorously designed, controlled clinical trials on team-based care for the management of hypertension.
2. Various methodologies for conducting prospective interventional studies.
3. Strategies to implement team-based care for hypertension

Limitations with many studies evaluating team-based care

- Small sample sizes (low power or limited generalizability)
- Single site and single intervention pharmacist or nurse
- Bias in BP measurement
- Lack of control groups (pre- post- design only)
- No evaluation of key covariates
- Few were intention-to-treat analyses
- Did not adequately evaluate missing data (last value carried forward versus more sophisticated modeling or sensitivity analysis).

Examples of Clinical Trials with Different Methodologies and Interventions

Contemporary and rigorously designed trials

Physician-Pharmacist Comanagement of Hypertension: A Randomized, Comparative Trial

Authors: Jeff E. Borenstein MD, MPH, Geneen Graber, PharmD, Emmanuel Saltiel, PharmD, Joel Wallace, PharmD, Seonyoung Ryu, PharmD, Archi Jackson, PharmD, Stephen Deutsch, MD, Scott R. Weingarten, MD, MPH
Cedars-Sinai Health System, Beverly Hills, CA

Methods

• Inclusion Criteria:
  1. last two documented BP measurement within 3 months:
     systolic/diastolic BP ≥ 140/90 if age < 65;
     ≥ 160/90 if age ≥65
• Randomized, comparative trial
  • Patients randomized to either a usual care (UC) or a physician-pharmacist comanagement (PPCM) group.
Methods

• Pharmacist Intervention
  – Determined BP with an automated BP cuff
  – Reviewed drug side effects
  – Provided patient education (e.g. dietary and lifestyle modifications)
  – Made treatment recommendations to physician
  – Provided follow-up every 2 to 4 weeks until BP control was achieved

Results

Table 1. Clinical outcomes and economic outcomes at the 12-month

<table>
<thead>
<tr>
<th>Clinical Outcomes</th>
<th>PPCM Group (n=98)</th>
<th>UC Group (n=99)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP change (mm Hg)</td>
<td>-22</td>
<td>-11</td>
<td>0.01</td>
</tr>
<tr>
<td>DBP change (mm Hg)</td>
<td>-7</td>
<td>-8</td>
<td>0.01</td>
</tr>
<tr>
<td>BP control rate</td>
<td>60%</td>
<td>43%</td>
<td>0.02</td>
</tr>
<tr>
<td>Provider visit costs/patient ($)</td>
<td>160</td>
<td>195</td>
<td>0.02</td>
</tr>
<tr>
<td>Antihypertensive drug costs increase/mo ($)</td>
<td>11.31</td>
<td>4.25</td>
<td>0.12</td>
</tr>
</tbody>
</table>
Federal Study of Adherence to Medications in the Elderly (FAME)

- Clinical pharmacist evaluation and education: Medication names, indications, doses, frequency, side effects, and proper medication-taking behavior
- Convenience aide: Custom blister-packed medications

Lee JK, Grace KA, Taylor AJ. Effect of a pharmacy care program on medication adherence and persistence, blood pressure, and low-density lipoprotein cholesterol: a randomized controlled trial. JAMA Dec 6 2006;296(21):2563-2571.

FAME Study Design

FAME Phase 1: Primary endpoint

- Adherence:
  - Baseline: 61.2 ± 13.5%
  - End phase 1: 96.9 ± 5.2%
  - 16-fold ↑ in participants ≥ 80% adherent to all medications

**FAME Phase 1: Secondary endpoint**

Associated changes in BP and LDL-C among patients with drug-treated HTN or HLD

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Baseline</th>
<th>End phase 1</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic BP (mm Hg)</td>
<td>142</td>
<td>142.9 ± 14.9</td>
<td>133.2 ± 14.9</td>
<td>.02</td>
</tr>
<tr>
<td>Diastolic BP (mm Hg)</td>
<td>142</td>
<td>70.5 ± 9.3</td>
<td>69.7 ± 9.3</td>
<td>.30</td>
</tr>
<tr>
<td>LDL-C (mg/dL)</td>
<td>122</td>
<td>93.8 ± 26.5</td>
<td>86.8 ± 23.4</td>
<td>.001</td>
</tr>
</tbody>
</table>

**FAME Phase 2: BP and LDL-C**

Pre-specified analyses

<table>
<thead>
<tr>
<th>Systolic BP</th>
<th>Change SBP (mm Hg)</th>
<th>95% CI</th>
<th>P (within group)</th>
<th>P (between group)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usual care</td>
<td>-1.0</td>
<td>-5.9 to 3.9</td>
<td>.69</td>
<td>.04</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>-6.9</td>
<td>-10.7 to -3.1</td>
<td>.001</td>
<td></td>
</tr>
</tbody>
</table>

**Hypertension Intervention Nurse Telemedicine Study (HINTS): Testing a multifactorial tailored behavioral/educational and a medication management intervention for blood pressure control**

Hayden Bosworth, PhD  
Benjamin Powers, MD, MHS  
Maren K Olsen PhD  
Felicia McCant MSSW  
Janet Grubber MSPH  
Pamela Gentry RN  
Cynthia Rose RN  
Mary K. Goldstein, MD, MS  
Eugene Z. Oddone, MD, MHz  
Center for Health Services Research in Primary Care  
Departments of Medicine, Psychiatry and School of Nursing  
Duke University Medical Center
HINTS Study: Four Group Design

1. Usual Care (n=147)
   - PCP drive management, no special program

2. Tailored Self Management Phone Intervention (n=147)
   - Home BP monitoring evaluated by nurse
   - Tailored self mgt modules administered by nurse

3. Medication Mgt Phone Intervention (n=149)
   - Home BP monitoring evaluated by nurse
   - HTN decision support for medication recommendations
   - Medication management implemented by study MD/RN

4. Tailored Self Management & Medication Mgt Phone Intervention (n=148)
   - Home BP monitoring evaluated by nurse
   - Tailored self mgt modules & medication mgt administered by nurse

Funded by VA HSR&D and American Heart Association

Blood Pressure Control

Systolic Blood Pressure
The Electronic Communications and Home Blood Pressure Monitoring Trial (e-BP)

Comparison of 2 Interventions to Usual Care:
- Home BP monitor and use of an existing patient Web site
- This plus pharmacist care management (delivered via the patient Web site)


Funded by NHLBI: 5R01HL075263-04

### BP control at 12 months

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>BPM-Web Only</th>
<th>BPM-Web-Pharm</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>31%</td>
<td>36%</td>
<td>56%**</td>
</tr>
<tr>
<td>Systolic BP at baseline &gt;160 mm</td>
<td>20%</td>
<td>26%</td>
<td>54%**</td>
</tr>
</tbody>
</table>

**P < 0.001 compared to UC and BPM-Web

Conclusion: the addition of the pharmacist intervention to the web was necessary to achieve good BP control.


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Cluster, Randomized Efficacy Trial

Original Paper

A Cluster Randomized Trial to Evaluate Physician/Pharmacist Collaboration to Improve Blood Pressure Control

Barry L. Carter, PharmD; George R. Bergey, MD; Jeffrey D. Dawson, ScD; Karen B. Farris, PhD; William R. Doucette, PhD; Elizabeth A. Chrischilles, PhD; Arthur J. Hartz, MD, PhD

Funded by NHLBI: RO1 HL69801

**Collaborative Management of Hypertension Study: Efficacy Trial**

- Only faculty / private physicians involved in the study.
- Patients 21-85 years with diagnosis of hypertension.
- Baseline BP: 145-179 SBP or 95-109 DBP for uncomplicated.
- 135-179 SBP or 85-109 DBP for diabetes.
- Clinic BP at 0, 2, 4, 6, 8, 9 months
- 24-hour BP at baseline and 9 months

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**Physician/Pharmacist Collaborative Management**

- Pharmacist conducted interview and assessed patient for strategies to improve BP control.
- Pharmacist made recommendations to MD and patient to improve BP control.
- Pharmacists and physicians worked to overcome/prevent sub-optimal treatment, clinical inertia, poor adherence, adverse reactions, drug interactions.
- Pharmacists saw patients at least every 2 months x 9 months.

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**Intervention**

- Pharmacist conducted interview and assessed patient for strategies to improve BP control.
- Pharmacist made recommendations to MD and patient to improve BP control.
- Pharmacists and physicians worked to overcome/prevent sub-optimal treatment, clinical inertia, poor adherence, adverse reactions, drug interactions.
- *Pharmacists saw patients at least every 2 months x 9 months*.
Data Analysis

- Continuous variables – likelihood-based mixed models with random patient effects fit to SAS Proc Mixed in an intention-to-treat analysis.
- Models adjusted for baseline BP, age, gender, race, education, insurance status, household income, marital status, smoking status, alcohol intake, BMI, number of co-existing conditions, baseline medication adherence and total number of visits during the study.

Baseline Demographics

<table>
<thead>
<tr>
<th></th>
<th>Control (n=78)</th>
<th>Intervention (n=101)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>61.0 ± 11.3</td>
<td>59.6 ± 13.7*</td>
</tr>
<tr>
<td>BP meds</td>
<td>1.4 ± 1.0</td>
<td>1.5 ± 1.0</td>
</tr>
<tr>
<td>Baseline med adherence</td>
<td>88.6%</td>
<td>71.1%*</td>
</tr>
<tr>
<td># co-existing DX</td>
<td>0.46 ± 0.78</td>
<td>0.47 ± 0.81</td>
</tr>
<tr>
<td>Diabetes</td>
<td>24.4%</td>
<td>24.8%</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>31.8 (±14.7)</td>
<td>32.3 (±7.7)</td>
</tr>
</tbody>
</table>

* - p < 0.001

Results


Sustainability

* p<0.05, ** p<0.01, *** p<0.001,
Results: BP Control Rates

Main Finding: The major reason for the high control was due to intensification of medications.

<table>
<thead>
<tr>
<th>Control</th>
<th>Intervention</th>
<th>Adjusted OR</th>
<th>CI; p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients</td>
<td>52.9%</td>
<td>89.1%</td>
<td>8.9</td>
</tr>
<tr>
<td>Diabetes</td>
<td>23.5%</td>
<td>81.8%</td>
<td>40.1</td>
</tr>
</tbody>
</table>


"Mixed" Efficacy-Effectiveness trial

ORIGINAL INVESTIGATION

HEALTH CARE REFORM

Physician and Pharmacist Collaboration to Improve Blood Pressure Control

Barry L. Carter, PharmD; Gail Ardery, PhD; Jeffrey D. Dawson, ScD; Paul A. James, MD; George R. Bergus, MD; William R. Doucette, PhD; Elizabeth A. Chrischilles, PhD; Carrie L. Franciscus, MA; Yinghui Xu, MS

Trial Registration: clinicaltrials.gov Identifier: NCT00201019


Adherence Study: Combination of Efficacy and Effectiveness

- Prospective, cluster-randomized controlled trial in 6 community-based family medicine residency clinics all with clinical pharmacist faculty in the medical office.

- Research nurse in each clinic measured BP at baseline, 3 and 6 months and 24-hour BP at baseline and 6 months.
**Intervention**

- Pharmacist conducted interview and assessed patient for strategies to improve BP control.
- Pharmacist made recommendations to MD and patient to improve BP control.
- Pharmacists and physicians worked to overcome/prevent sub-optimal treatment, clinical inertia, poor adherence.
- **Pharmacists only encouraged to see patients at baseline and 1 month with a telephone call at 3 months with a goal to achieve BP control by 6 months (but they could see patients more often).**

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**Systolic Blood Pressure**

![Graph showing systolic blood pressure changes over time]

< p<0.001; **p<0.001; ***p=0.0015; ***p=0.0023


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**Studies Involving Nurses**

<table>
<thead>
<tr>
<th>Study</th>
<th>Odds Ratio (CI) (intervention: control)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hill 2003</td>
<td>8.16 (5.00, 13.25)</td>
</tr>
<tr>
<td>Curzio 1990</td>
<td>2.86 (1.05, 3.07)</td>
</tr>
<tr>
<td>Garcia-Pena 2001</td>
<td>2.41 (1.11, 2.23)</td>
</tr>
<tr>
<td>Woodall 2007</td>
<td>2.86 (1.69, 3.07)</td>
</tr>
<tr>
<td>New 2007</td>
<td>2.86 (1.01, 3.24)</td>
</tr>
<tr>
<td>Bebb 2007</td>
<td>2.0 (0.35, 11.58)</td>
</tr>
<tr>
<td>McClellan 1985</td>
<td>1.41 (0.89, 2.23)</td>
</tr>
<tr>
<td>All Studies</td>
<td>1.69 (1.06, 2.70)</td>
</tr>
</tbody>
</table>

potency of Team-based Care: Management by Pharmacists within Clinics


Meta-Analysis: Potency of individual components of team-based care

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Median reduction in SBP (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacist recommended medication to physician</td>
<td>-9.3*</td>
</tr>
<tr>
<td>Education on BP medications</td>
<td>-8.75*</td>
</tr>
<tr>
<td>Pharmacist did the intervention</td>
<td>-8.44</td>
</tr>
<tr>
<td>Assessed medication compliance</td>
<td>-7.9</td>
</tr>
<tr>
<td>Counseling on lifestyle modification</td>
<td>-7.59</td>
</tr>
<tr>
<td>Nurse did the intervention</td>
<td>-4.6*</td>
</tr>
</tbody>
</table>

* = statistically significant


Meta-analysis of Potency of individual components of team-based care

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Odds that BP was controlled (95% confidence interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Studies involving nurses</td>
<td>1.89 (1.48-2.43) [69% increased chance]</td>
</tr>
<tr>
<td>Studies involving pharmacists within physician offices or clinics</td>
<td>2.41 (2.05-2.89) [148% increased chance]</td>
</tr>
<tr>
<td>Studies done in community pharmacies</td>
<td>2.89 (1.83-4.55) [189% increased chance]</td>
</tr>
</tbody>
</table>

Conclusion: All were effective but interventions by pharmacists appear to be more potent than by nurses.

A Web-based Cardiovascular Risk Service to Improve Secondary Prevention: The MED-FOCUS proposal

Application Submitted to NIH February 2012

Aim 1: To reduce CV events in patients needing secondary prevention with a CVRS managed by clinical pharmacists.

Design and Inclusion

- Cluster, randomized trial in 16 existing CAPTION sites
- 800 patients, 320 will be racial or ethnic minorities
- ≥55 years of age with a history of one of the following:
  - coronary artery disease
  - MI
  - Stroke or TIA
  - atrial fibrillation
  - systolic heart failure, or the following risk equivalents:
  - peripheral vascular disease/claudication, carotid artery disease, or diabetes mellitus with co-existing uncontrolled hypertension and/or hyperlipidemia.

Activities of the CVRS Clinical Pharmacists and Nurses

- Assist patient with a Personal Health Record to increase self-monitoring (e.g. blood glucose, BP);
- emails every two weeks x 2 months then at least monthly to engage patient;
- CVRS Nurse to assist with immunizations, cancer screening, lifestyle modification
- CVRS clinical pharmacist conducts monthly telephone follow-up assessment and counseling for medication adherence, side effects, CHD knowledge and counseling;
- Make recommendations to PCP and on-site clinical pharmacist
**Summary**

- Team-based care is well established in many health systems like Kaiser, Group Health, VAs and academic centers.
- One big challenge is how to most efficiently and effectively use each team member.
- Combinations of self-management, face-to-face visits and telephone or internet are likely the most effective and cost effective approaches.

**Comments and Questions**

**Cost Analysis of the Two Previous Studies**

*Incremental Costs Associated With Physician and Pharmacist Collaboration to Improve Blood Pressure Control*

Results

Comparison of 6-month costs

<table>
<thead>
<tr>
<th>Cost category</th>
<th>Control</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug discontinuation</td>
<td>$80.6</td>
<td>$80.6</td>
</tr>
<tr>
<td>Generic</td>
<td>$13.1</td>
<td>$13.1</td>
</tr>
<tr>
<td>Protocol</td>
<td>$96.3</td>
<td>$96.3</td>
</tr>
<tr>
<td>Non-RX supplies</td>
<td>$107.5</td>
<td>$107.5</td>
</tr>
<tr>
<td>Laboratory</td>
<td>$80.8</td>
<td>$80.8</td>
</tr>
<tr>
<td>$341.7</td>
<td>$341.7</td>
<td></td>
</tr>
</tbody>
</table>

- p < 0.01
- • p < 0.001

Adjusted Total Costs

- $747 in intervention vs. $456 in control, difference = $290, p < 0.001
- Range in sensitivity analysis for the difference was $223-$512
- Cost was $1,181 for each additional patient to achieve BP control
- Cost was $32 for each 1 mm Hg reduction in SBP