

Cardiovascular Disease Prevention and Control: Team-Based Care to Improve Blood Pressure Control

Summary Evidence Table - Economic Review

Author, Year Study Design Economic Method	Study Location Sample Size Population Characteristics Time Horizon	Intervention Description	Effect Size	Program Costs	Direct Medical Costs Averted Productivity Losses Averted	Full Economic Summary Measure
<p>Artinian 2001</p> <p>Randomized Controlled Trial</p> <p>Cost-analysis</p>	<p>Detroit, MI</p> <p>Convenience recruit from family community center housing several other gov/community offices including a health clinic</p> <p>Area Demography Afr Amer-95% Below FPL-41% Unoccupied homes-10.6% Eligibility >17 years HTN with or without diabetes or CVD.</p> <p>63 screened and 26 enrolled 3 men and 23 women Age 32-93 (mean 59) Afr Amer-100% <FPL-53.9%</p> <p>12 week (3 months) interv.</p> <p>Recruit and interv dates not provided.</p>	<p>Pilot Study</p> <p>Nurse home BP telemonitoring (Home) [n=6] –. Home devices set up by nurse and patient trained and given lifestyle brochure. Follow-up within 24 hours. BP readings sent every week to server and forwarded to nurse with patient receiving instant report plus lifestyle and meds counseling call from nurse. Weekly readings and report sent to GP.</p> <p>Nurse community health center BP monitoring (Community) [n=6] – Similar to home monitoring except BP readings taken at Center 3 times a week (1-5 miles from residences). Weekly counseling meetings for lifestyle and meds. Weekly readings and report sent to GP.</p> <p>Usual Care [n=9] -</p>	<p>Analysis for 21 of 26 who had follow-up data.</p> <p>Primary outcome is change in SBP and DBP. Stratification by use/non-use of meds did not produce differences and hence analysis is for full data. Patient compliance (BP readings) with protocol was 67% in Home and 89% in Community.</p> <p>Home SBP dropped from 148.8 to 124.1 DBP 90.2 to 75.6</p> <p>Community SBP dropped from 155.2 to 142.3 DBP 89.4 to 78.2</p> <p>Usual SBP 142.4 to 143.3 DBP 91.2 to 89.1</p>	<p>\$10 incentive at baseline and \$15 at follow-up.</p> <p>Study does not provide the cost of intervention except for a conjecture about the per day cost of telemonitoring equipment</p> <p>Two Afr Amer RN nurses delivered interventions and were trained 10 hours.</p> <p>Authors state the cost of telemonitoring equipment plus training is \$1.50 per day including training in use.</p>	<p>Health care costs averted not considered for study groups.</p> <p>No productivity improvements considered.</p> <p>Used CPI and year 2000 base year (CPI-1.266)</p>	<p>The authors consider persons ('White-coat HTN) who appear to not have BP control during visit who in fact are well controlled. Authors assume telemonitoring can identify these persons (25% prevalence in HTN pop).</p> <p>Annual treatment cost of uncomplicated HTN following JNC6 is \$1000. Hence, placing 4 HTNs on a 1 month telemonitor costs \$180 and identifies the white-coat and saves \$1000 in treatment costs</p> <p>Is the cost-benefit of telemonitoring conjectured by authors reasonable? Convenience recruitment Mostly women Tiny samples</p>
<p>Bertera 1981</p>	<p>Baltimore, MD</p>	<p>Clinic managed by nurse-practitioners,</p>	<p>Median systolic and diastolic BP declined</p>	<p>Social Worker Led Average counseling</p>	<p>Health care costs not considered.</p>	<p>Cost-effectiveness defines as program cost divided by</p>

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Pre-Post with comparison Cost-Effectiveness	Health Care Center part of Johns Hopkins Population predominantly Black, elderly, poor, and female. 3 groups formed from 230 patients with high BP. 10 patients each assigned to TC, CC, and Usual. For the treated groups, only half were random assignments. 6 month intervention with baseline and F/U at 6 months	physician assistants, physician consultants, a clinical social worker. Interventions led by Social Worker Telephone Counseling (TC) – counseling every 3 weeks for 6 months Clinic Counseling (CC) – counseling every 3 weeks for 6 months Usual Care – usual care available at Center Counseling Content: By social Worker medication, weight control, sodium restriction, relaxation and stress, exercise, smoking cessation, and appointment reminders	significantly for the TC and CC groups. There was no change for the usual care group. Proportion with BP under control (Diastolic < 90) increased for both CC (10% pre to 50% post) and TC (50% pre to 80% post) with the change approaching significance for CC group. No change for usual care.	length (n=9 over 6 months): Telephone – 30 min Clinic – 40 min Hourly wage - \$9 Clinic Couns - \$6 Phone Couns - \$4.50 Penalty for missed contact: Phone – 5 min (\$0.75) Clinic – 15 min (\$2.25). Total 6 month Costs (10 Patients): CC - \$412 (\$41.20 per patient) TC - \$316 (\$31.60 per patient)	Productivity effects not considered. Base year not provided. Use 1980 and CPI (2.646)	number with BP under control in interv groups. Average cost effectiveness based on BP control as reported in study: TC – \$39 CC – \$82 Limitations: Very small samples. TC group using less meds at base CC group had higher DBP at base Authors use cost-effectiveness inappropriately More accurate measure of cost-effectiveness based on those achieving BP control is calculated in Table below. Number with BP Under Control Incremental CE Based on BP Control: TC- \$105.33; CC - \$103.00
Bogden 1998 Randomized Controlled Trial Benefits Only	Honolulu, Hawaii Recruit from teaching clinic associated with U of Hawaii Mostly indigent population. Uncontrolled BP (JNC5) past 6 months Age: 54-56	Pharmacist-led Intervention [n=49] Pharmacist interacted with physician and patient on each visit. Patient met with pharmacist ½ hr before seeing resident/intern – med history, answer questions, and encourage compliance. Pharmacist met resident/intern and discussed lab reports, and	Primary effect is proportion reaching JNC5 goal for BP at 6 months. BP Control 55% in interv achieved JNC5 goal compared to 20% in control. Reduction in SBP (mm Hg)	No program costs provided. Each group had 5 physicians, 5 3 rd yr residents, 4 2 nd yr residents, and 6 interns. No intervention costs provided	Only cost information provided is the cost of medications in the interv and control groups Meds Cost per Person Per Month: Interv: Dropped by \$6.80 Control: Increased by \$6.50	No summary economic measures. Authors mention the costly component may be using physicians/pharmacists away from their normal activities. Resident teaching clinic.

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	<p>= >15K Income: 6-22% Female: 57-59% >12 yrs Edu: 27-28% Non-Hawaiian: 73-76%</p> <p>6 month Interv.</p> <p>Recruit Oct 93-Oct 94. Follow-up during 6 months.</p>	<p>least costly effective med regimen (attached on front patient chart). Resident/intern saw patient and discussed treatment plan. Also discussed with physician and considered accept/reject pharma recommendation. Physician considered other risk factors, CVD, lifestyle, diet, preferences and circumstances.</p> <p>Usual Care [n=46] – similar to intervention group except pharmacist input. Access to pharmacy clerk initiated by patient.</p>	<p>Interv – 14 and Usual – 3 Reduction in DBP (mm Hg) Interv – 23 and Usual – 11</p> <p>Assuming worst case outcomes for the groups for those lost to follow-up did not change overall conclusion about interv effect. Effective for both Hawaiian and non-Hawaiian.</p> <p>Pharmacist made 162 recommendations (52 to cheaper drug; 34 to increase dose; 10 for added meds; 5 to reduce dose; 16 to renew at current dose; 20 to more effective med). 12 were declined.</p>		<p>Authors state physician visits, ED, hospitalization were very similar across groups.</p> <p>No productivity improvements considered.</p> <p>Used CPI and year 1994 base year (CPI-1.471)</p>	
<p>Borenstein 2003</p> <p>Randomized Controlled Trial</p> <p>Costs Only</p>	<p>Los Angeles (?), CA</p> <p>Recruit n=1272 from General Practices affiliated with large community hospital</p> <p>Chart review of =>18 yrs with HTN Dx and uncontrolled BP (JNC5) with capitated</p>	<p>Physician-Pharmacist CoManaged (PPCM) [n=98]</p> <p>First attend HTN clinic run by clinical pharmacist. Take BP; adherence to drugs; side effects; record patient lifestyle and risk habits; counsel re diet and lifestyle.</p> <p>Pharmacist calls Physician with findings and recommendations based</p>	<p>Intent to treat analysis</p> <p>BP goal is controlled BP at 2 consecutive visits based on JNC5.</p> <p>Change from baseline recorded at 3, 6, 9, and 12 months.</p> <p>Primary effect is proportion reaching JNC5 goal for BP at</p>	<p>Perspective of capitated medical group also at risk for pharma costs. Study had 4 clinical pharmacists and 39 physicians</p> <p>Average Provider Visit Cost Per Patient PPCM: 160 Usual: 195 (Average visits to</p>	<p>Outpatient visit costs and pharmacy costs are discussed in program costs column.</p> <p>No productivity improvements considered.</p> <p>Used CPI and year after recruitment data, 1999 base year</p>	<p>No summary economic measures.</p> <p>Physician-pharmacist Co-management resulted in greater reduced systolic blood pressure, larger proportion achieving BP control, and reduced provider visit costs, with no increase in BP drug costs.</p> <p>Authors claim true clinical</p>

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	<p>insurance.</p> <p>Exclude severe dementia, terminal illness, organ transplant.</p> <p>Age: 61.5-62.5 More Afr Amer in PPCM Higher SBP at base for PPCM Female: 59-63%</p> <p>12 month Interv.</p> <p>Year of intervention not provided</p> <p>Recruits identified 1996-98 data.</p>	<p>on treatment algorithm. Changes based on cost alone not allowed.</p> <p>Follow-up visits every 2-4 weeks at pharmacist discretion</p> <p>Usual Care [n=99]</p>	<p>12 months.</p> <p>At 12 months Decrease in Systolic BP PPCM: 22 mm Hg Usual: 11 mm Hg Diff significant</p> <p>At 12 months Decrease in Diastolic BP PPCM: 7 mm Hg Usual: 8 mm Hg Diff not significant</p> <p>Proportion Achieving BP Goals at 12 Months PPCM: 60% Usual: 43%</p>	<p>Physician : PPCM: 3.4 Usual: 6.6; Average visits to Physician or Pharmacist: PPCM: 8.0 Usual: 6.6)</p> <p>No statistically significant difference in monthly drug costs at end of 12 months.</p> <p>Increase from baseline for med costs higher for PPCM (11.31) vs Usual (4.25)</p>	<p>(CPI-1.309)</p>	<p>setting</p> <p>Exclusions after randomization – but authors point out there were no differences at baseline between these groups.</p> <p>In capitated environment, reduced physician visits due to pharmacist co-management can save money only if the physician time is used to see more patients.</p>
<p>Bosworth 2009b</p> <p>RCT with 3 arms</p> <p>Cost Analysis</p>	<p>Durham, NC</p> <p>Two Duke affiliated primary clinics</p> <p>636 in control. 636 randomized from 2060 eligible Mean age-61%; AfrAmer-49%; Female-66%; Low Income-19%. 73% had adequate BP control at baseline Hypertension Dx and enrollment with GP at least 12 months prior; self-reported anti-hypertensive medication;</p>	<p>Randomized to 4 groups: Usual Care; Bi-Monthly Nurse-administered tailored telephone behavioral interv (Beh); At home self BP monitoring (Mon); Combination (Mon-Beh)</p> <p>Stratified at baseline by enrollment site and health literacy.</p> <p>Beh (n=160)- risk perception, hypertension education, provider relations, social support. Also adherence to recs for diet, smoking cessation/alcohol reduction, sodium intake.</p>	<p>Intent to treat analysis.</p> <p>Recommended BP: (Systolic BP < 140 & diastolic BP < 90 mmHg [<130 and <80 mmHg for patients with diabetes])</p> <p>Primary outcome- BP control at 24 months (and at base, 6,12,18 months)</p> <p>BP control relative to usual at 24 months: Beh: 4.3% (95% CI: -4.5%, 12.9); Mon: 7.6% (95% CI:</p>	<p>Calls by single nurse Patients paid \$25 at baseline and for each of 4 followup (\$125 total)</p> <p>Beh – Nurse completed 1682 calls, 11 per patient, mean of 16 minutes.</p> <p>Beh-Mon – Nurse completed 1589 calls, 10 per patient, mean of 16 minutes.</p> <p>2 Years Cost Per Person Beh - \$345</p>	<p>Health care use in Duke system collected through 24 months.</p> <p>Mean outpatient encounters similar across groups; No difference in proportion hospitalized.</p> <p>Mean 2 year total health cost of \$15,641 across all groups (SD=\$25,769, median= \$6698).</p> <p>No averted costs estimated or reported.</p>	<p>No summary economic measures reported.</p> <p>There was no difference in health care utilization across groups but there was improvement in health outcome for combination group.</p> <p>Limits: Academic health center; 25% no 24 month data; 73% controlled BP at baseline</p>

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	<p>primary care provider appointment during the next 30 days; resident in area of health system.</p> <p>24 months - Dec 2005 through Jan 2008.</p>	<p>Mon (n=158)- Provided BP monitors, trained on use, 3 days a week readings, stamped envelopes to send logs every 2 months.</p> <p>Beh-Mon (n=159)</p>	<p>-1.9%, 17.0%); Mon-Beh: 11.0% (95% CI: 1.9%, 19.8%). Note only combination had clinically significant effect. SBP and DBP vs Usual at 24 months for Beh and Mon-Beh: Beh: SBP: +0.6 (-2.2, 3.4) DBP: +0.4 (-1.1, 1.9) Mon-Beh: SBP: -3.9 (-6.9, -0.9) DBP: -2.2 (-3.82, -0.6) Other groups not significant.</p>	<p>Mon - \$90 Beh-Mon - \$416 (Sensitivity analysis cost for Beh-Mon was \$208-811).</p>	<p>Used CPI and 2006 mid-year intervention (1.082)</p>	
<p>Bosworth 2011</p> <p>Hypertension Intervention Nurse Telemedicine Study (HINTS)</p> <p>RCT</p> <p>Average Cost</p>	<p>Durham, North Carolina</p> <p>Veterans Affairs Medical Center.</p> <p>Patients from VAMC primary care practices that had hypertension Dx, uncontrolled BP, and were on medication. Randomized to 4 arms and stratified by diabetes.</p> <p>591 included in analysis. Mean age: 63-64; Male: 86-96%; Caucasian: 44-53%;</p>	<p>3 arms assisted by telephony and BP home-device</p> <p>1.Nurse-led behavioral [NB] (n=148) - 11 tailored modules on knowledge, meds, diet, health behaviors</p> <p>2.Nurse-led physician directed medication [NM] (n=149) within decision support system. GP informed and assented.</p> <p>3.Combined [C] (n=147)</p> <p>4.Usual care (n=147) by GP</p> <p>Daily BP readings – assessments based on 2-week average.</p>	<p>BP Control</p> <p>BP Control vs. usual care at 12 Months: NB: 12.8%; NM: 12.5%; C: Not significant.</p> <p>BP Control vs. usual care at 18 Months: C: 7.7% (Not significant)</p> <p>Systolic for Versus Usual Care at 12 months</p> <p>2.1, 2.4, and 4.3 mm Hg lower for NB, NM, and C groups respectively.</p> <p>Systolic for Versus Usual Care at 18 months</p> <p>1.2 and 3.6 mm Hg</p>	<p>Patients paid \$10 at baseline and at three 6-month GP visits.</p> <p>Poor BP control triggered 1945 nurse alerts for 389 of the 444 interv. patients. Average nurse encounter – 13.2 minutes. Alerts similar across groups.</p> <p>Program Cost Per Person (18 Months):</p> <p>NB: \$947 NM: \$1275 C: \$1153 (Unclear if this is</p>	<p>Health care includes outpatient and inpatient care within VA system. Utilizations were similar across groups.</p> <p>Median Medical Cost (18 Months):</p> <p>NB: \$6910 per person NM: \$5180 per person C: Not Reported (Study uses ‘median’ and ‘per person’ to describe the statistic).</p> <p>No base provided. Use start year plus 1 (= 2007) as base year and CPI (1.052)</p>	<p>No final economic measures provided.</p> <p>May be able to calculate cost per mm Hg.</p> <p>Contents of the program cost not clear.</p>

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	<p>Diabetes: 40-44%; Employed: 34-35% Uncontrolled BP: 35-48%</p> <p>Start in May 2006. Length 18 months. Measurements at base, 6, 12, 18 months.</p>		<p>lower for NM and C groups but not significant.</p> <p>Diastolic differences were not significant.</p> <p>Subgroup with Uncontrolled BP</p> <p>Systolic for Versus Usual Care 8.3, 7.9, 14.8 mm Hg lower at 12 months for NB, NM, C. 8.0 mm Hg lower at 18 months for C group. Diastolic decreased at 12 and 18 months for NM and C groups.</p>	<p>per participant and what is included in costs)</p>		
<p>Bunting 2008</p> <p>Medication Therapy Management (MTM)</p> <p>Longitudinal pre-post.</p> <p>Average Cost</p>	<p>Asheville, North Carolina</p> <p>Employees of City of Asheville and Mission Hospitals in self-insured plans (12,000 covered lives).</p> <p>Persons with HTN or dyslipidemia.</p> <p>620 met inclusion criteria for economic analysis and 565 for clinical.</p> <p>Mean age: 48-52; Male: 44-50%; Caucasian: 73-91%;</p>	<p>Long term pharmacist-led medication therapy management.</p> <p>Pharmacists received CVD training. Self-care education by professionals. Face to face pharmacist consulting with patients. Participants matched to or chose care-manager (pharmacists), who they met regularly. Sessions usually 30 minutes. Goals based on JNC-7 and ATP-3.</p> <p>BP measures at base and each visit. Lipid measure at base and annually.</p>	<p>BP Of 423 with HTN, for all cohorts by enrollment year, both systolic and diastolic BP reduced significantly compared to baseline year. SBP was 137.3 at baseline, 129.3 at year 1, and 127.5 at 5 years. Percent with controlled BP increased from 40.2% to 67.4%</p> <p>Lipid Of 424 with dyslipidemia, for all cohorts by enrollment year, all</p>	<p>Program costs are reported within the health care and medical totals. No separate estimate provided.</p> <p>18 pharmacists participated. Employers compensated educators and pharmacists, and also reduced pharma copays for patients.</p> <p>Prog Costs included MTM services, educator fees, study-related laboratory testing, reduced medication</p>	<p>CV-related health care costs from claims for inpatient, outpatient, ED, pharma.</p> <p>Based on 1189 historical patient-years claims and 1286 interv period claims: Per Person CV-Medical Costs Per Person Historical - \$1362 Intervention - \$734 Difference – Reduced \$628 Per person per month decrease - \$52.42</p> <p>Per Person CV-Pharma Costs Per</p>	<p>No final economic measures provided.</p> <p>From health plan perspective, sum of medical plus pharma costs probably led to modest reduction in cost per member per year.</p> <p>If averted CV-events are also accounted, there may be substantial savings for the plans.</p> <p>Limitations: Pre-post design OOP incentive may attract those with health events in historical period</p>

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	<p>Diabetic: 14-32% College: 27-38%</p> <p>Enrollment Jan '00 – Dec '05. Major endpoint is 1 year F/U.</p>		<p>lipid measures significantly favorable compared to baseline year except for HDL in year 5.</p> <p>CV-Events 1189 CV-related claims from historical period and 1286 claims from interv. period compared. The number of CV events reduced significantly from 92 to 48 (OR=0.469).</p>	<p>copayments.</p>	<p>Person Historical - \$287/year Intervention - \$846/year Difference – Increased \$559/year Per person per month increase - \$45.83</p> <p>Cost of CV Events Based on historical and interv period CV events and mean event costs, events cost was \$1,405,614 compared with actual costs of \$476,688, a reduction of \$928,926 in averted CV costs.</p> <p>No productivity effects estimated.</p> <p>Base year is 2005 and CPI (1.117)</p>	
<p>Carter 1997</p> <p>Randomized Controlled Trial</p> <p>Health Costs Only</p>	<p>Taylorville, IL</p> <p>Medical Clinic with 11 physicians in Rural community of 10K</p> <p>Private pharmacy with 1.5 pharmacists in same building</p> <p>=>18 yrs with HTN Dx or prescribed hypertensives.</p> <p>Excluded if not</p>	<p>Pharmacy modified to include consultation space, BP monitor, and HTN edu material</p> <p>Pharmacists provided extensive training and experience at VA clinic in Chicago.</p> <p>Pharmacist Led [n=25] – optimize therapy quality, improve compliance, reduce reactions, reduce costs. Access to medicals records, diagnostics, and labs.</p> <p>Provided written progress</p>	<p>BP taken at baseline, monthly, and at 6 months.</p> <p>SF-36 completed at baseline and 6 months.</p> <p>Adherence defined as # Doses Taken in 6 months/# Doses Prescribed x 100</p> <p>Systolic BP Interv Baseline 151+-21 6 Month 140 +-14 Usual</p>	<p>Note at base # hypertensives were 1.5 for controls and 2.8 for study group which also was less healthy.</p> <p>There is no separate estimate for interv cost apart from health care use</p> <p>Per Patient Charges Interv vs Usual Drugs: 317+-183 v</p>	<p>Outpatient visit costs and pharmacy costs are discussed in program costs column.</p> <p>No productivity improvements considered.</p> <p>Used CPI and 1995, 2 years before publication, as base year (CPI-1.431)</p>	<p>No summary economic measures.</p> <p>Non-academic setting where pharmacists were trained.</p> <p>Unexpected high rates of controlled BP in both groups at baseline.</p> <p>Study based in rural area is an applicability plus in evidence review.</p> <p>Randomization led to unexpectedly larger</p>

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	<p>with clinic or pharmacy, unable to visit clinic, with serious co-morbid conditions etc.</p> <p>Age: 67.3-68.5 % Controlled BP: 52-54% Female: 76-77% Comorbidities: Interv-3.5, Usual-3.2</p> <p>6 month Interv.</p> <p>Years of recruitment and intervention not provided</p>	<p>notes with findings, assessment and plans to physicians and placed in records.</p> <p>Patients returned for monthly visits with pharmacist</p> <p>Education standardized with pamphlets, visual materials, and instructions including diet and lifestyle.</p> <p>Patients saw physicians/nurses and had BP recorded before, during, and after study.</p> <p>Usual Care [n=26] provided at Annex clinic. Pharmacist took BP at baseline and at 6 months.</p>	<p>Baseline 145+-19 6 Month 143 +-20</p> <p>Diastolic BP Was controlled for both groups at baseline (Elderly population)</p> <p>Controlled BP Interv: improved 52 to 68% Control: improved 54 to 58%</p> <p>Change in Diet Interv: 35 to 71% Control: 23% at base and 6 months</p> <p>Quality of Life At baseline the study group had worse scores and subscores At 6 months there study group scores increase markedly and above the control group</p>	<p>212+-162 Visits: 823+-1123 v 336+-246 Total: 1106+-1103 v 526+-310</p> <p>Per Patient HTN Related Charges Interv vs Usual Total: 122+-124 v 52+-65</p> <p># Visits Interv v Usual 8 v 5</p>		<p>proportion of poorer health among study group.</p>
<p>Cote 2003</p> <p>Before-After with Control</p> <p>Cost-Benefit</p>	<p>Quebec City, Canada</p> <p>9 Pharmacies with 4 in interv. and 5 in control.</p> <p>Sample: Interv-41 Control-59</p> <p>Pharmacies chosen among those using software compatible with</p>	<p>Precede-Proceed modeled health promotion to improve adherence behavior. Computer assisted educational program.</p> <p>Objectives: modify negative factors for adherence; optimize pharma; reinforce non-pharma.</p> <p>Computer-assisted program flags participants as they enter pharmacy for</p>	<p>BP measurements at home at baseline and 9 months later.</p> <p>For high income, reduction in systolic BP by 8 mm Hg (p=0.01) Not effective for low income.</p>	<p>Interv Costs: BP Readings (n=222)-\$888 Verbal Instr. (n=70) - \$350 Pharma Opinions (n=2) -\$20 Total- \$1258 Per Participant (n=41)-\$30.68</p> <p>Fixed Costs: Software costs (C\$8500) and</p>	<p>Health Care Costs: included cost of pharma, outpatient visits, BP-related hospitalizations. Time to visit pharma and patient and patient companion and pharmacist time and wages considered. Diff-in-diff for health care was \$331.30 higher for controls than interv (also due to increase in post for</p>	<p>Two Scenarios Considered: Scenario 1: Public intervention to 717,538 hypertensives in Quebec province. Scenario 2: Private intervention to 71,754 (10% of hypertensives)</p> <p>Per Participant</p> <p>Total Benefits: Health care savings+WTP=</p>

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	<p>interv decision support software.</p> <p>Interv Group: Age: >=65-63%; Female-68%; Low Income-54%. 50% had controlled BP</p> <p>There were less older patients in control (age>=65: 49%).</p> <p>Interv year Oct 1998-1999</p> <p>9 month interv Measurements taken 9 months before and 9 months during intervention.</p>	<p>refill and BP measured. Software discerns those with controlled BP (140/90 for <60 years, 160/90 otherwise). Software flags as non-adherent if more than 7 days late in refill.</p> <p>Health/pharma costs, sociodemographics, income collected from surveys intervention.</p>		<p>services (C\$1175) included (Fixed cost at 5% for 3 years). Total-\$9675</p> <p>Authors discuss possibility that pharmacist cost were double counted for interv. group. But that would favor the intervention value. No training costs considered, which was about \$48.58 per individual pharmacist.</p>	<p>control). Diff in diff for time to get treatment was \$40.70 higher for interv than controls. Hence, total health care costs was \$290.60 lower for interv than controls.</p> <p>Willingness-to-Pay: Patients asked max willing to pay per month for regular pharmacist-led measurement of BP and advice regarding medications. WTP (n=2): \$0.54 per month (\$4.86 for 9 months)</p> <p>Used CPI (1.338) and PPP (1.19) for Canadian 1998 as base year</p>	<p>290.60+4.86=\$295.46.</p> <p>Scenario 1: Total Costs: Program cost + Fixed Costs =30.68+0.02=\$30.70 Benefits/Cost~10.0:1.0</p> <p>Scenario 2: Total Costs: Program cost + Fixed Costs =30.68+0.24=\$30.92 Benefits/Cost~10.0:1.0</p> <p>The assumption that fixed costs of software for pharmacies and entire population are similar may be questionable. Note most of the effect comes from health care and less from software, program, or WTP.</p>
<p>Datta 2010</p> <p>Effectiveness paper is Bosworth 2009a</p> <p>Cluster Randomized</p>	<p>Durham, NC Veterans Administration Medical Center</p> <p>All 32 clinic providers participated.</p> <p>Eligible patients are those with hypertension Dx or Rx filled during last year. Exclude those with kidney disease.</p>	<p>1. Nurse-administered patient behavioral intervention (NB) – One call within week of recruitment and once every 2 months. Each call covered 9 modules: perceived risk; memory; health literacy; social support; relationship with provider, pill refill, missed appointments; health behaviors (diet, exercise, smoking, and alcohol use); and adverse effects. Also</p>	<p>Neither decision support (DS) nor combined behavioral and DS led to significant effect.</p> <p>Uncontrolled defined as (JNC6): SBP>140 mmHg or a DBP>90 mm Hg for nondiabetic persons and >130 mm Hg and >85 mm Hg</p> <p>In NB, BP control</p>	<p>Development of nurse modules not considered. Nurse training time and piloting over 75 hours included.</p> <p>Based on review of actual calls during intervention and preparation time: 1. Model assumed 15 minutes to review medical records and successfully</p>	<p>Health care costs from perspective of VA system. OOP and outside VA charges not included.</p> <p>Health care util not linear presented as 2-year total. Not adjusted for censoring since loss to FU and death was small. Two Year Health Care Costs</p>	<p>Lifetime benefits considered for cost-effectiveness.</p> <p>Life expectancy by BP, BMI, and gender derived from the Framingham study for 50 year olds and 3 possible BP states at end-point (Normal, High-Normal, Hypertensive).</p> <p>Program cost assumed triangular distribution. Discount set at 3%.</p> <p>Cost-effectiveness developed using TreeAge</p>

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	<p>Mostly male mean 63 years. 40% African American 50% at least a high school</p> <p>24 months or until patient dropped. Rolling enroll March 02 and final FU on April 05.</p>	<p>feedback about BP values, reminders for refills and office visits, support for adherence to meds; hypertension-related questions.</p> <p>2. Decision support system for providers to adhere to guidelines (DS)</p> <p>3. Combination (NB+DS)</p> <p>Only NB led to significant effect. Hence, only NB [n=294] was evaluated for cost-effectiveness and DS, NB+DS were combined into 'No Intervention' [n=294] for analysis.</p> <p>'No Intervention' is called usual care by authors but some received decision supp.</p>	<p>improved from 40.1% to 54.4% (14.3%, 1.2%-27.4%, P = .03) over 2 years; for the Non-NB, BP control improved from 38.2% to 43.9% (5.7%, -6.9% to 18.4%, P = .38).</p>	<p>complete intervention calls.</p> <p>2. At 48 weeks/year and 35 hours/week making intervention calls to each patient every 2 months, the nurse could manage 1,120 hypertensive patients per year. Sensitivity analysis assumed 560 and 840 patients.</p> <p>3. Nurse salary at federal rate of \$60,234 and sensitivity \$52379 and \$69660 (Benefits inflate these by30%)</p> <p>4. Computer Costs - \$2500 depreciated over 4 year life</p> <p>5. Indirect costs use of facilities, phone, utilities imputed as 0.59 ratio to direct costs</p> <p>Annual Nurse Cost Per Patient By # Patients Direct 94; Indirect 55; Total 149</p> <p>Space cost added \$2.50 to \$4.50 per patient</p>	<p>Intervention InPatient: 2293112; OutPatient: 2863775; Total 5156887</p> <p>Usual Care InPatient: 2018535; OutPatient: 2822215; Total: 4840750</p> <p>The interv group had higher incremental inpatient (934/patient) and outpatient (141/patient) costs though none of util costs between groups were statistically significant.</p> <p>Used CPI and 2004 as base year (1.154)</p>	<p>decision analysis software.</p> <p>Cost-Effectiveness (Cost/LY)</p> <p>NM 87300 OM 43567 NF 42457 OF 58560</p> <p>NM-Normal weight male; OM-Overweight male; NF-Normal weight female; OF-Overweight female</p> <p>The intervention costs more and there is increase in utilization. Based on standard threshold, it can be cost-effective from a societal perspective. Employers must be willing to pay more premium to cover cost based on benefits increase from productivity.</p> <p>Limitations VAMC population Single primary care clinic Charges outside VA system not considered</p>
<p>Devine 2009 Interrupted</p>	<p>Puget Sound, WA Community</p>	<p>2 clinical pharmacists hired by physician group to control and optimize</p>	<p>Study provides effects beyond BP control.</p>	<p>Study simplifies the analysis by focusing on the</p>	<p>Effect of All Generics Use: Comparing pharma</p>	<p>Study illustrates savings from various strategies but we focus on their</p>

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<p>Time Series of an Existing Program Compared to Network average.</p> <p>Cost Benefit Analysis?</p>	<p>Physician Group Practice (PPO)</p> <p>250 Physicians, 1330 employees, with 225K members logging 700K visits per year. From 16 locations, 2 surgery centers, and 1 cancer center.</p> <p>Program began in 1999? Data from 2003 through 2007.</p>	<p>pharma use and costs.</p> <p>Use of 9 disease management registries with sophisticated in-house health record and order entry system.</p> <p>Based on evidence, managed by pharmacy and therapeutics committee, ability to substitute drugs (to generics or prescriptions to OTC) with physician permission, provider education by pharmacists. Pharmacists contribute to information systems development and provide latest safety/recall news to providers. Assist patients with pharma assistance programs.</p>	<p>Preliminary BP Results: Of 32,000 in hypertension registry, BP control increased in 2 years from 45% to 55% in family practice and 45% to 60% in internal medicine.</p>	<p>salary of 1 clinical pharmacist able to serve 100K patients. Salary assumed to be \$100K with \$30K benefits per pharmacist.</p>	<p>for PPO to average for network, savings for 2 health plans covering 40% of patients was \$12 million in 2006. PPO received bonus via P4P for this saving.</p> <p>Detail not provided but PPO used 71% generic for hypertension vs 41% average for network.</p> <p>Productivity effects not considered.</p> <p>Base year is reported 2006-2007. Assume it is 2007. CPI (1.05)</p>	<p>hypertension results.</p> <p>Assume single pharmacist serving 100K members of which 16.67% are hypertensives and 50% of them receive antihypertensive treatment, 50% of which receive preferred ACE-inhibitors, 50% of which can be switched to generics. The PPO used the target drug program strategy for antihypertensive agents, converting 50% of brand ACE inhibitors to first-line agents, achieving savings of \$4.18 per member or \$418,219 during the first year of the program. Study compares this to a pharmacist salary of \$100K plus \$30K in benefits.</p> <p>The cost savings are conjecture based on model. However, the % achieving BP control over 2 years is an actual effect. We may apply 16.67% to 225K lives to obtain the # hypertensives. Program cost may be assumed to be 2 pharmacists salaries over 2 years.</p> <p>Comments: This is an important study because it is LT and based in large health system. But the economics data is limited.</p>
<p>Eckerlund</p>	<p>Skaraborg County,</p>	<p>Hypertension Care</p>	<p>Study states that the</p>	<p>Program cost is</p>	<p>Health Care and</p>	<p>Authors note duration of</p>

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<p>1985</p> <p>Population level intervention over 5 years with controls.</p> <p>Cost Analysis</p>	<p>Sweden</p> <p>Implemented in various municipalities in 1976. Target ages 40-69.</p> <p>County divided into interv and control. Control area has usual care.</p> <p>At baseline 15-16% above (170/105) for ages 40-60 and above (180/110) for age >60. 20-25% were not on treatment.</p> <p>Over 5 years, 3240 patients enrolled.</p> <p>Analysis done for 211 in interv. and 98 in control, with no comorbidities, and age 40-69, with similar age and sex. Diagnosis of HTN at least 1 year prior to study.</p> <p>Program began in 1977. 5 year trial duration</p>	<p>Program (HCP) – Nurse Led.</p> <p>Cooperation between nurses and physicians in primary care and area departments of internal medicine. Consultations with U of Gothenburg. Establish hypertension clinics in outpatient units. Recommendations for measurement, treatment, referral, quantity of meds, and organization of care.</p>	<p>trial fully controlled 7% of the population at risk. We assume this is from the 15-16% with uncontrolled BP at baseline.</p> <p>Control largest in first year but continued into 5 years.</p>	<p>conceptualized as difference between interv and control groups for:</p> <p>Patient time; Staff time; Materials; Medications; Lab Tests.</p> <p>Authors note that all cost of HTN care were not included.</p> <p>See health care cost column for the estimates.</p>	<p>Patient Time Costs</p> <p>Total cost per person per year: Interv: 799 SEK Control: 918 SEK (1 SEK=0.125 US\$)</p> <p>Intervention was cost saving.</p> <p>Note that meds comprised 73-74% of these costs. Components of costs were not statistically different between groups. Trial area patients spent proportionately larger time (78%) with nurse than physician (47% in control).</p> <p>Much of the difference in cost is due to greater nurse time than physician time in the trial area.</p> <p>Screening Costs: Initial: 10 SEK; Check-up I: 35 SEK; Check-up II: 180 SEK. Total 2-year cost in Skara Municipality was 62,000 SEK identifying 65 cases at CE of 960. Productivity effects not considered. Screening results from trial not different from yield in control area.</p>	<p>trial is too short to calculate cost per morbidity or mortality outcomes.</p> <p>We may calculate program cost per additional person achieving BP control (pre-post measure): $= (799) / (0.07)$ 11414 SEK.</p>

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					Use mid interv year 1979 as base. CPI (3.0). PPP=6.77 PPP is given by study as (1 SEK=0.125 US\$)	
<p>Edelman 2010</p> <p>Randomized Controlled Trial</p> <p>Cost-analysis</p>	<p>Durhan, NC; Richmond, VA.</p> <p>Veterans Affairs Medical centers in Durham, NC and Richmond, VA</p> <p>Patients enrolled at either center with co-morbid diabetes with hypertension. Excluded those with care outside VAMC, reduced life expectancy, psychotic hospitalization, enrolled in endocrine clinic. 239 assigned; 609 eligible; 3469 screened</p> <p>Afr Amer – 54-65% Low Income -32% HS or Less 36-43%</p> <p>Appears to be 12 months. Enrolled June 06 to Sept 07.</p>	<p>Group Medical Clinics (GMC) [n=133] Intensive individualized medical management added to self-management education. GMC made up of internist, pharmacist, nurse/diabetes educator). Group meeting every 2 months (7 visits) At visit, BP and Glucose checked followed by meeting led by nurse/educator. Internist and pharmacist reviewed records, readings and recommended medication changes, and lifestyle changes. Each session 90-120 minutes. Telephone contacts limited to changes in readings or disease management. GP informed solely by EMR Usual Care [n=106]</p>	<p>Intention to treat analysis.</p> <p>Systolic BP and Glycemic measures at baseline, midpoint, and end of study.</p> <p>End of study effects after adjustment for stratification and clustering:</p> <p>Mean systolic BP 7.3 mm Hg lower in GMC (95% CI, -12.8 to -1.7 mm Hg). Mean HbA1c levels were 0.33% (CI, -0.8 to 0.13%) lower in GMC.</p> <p>Intervention had no effect on glycemic control.</p> <p>Intervention improved BP control at 12 months.</p>	<p>GMC-\$10 reimbursement for each visit.</p> <p>Per GMC Visit Physician-1.5 hr Pharmacist-2 hr Nurse-2 hr Calls by Physician/Pharmacist 104 brief calls and 71 longer calls to 133 patients in GMC</p> <p>Cost per Group Visit - \$504 (\$445 to \$578) Cost per Group Visit per Person \$63 (\$56 to \$72)</p> <p>Annual per Patient Cost of Group Visit \$441 (\$389 to \$506) Annual Cost per Patient for Follow-up Calls \$19 (\$4 to \$48)</p> <p>Total Annual per Patient \$460 (\$393 to \$554).</p>	<p>Health care administrative data from USDVA from 1 through 13 months after enrollment. Utilization: GMC had 0.4 fewer ED visits GMC had 0.9 fewer GP visits GMC had 23 hospitalized 32 times and usual had 23 hospitalized 39 times</p> <p>Used CPI and 2009 base year (1.0164)</p>	<p>No summary economic measures.</p> <p>All recruits had poor BP and diabetes control at baseline</p> <p>Based on VAMC Authors don't have explanation for lack of effect on glycemic control.</p>
Fedder 2003	Baltimore, MD	Community Health	1 Year after CHW	CHWs provided bus	Health Care	Based on CHW caseload of

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<p>Retrospective cohort.</p> <p>Cost Analysis</p>	<p>Medicaid diabetics with or without hypertension and age =>18. Generally from U of MD hospital discharge rolls, and also from referrals, and Medicaid diabetes program.</p> <p>Interv. Group: Patients with =>5 CHW contacts over study period (n=117) and only African Americans included in analysis. Age=57; Female=78%;</p> <p>Analysis based on 1 year pre and post CHW program enrollment.</p> <p>Recruit March 92 to June 93. 3 year program. Interv from March 92 to October 94. Study started 2 years after program started. Study period March 91 to June 94.</p>	<p>Worker (CHW) – interviewed and recruited from area; 60 hours training over 6 months and initial supervised work with patients.</p> <p>Patient contact at least once a week alternating with phone and in-home. Link patients with primary and specialty care, assist with appointments, monitor self-care, monitor for complications, assist with Medicaid, and provide social support. Biweekly supervision meeting for discussion and to assign patients.</p>	<p>Effects ER Visits: Reduced by 38%; ER followed by Hospitalization: reduced by 53%. Hospitalization: Reduced by 30% Length of Stay: Reduced 5%.</p> <p>Note this study does not report any clinical outcomes such as BP, glucose level etc.</p>	<p>passes and stipend of \$45-\$60 per month.</p> <p>Total of 68 CHWs trained over 3 years. Of these 38 were actively involved with patients. Mean education just under 12 years.</p> <p>No program cost provided beyond the nominal stipend amount.</p>	<p>Utilization based on Medicaid claims data including outpatient, inpatient, drugs, and labs. Utilizations annualized based on duration of Medicaid enrollment.</p> <p>Mean health care expenditures based on reimbursements: Decreased 27% from \$8266 1 year before to \$6020 1 year after, difference of -\$2246.</p> <p>Use mid interv year 1993 as base. CPI (1.509).</p>	<p>30 patients, expect health care savings of \$80K-\$90K per year.</p> <p>Limitations: Hospital discharge recruitment may be a selection bias, as is offer of free care.</p>
<p>Forstrom 1990</p> <p>Pre-post with</p>	<p>Puget Sound, WA</p> <p>HMO family practice clinic with</p>	<p>Clinical Pharmacist – Formal written drug consultation placed in patient records prior to</p>	<p>Physicians fully or partially followed 77% of pharmacist recommendation</p>	<p>No program costs provided</p>	<p>Average Daily Drug Cost (ADDC) Average daily drug cost (ADDC) reduced</p>	<p>No summary economic outcomes are reported. Focus was on target drug reduction and reduction in</p>

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<p>controls. Cost Analysis</p>	<p>5 physicians and serving 5500 patients. Part of Group Health Cooperative of Puget Sound.</p> <p>4 matched family physicians from 4 of other 6 clinics in region chosen as control. Interv=154; Control=172.</p> <p>Eligible patients were hypertensives taking meds and keeping appointments.</p> <p>Patient panels were similar: Age 61-66; Female: 66-69%. Controls had more >50 year olds.</p> <p>Data collection and analysis 12 months after interv start. Study period was 6 months. Hypertensives identified by pharmacists during April to June 1986.</p>	<p>visit with physician. Note included current meds, any recommended changes and cost impact, any suspected adverse reactions, interaction, and assessment of compliance. Also focused on certain targeted drugs and targeted patients for step-down.</p> <p>Onsite pharmacy with 2 pharmacists and 1 tech doing 5100 prescriptions per month.</p> <p>Pharmacists also screen orders, maintain drug profiles, advice patients on use, and contact physician for refills.</p>	<p>(102 consults on 87 patients over 6 months).</p> <p>Targeted drugs were reduced for the intervention group compared to control (Excess of HCTZ and similarly for potassium supplements and prazosin).</p> <p>No clinical outcomes such as BP reported.</p>		<p>\$20.61 (40.99) per year per patient for intervention. Average daily drug cost (ADDC) increased \$6.21 (\$12.35) per year per patient for intervention. Hence, intervention savings were \$26.82 (\$53.34).</p> <p>Health Care and Patient Time Costs No other health care costs provided.</p> <p>No productivity effects.</p> <p>Use interv year 1986 as base. CPI (1.989).</p>	<p>drug costs.</p> <p>NO CEA measures can be calculated.</p> <p>Authors conjecture that though ADDC reduction is small there may be reduction in metabolic complications, less changes in lipid profiles and increase in uric acid.</p>
<p>Isetts 2008 Existing intervention. Prospective interv. group vs</p>	<p>Minneapolis, St Paul, MN</p> <p>Implemented in 6 of 15 primary care clinics in a health care organization.</p>	<p>Medication Therapy Management (MTM) – Pharmacist Led. Collaborative pharmaceutical care with pharmacist, physician and patient. Goals set for each</p>	<p>Study provides effects for both hypertension and hyperlipidemia. We focus on BP.</p> <p>% achieving HEDIS</p>	<p>Pharmacists underwent 120 hour, 50 patient, 8 week training.</p> <p>Cost of MTM care for study obtained</p>	<p>Health care impact is simple pre to post comparison from medical and pharmacy claims.</p> <p>Total annual claims</p>	<p>Note program costs and health care cost impacts are for all conditions.</p> <p>Program cost for 186 interv. patients in MTM: \$49,490 (\$266.08 per</p>

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<p>retrospective historical control.</p> <p>Cost-Benefit Analysis</p>	<p>Analysis for those with continuous insurance coverage under BC/BS of MN. With =>1 of 12 conditions and with =>2 claims for the conditions. =>18 years old. High resource use members.</p> <p>Initial 285 patients in interv of which 186 had claims in pre and post. Female-66%; Over65-14%; 6.4 conditions per patient.</p> <p>Historical control of 126 with BP and 126 with lipidemia.</p> <p>Program began in 1999. Analysis is for a 1 year period pre and post. Enroll Aug 1 '01 to Jan 31 '02.</p>	<p>patient by pharmacist with physician approval for each condition. Pharmacist evaluated therapy problems based on indication, effectiveness, safety, and adherence. Progress to goal evaluated at each follow-up.</p> <p>4 pharmacists with PhD and 3 with BS in pharmacy with mean experience of 12 years.</p>	<p>2001 BP control goal in interv vs control.</p> <p>Effect estimates based on 128 each in interv. for BP and hyperlipidemia and 126 each in historical controls.</p> <p>HEDIS 2001 BP Control: 71% in interv. and 59% in control.</p> <p>HEDIS 2001 Cholesterol Control: 52% in interv. and 30% in control.</p>	<p>as cost per member of health care organization receiving MTM multiplied by members in intervention group.</p> <p>MTM costs included salary and benefits; rent and utilities; computer software and hardware; marketing; customer service; net margin contribution. Also included claims processing, provider credentialing, and audit.</p> <p>Incremental per person per year cost of MTM - \$239.40.</p> <p>Incremental per person per year cost of MTM + claims processing - \$266.08.</p>	<p>per person reduced from \$11,965 to \$8197 from pre to post period for interv. group. (Note this is for all 186 patients with claims including non-hypertensives).</p> <p>Productivity effects not considered.</p> <p>Use interv year 2002 as base. CPI (1.212)</p>	<p>person) Post Minus Pre Total Claims and processing Costs for 186 interv patients: \$1,524,703-\$2,225,540=-\$700,837</p> <p>Third party perspective further subtracts patient copay, coinsurance, and deductibles of \$99,066, for net savings of: \$601,771</p> <p>Return on MTM Expenditures from 3rd party perspective=601771/49490 =12.15</p> <p>We may calculate program cost per additional person achieving BP control (pre-post measure): =266.08/(0.71-0.59) =\$2217.33. Caveat is program cost is for all conditions and effect is pre-post.</p> <p>Major limitation: selection bias due to high resource utilizers</p>
<p>Katon 2010</p> <p>RCT. (Permuted Block Design)</p> <p>Average Cost</p>	<p>Washington State.</p> <p>Patients from 14 general practices with Group Health Cooperative.</p> <p>214 persons with</p>	<p>Led by 3 Part Time RN's with experience in diabetes education. Underwent 2-day training by psychiatrist, FP, endocrinologist, nephrologist, psychologist, and nurse. Materials were</p>	<p>Telephone interviews at base, 6, 12 months for depression symptoms, risk behaviors, and satisfaction with care. In-person BP and</p>	<p>In-person visit mean 30 minutes and telephone contact 10-15 minutes. Costs based on actual staff and supervision salaries</p>	<p>Health care costs not considered.</p> <p>Productivity effects not considered.</p>	<p>No final economic measures provided.</p> <p>Limitations: Program cost is very likely an average and not</p>

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	<p>depression and CVD, Diabetes, or both. With uncontrolled BP and/or Lipidemia. Usual – 108 Interv. – 106</p> <p>Mean age: 56-58; Female: 48-56%; Minority: 22-25%; Unemployed: 10-13% 1 Yr College: 56-61%</p> <p>Interv length 12 months. Recruit May 07 - Oct 09. F/U at base, 6 months, and 12 months.</p>	<p>for depression mgmt., beh. strategies, and glycemic, BP, and lipid control.</p> <p>Collaborative care for depression, and self-care with pharma for hyperlipidemia, hypertension, and hyperglycemia. Structured visits with nurses in GP clinics every 2-3 weeks. Those achieving control met every 4 weeks. Treatment protocols and goals developed and support for medication adherence and motivational coaching. Weekly supervision by GP, psychiatrist, and psychologist. Educational materials and videos.</p> <p>Usual Care – GP notified of patient diagnoses and readings. Patients encouraged to consult with specialists.</p>	<p>glycated hemoglobin at similar intervals. Lipid measures at base and 12 months. Depression measure by Patient Health Questionnaires (PHQ-2 and PHQ-9). Depression outcome by Symptom Checklist (SCL-20). Also a single outcome measure modeled across the 4 conditions.</p> <p>12-Month Change Systolic BP: reduced 5.1 mm Hg Lipid LDL: reduced 9.1 mg/dl Glycated Hemoglobin: reduced 0.56% SCL-20: reduced 0.41 Also, improvement in joint outcomes for 4 conditions</p>	<p>plus fringe benefits. Overhead calculated at 30%. Also added outreach efforts and records maintenance work by inflating the nurse time for each visit and contact. Unit cost per in-person visit: \$79 Unit cost per telephone visit: \$31 \$100 per participant added for supervision costs and information systems.</p> <p>Interv. patients had 10.0 and 10.8 in-person and telephone mean visits over 12 months.</p> <p>Per patient 12-month program cost: \$1224.</p>	<p>No base year provided. Use 2008 middle year of recruitment and CPI (1.013).</p>	<p>incremental. Cost is composite for all outcomes.</p> <p>Interv. and control differed in GP visits Inadequate power to discern CV events and hospitalizations. Highly specialized nurses. Treated comparison</p>
<p>Kulchaitanar oaj 2012</p> <p>Based on Carter 2008, 2009 RCTs</p> <p>CEA</p>	<p>Midwest, USA</p> <p>11 medical offices randomized to interv (n=5) and control (n=6). Patients with Dx for hypertension recruited. Interv. patients were 252 and Usual care was 244.</p>	<p>Based on Carter 2008, 2009 both of which are physician/pharmacist collaborations in community-based practices to control BP. Both included in effectiveness review. Providers ranged from FP, nephrologists, cardiologists, clinical pharmacists, medical</p>	<p>Regression analysis with same control variables as cost analysis to find BP control rates and BP reduction.</p> <p>Interv vs. Control (Difference) <u>% Patients Achieving BP Control</u> 66.0 vs 41.4</p>	<p>Physician visit times based on national survey. All other contact and activity times based on survey of interv. pharmacists and applied to all providers. Used mean values and max/min for sensitivity. Applied</p>	<p>Physician visits, pharmacy costs considered.</p> <p>No productivity effects considered.</p> <p>Base year is 2011.</p>	<p>Costs adjusted with multiple regression analyses for age, sex, race, baseline BP, baseline meds and # meds, comorbidities. Also sensitivity analysis including those who dropped out of study.</p> <p>Over 6 Months (Minutes per Patient) Physician: 74.70 vs 53.74</p>

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	<p>Patients with BP<180/110 and age =>21</p> <p>Male: 38-43% Age: 59-62 White/Hispanic: 85-90% Never Smoked: 44-52% >1 drink daily: 14%</p> <p>Data based on 6 month follow-up.</p>	<p>residents.</p> <p>Pharmacist generally collocated with physician. Protocol encouraged pharmacists to attend clinic visits, patient contacts at baseline and specific timed F/U and additional discretionary F/U. Visit with physician not mandatory except at baseline for one interv. Physician-Pharmacist communications by phone, in-person, written, or curbside (very brief). Pharmacist focus on suboptimal therapies per JNC-VII. No direct contact with specialists.</p> <p>No Intervention – BP care by physician. Pharmacist abstained from direct care.</p>	<p>(24.6%) p<0.001 <u>Reduction in SBP/DBP (mm Hg)</u> -21.49/-8.61 vs. -12.41/-5.12 (-9.1/-3.5) p<0.001</p>	<p>average wage plus 30% overhead.</p> <p>Program development costs approximated by adding overhead of \$50 per hour for direct care and \$25 per hour for collaborative activities.</p> <p>Also included medication costs and laboratory tests.</p> <p>See summary column for costs.</p> <p>Difference in adjusted total 6 month cost: \$290.42</p>		<p>(due to 21 min of pharmacist collaboration) Pharmacist: 114.34 (26 minutes in collab. with physician) 6 Month Adjusted Costs (Interv Vs Control) GP: 161.47 vs 115.88 Pharmacist: 154.57 vs 1.66 Specialist: 12.15 vs 8.75 Labs: 34.93 vs. 42.28 Medications: 383.53 vs. 287.65 Total Cost: 746.65 vs. 456.24 Diff Total Cost: \$290.42 (p<0.001) 6 Month Cost-Effectiveness CEA (% BP Control) =290.42/24.6 =\$1180.58 per 1% CEA (Reduced SBP) =290.42/9.1=\$31.91 per mm Hg CEA (Reduced DBP) =290.42/3.5=\$82.98 per mm Hg Cost Drivers GP visits were same for both groups. Physician time in collab. Increased</p> <p>Study pays attention to cost of collaboration. Not all health care accounted. Small samples. Not a lifetime analysis of benefits and costs Pharmacist/Physicians already working together</p>
<p>Litaker 2003 Randomized</p>	<p>Cleveland, OH. 1000-bed tertiary</p>	<p>NP-MD Team Care [n=79] 1. Written treatment</p>	<p>Process and outcome measures assessed. Outcomes included</p>	<p>Mainly based on labor and salaries. Average time on</p>	<p>Health care utilization patient reported.</p>	<p>No summary economic measures.</p>

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<p>Controlled Trial</p> <p>Cost-analysis</p>	<p>affiliated with Cleveland Clinic</p> <p>Patients with mild to moderate hypertension (JNC3) and non-insulin dependent diabetes. No end-organ complications. Enrolled at clinic or residents of Cleveland area.</p> <p>12 month treatment Recruitment Oct'96 to Jan'98</p> <p>157 assigned; 1717 screened Mean age: 61 Afr Amer: 43-50% Female: 45-47% School Years: 12.3-12.9 years</p> <p>12 month intervention. Enrollment Oct 96 to Jan 98.</p>	<p>algorithms (JNC3 and ADA)</p> <ol style="list-style-type: none"> 2. Patient management flowcharts 3. Nurse practitioner responsible as the first-line contact for care and treatment decisions 4. NP training preceded the study enrollment phase 5. NP discussed problems not addressed in the algorithms with the patient's GP and treatment plan was established. Otherwise, GP saw patient directly. 6. Telephonic management, in-office follow-up with the NP 7. During contacts, NP developed treatment regimens that incorporated patient preferences and for assessing treatment adherence, individual barriers to adherence, family support for treatment. <p>Usual Care [n=78]</p>	<p>clinical measures and patient reported HRQoL (SF-12) and Diabetes Quality of Life (DQOL).</p> <p>NP-MD group had more education on variety of topics. NP-MD also received more preventive care.</p> <p>No difference in achieving nationally recognized goals for BP or dyslipidemia.</p> <p>NP-MD benefited from increased HDL-c (reducing risk of CVD). NP-MD had better long-term diabetes control but with rapid loss of effect after trial.</p> <p>Patient-reported satisfaction with care higher in NP-MD.</p>	<p>tasks determined by prior time studies. If both BP and Diabetes mentioned in encounter notes, then counted equally in time. Answering patient questions and education on phone not included in cost.</p> <p>NP-MD had average 180 minutes contact time vs 85 for usual care.</p> <p>MD was involved in 40% of visits.</p> <p>Personnel based 12 month cost per person: NP-MD: 134.68 Usual: 93.70</p> <p>Total cost for NP-MD was higher at \$10,639.70 vs. \$7,308.53</p>	<p>No costs of health care beyond outpatient encounters were considered. These are included in program costs.</p> <p>No benefits of averted health care costs or productivity improvements considered given the short intervention and follow-up period.</p> <p>Used CPI and interv year 1997 base year (1.359)</p>	<p>Improved clinical outcomes and quality of care at a higher cost were unexpected</p> <p>The authors conjecture that the cost difference would disappear with a longer intervention period.</p> <p>Small sample University based system</p>
<p>Logan 1981</p> <p>Randomized Controlled Trial</p> <p>Cost-Effective</p>	<p>Toronto, Canada</p> <p>21906 volunteers 18-69 years in 41 businesses</p> <p>Eligibility: intent to remain in empl 1 year; not on hypertensives past 3 months;</p>	<p>Worksite hypertension care (WC) [n=232]</p> <p>Evaluated at entry by physician and BP goal set along with hypertensive treatment.</p> <p>Long term follow-up at worksite on company time by 2 nurses trained in HTN control and reported to physicians from HTN Clinic</p>	<p>Cost and effect data available for 214 WC's and 207 UC's. Other 36 discarded from analysis</p> <p>Primary effect is average reduction in diastolic BP from entry to endpoint.</p>	<p>Screening costs distributed equally across groups (5 BP Techs, 2 Nurses, 1 Cardio). Participant time calculated from wage, where available or imputed.</p>	<p>Health care costs include outpatient, hospital, drugs, and labs considering only HTN related. Also includes patient waiting and travel costs.</p> <p>Mean Per Patient Cost</p>	<p>Costs per participant not significantly different between groups after adding screening costs to cost of treatment (WC-465.86, UC-434.34)</p> <p>Average Cost Effectiveness (with Screening Cost): WC: 20.07 (38.50)/mm Hg</p>

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	<p>457 were eligible</p> <p>3 screening sessions with BP reading and lab works at 3rd along with completed attitudinal questionnaire</p> <p>Stratified by median age, sex, diastolic BP and randomized to worksite or usual care.</p> <p>Age: 46-47 SBP: 153-154; DPB: 100.3-100.4 Male: 77-81% White: 88% Known HTN: 37.9-39%</p> <p>12 month Interv. Follow-up at 6 and 12 Screened in 1976-77</p>	<p>at Mt Sinai, Toronto.</p> <p>Follow-up at 6 and 12 months for readings and medication status.</p> <p>Usual Care by Community GPs (UC) [n=225] Appointment made with own GP for all usual care patients with HTN Dx.</p>	<p>Mean reduction in diastolic BP: WC: 12.1 ± 0.6 mm Hg UC: 6.5 ± 0.6 mm Hg (<i>p</i> < 0.001). Diff: 5.6 mm Hg</p>	<p>Variable Cost(\$) Personnel 41,139 Equipment/supplies 898 Travel 490 Participants' time 46,724 Administration 12,768 Total screening cost 102,009</p> <p>Costliest items were patient time and staff salaries (86%)</p>	<p>WC Group Hlth Sys Cost 197.36; Patient Cost 45.50 Total Cost 242.86 Drugs 87.34; Nurse 67.38; Hospital 0 Govt. Insur 58.17</p> <p>Usual Care Group Hlth Sys Cost 129.33; Patient Cost 82.00 Total Cost 211.34 Drugs 51.01; Nurse 67.38; Hospital 1080.71 Govt. Insur 76.03 WC group made less physician visits (2.9 v 5.7) WC group made 8.6 nurse visits, much more than UC WC group more likely on hypertensives Total health system cost higher for WC (197.36 v 129.33) Costs higher in WC substantially because of drugs and parallel care by community physicians.</p> <p>Productivity effects only through loss of work during health care.</p> <p>Used CPI and 1977 as base year (PPP-1.16 CPI-3.598)</p>	<p>UC: 32.51 (66.82)/ mm Hg</p> <p>Incremental Cost Effectiveness: 5.63/ mm Hg</p> <p>Sensitivity analysis imputing highest cost for WC and lowest cost for UC for missing values. Results still showed cost-effectiveness for WC</p> <p>In further analysis, even if patient cost is ignored the RC cost-effectiveness (19.90) is more than ICER of 12.15.</p> <p>Note that loss of time during health visits is important in reducing the difference in cost between WC and UC (\$36.5 per person). Due to worksite nurses. Worksite may be a good setting to target middle aged men.</p>
Logan 1983	Toronto, Canada	Worksite Occupational	End of study year	Nurse time	Cost divided into	Average CER:

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<p>Similar to Logan 1981 (But Logan 81 did not include those already on meds?)</p> <p>Randomized Controlled Trial</p> <p>Average and Incr. Cost Effectiveness</p>	<p>Screened 9743 30-69 year olds in 38 businesses and 213 were eligible. Eligibility: intent to remain in empl 1 year; meeting HTN Dx based on DBP.</p> <p>Stratified by age, sex, DBP, previous hypertensive exp, and randomized to worksite or usual care</p> <p>Age: 49.3-50.8 SBP: 154.3-154.9 DBP: 103.3-103.7 Male: 69.1-76.3% White: 82.5-84.5% Meds at Entry: 53.6-59.8%</p> <p>12 month Interv.</p> <p>Year of intervention not provided</p> <p>Recruits identified '79</p>	<p>Health Nurse Led Care (WC) [n=97] Nurse responsible to ensure they saw GP or help them obtain one. Visit with nurse every month for uncontrolled BP and every 2-3 months otherwise. Each visit: measure BP, discuss compliance and side effects, report to GP, implement compliance strategies such as pocket calendars. Difficult cases given tailored methods such as tying meds to daily habits, home BP monitoring, more freq visits.</p> <p>Usual Care by family physician (UC) [n=97] GP notified of HTN and employees reminded twice to contact GP</p>	<p>assessments made by external observers: BP (Controlled if DBP<=90 mm Hg); Medication History; Compliance (based on pill count with compliance at 80%) First year-end visit at home followed by 2 BP measures at work 1 week apart. However, analysis used first BP measurement because of fall in BP between first and subsequent worksite measurements (Effect of notification).</p> <p>At 12 months Decrease in Diastolic BP WC: 10.5 ± 1.1 mm Hg (significant) Usual: 7.7 ± 1.1 mm Hg (significant) % with BP Control: WC: 41.8% Usual: 31.0% Difference in change in DBP, and difference in proportion achieving control not significant. Referral failures were same in both groups Larger proportion of WC were prescribed meds at some point</p>	<p>recorded from patient encounter forms for each subject. Patient time and cost recorded from self-reported logs kept by patients during physician and lab visits. Used Nurse wage and subject wage to calculate dollar values. Group means imputed for missing values.</p> <p>WC visited nurse 12.1 ± 1.1 times spending 2.5 ± 0.2 hours each time.</p>	<p>HTN-related Health Care and Patient Costs (Productivity from loss of work/leisure due to waiting and travel) Health care included physician visits, medications, labs, and nurse time. Note labs and physician time borne by government universal insurance.</p> <p>Mean Per Patient Cost WC Group Hlth Sys Cost 229.09; Patient Cost 175.05; Total Cost 404.14 Drugs 100.75; Worksite Health 24.87; Govt. Insur 90.06</p> <p>Usual Care Group Hlth Sys Cost 148.91; Patient Cost 101.24; Total Cost 250.15 Drugs 58.33; Govt. Insur 81.39 The higher cost in WC is substantially due to visits with nurse and drug cost (73% more), probably more expensive drug choices.</p> <p>Used CPI and drug</p>	<p>WC: \$38.38 UC: \$32.65</p> <p>Incremental CER: Incr DBP: 2.9 mm Hg Incremental total cost: 153.99 ICER: \$53.67/ mm Hg</p> <p>Sensitivity analysis replaced WC missing cost with 10th percentile and UC missing values with 90th percentile. ICER-\$22.91/ mm Hg</p> <p>Study demonstrates reduction in DBP when referral made to GP from worksite.</p> <p>Study did not show worksite monitoring and care improved DBP cost-effectively compared to simple referral Authors state that the lack of effect may be failure to prescribe efficacious drug regimens. Special worksite HTN clinics may be needed.</p>

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			in study than UC WC did not have greater compliance		cost year book, 1983 base year (PPP- 1.22 CPI-2.189)	
Lowey 2007 Pre-Post. CEA	North Yorkshire, UK Implemented clinic in rural hospital. Patients with type 2 diabetes and resistant hypertension and/or hyperlipidemia. Indirect referral from outpatient and diabetes specialists. 53 patients recruited 27 female (51%); Age: 66.9; 52 White and 1 Polynesian; Nephropathy in 7 (13%) 6 month intervention and data. However, analysis is over 10 year horizon. Interventio date not provided.	Pharmacist led Clinic – Prepared individualized info and education materials. Patients given BP and lipids record cards. Med adjustments every 4 weeks using algorithm. Appointments lasted 20 minutes. Those with 2 consecutive normal BP discharged from clinic. Pharmacist responsible for treatment effectiveness and adverse effects. Referrals to dietician available. Treatments were for BP, lipidemia, other CVD risks, and diabetes. Appriaisal of service after 1 year.	Effect evaluated at 6 months. Also included those with less than 6 months. Main Effect: 10 year risk reduced by CHD: 11.9 and CVA: 9.6%, Authors also report 15 mm Hg reduction in SBP, 7 mm Hg reduction in DBP, Also reductions total cholesterol and LDL. Triglycerides and HDL unchanged.	Program cost included pharmacist time for consultation and administration; pathology and labs; and medications. Incremental total cost per person over 10 years: 1576 pounds, substantially made up of 1512 in pharma costs increase and just 37.0 in pharmacist cost. This is inclusive of lipid and hypertension care and meds. 10 year discounted cost was 1244 pounds per person.	Cost per month per person of antihypertensives increased by 6.6 to 33.4 pounds. Cost per person per month of statins increased by 6.0 to 1.9 pounds. The model used health care costs increase of 1244 (\$2319) discounted over 10 years for meds and pharmacist time. This translates to about \$315 per year. Productivity effects not considered. Base year 2002. CPI (1.212) PPP (0.65)	10 year horizon with 6% for costs and 1.5% for health benefits. Averted per person 10 year costs of CVA and CHD based on reduced risk and UKPDS Risk Engine calculator. Cost per averted CVA event: 63,320 pounds and Cost per averted CHD event: 34,708 pounds We may calculate 10 year cost per mm Hg for SBP and DBP (pre-post measure): DBP: (1244)/7=177.71 SBP: (1244)/15=82.93 Limitations: Small sample; No control; Short Duration
Ma 2009 Randomized Controlled Trial	San Mateo County, CA San Mateo Medical Center	CVD Case Management (CM) [n=212] 1 on 1 by visits and phone case management led by nurse and dietitian stressing behavior change	Effect based on Global CVD Framingham Risk Score (FRS) which includes BP. We focus on the hypertension	Note this is a comprehensive CVD risk reduction trial and BP control was only a part. Mean face to face	ED visits (28% v 25%) and hospitalizations (18 per 1K v 16) were similar in CM and usual care groups.	No summary economic measures. Study shows CM effective for poor and multi-ethnic populations.

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<p>Cost-analysis</p>	<p>Physician referred 1005 patients; 419 eligible; Age: 35-85 (Mean 55) Moderate to severe modifiable CVD risk factors Hispanic: 63%; Asian 11-13%; Afr Amer: 9-10% Female: 64-67% Lang Difficulty: 48-51% Less than 8th Grade: 39-51% Sizable low-income most with Medicaid or County-assistance. Average 16 month intervention. Recruit Oct 03 to April 05.</p>	<p>and med management. Visits 30-60 minutes at 4-6 week intervals first 6 months and every 2-3 months next 9 months. Target 8-10 visits over 15 months. Nurse and dietitian trained 1) intensive individualized care, 2) continuity and coordination with primary and specialty, 3) self-management support, 4) evidence-based treatment CVD guidelines 5) behavioral counseling to improve physical activity, nutrition, weight management, stress reduction, and medication adherence. Usual Care [n=207]</p>	<p>measure. FRS of CM group was significantly lower at 15 months (difference between groups, -1.13; 95% CI, -1.94 to -0.32; adjusting for baseline FRS and the effects of clinic and physician. Effect less for women and Hispanics. FRS scores driven mostly by BP subscore. Mean (SD) change from baseline in systolic BP was decrease by 4.2 (18.5) mm Hg in the CM group and increase by 2.6 (22.7) mm Hg in the UC group (<i>P</i>= .003). Diastolic BP declined in both groups but magnitude of reduction significantly greater for the CM group (6 vs. 3 mmHg) (<i>P</i>= .02). Proportion with BP control higher for CM (56%) than Usual (38%), with or without diabetes.</p>	<p>contact time was 11.2 hours. Program cost includes labor, supplies, and office space - \$896 per person over 15 months. Estimate cost would be \$371 for Year 1 and \$337 annually thereafter if delivered entirely by RN. Estimate cost would be \$686 in Year 1 and \$647 annually after if delivered by internist.</p>	<p>These values are not provided in dollar terms. No productivity improvements considered. Used CPI and year 2008 base year (1.013)</p>	<p>High diabetes prevalence was a challenge.</p>
<p>Mason 2005 Specialist Nurse-led Clinics to</p>	<p>Salford, UK Hospital cared diabetes patients.</p>	<p>Main Objective: Model with link between treatment and implementation trials. The implementation trial is</p>	<p>BP Clinic 26.6% vs. 24.1% achieved target (not significant) Reduced by 1.2 mm</p>	<p>Assumed 0.5 FTE nurse assigned to each clinic. Add clerical and overhead costs,</p>	<p>Includes health care costs in the modeling of the treatment component alone.</p>	<p>Treatments and clinics costs and effects are modeled using a Markov system over lifetime of patients of about 16 years.</p>

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<p>Improve Control of Hypertension and Hyperlipidemia in Diabetes (SPLINT)</p> <p>RCT plus Markov Modeling</p> <p>Cost Effectiveness</p>	<p>F/U Counts By Assignments BP-406 BP_Control-429 Lipid-317 Lipid_Control-310</p> <p>1407 diabetics with high BP or hyperlipid attending diabetes center at local hospital. BP Mean Age: 63-64. Lipid Mean Age: 56-59. Male: 49-51%.</p> <p>Inner city with low SES.</p> <p>The modeled component assumed patients with a 10-year CVD risk of ~30%.</p> <p>Start year -1997? Interv Length?</p>	<p>SPLINT.</p> <p>2 Nurse Specialist-led BP and Lipid clinics as adjunct to Hospital-based diabetes care.</p> <p>Those with BP and hyperL could go to either or both clinics.</p> <p>Initial 45 minute visit discussed targets and reasons, medications review, current condition, and diabetes control. BP readings taken, discuss lifestyle factors, medications titrated, and action plan drawn.</p>	<p>Hg.</p> <p>Lipid Clinic 53.3% vs. 40.3% achieved target (significant) Reduced by 0.28 mmol/l</p>	<p>plus clinic rental cost. Nurses were degreed and had >2 years experience. Also received training.</p> <p>Costs and Effects of Clinics BP Clinic (over patient lifetime – 16 years) # patients=506 per year Cost=\$306,400 Cost/Patient=\$605 Effect=1.2 mm Hg Lipid Clinic # patients=345 per year Cost=\$306,400 Cost/Patient=\$888 Effect=0.28 mmol/l</p>	<p>Used CPI and 2003 as base year (1.185) Study already converted to US\$.</p>	<p>Treatment Costs and Effects (Assumed from Other Studies and Modeled) BP Control Treatment (UKPDS Study) Incr QALY – 0.53 per patient Life Expect – 16.1 years Reduced by 5.7 mm Hg - from study Incr. Net Cost=-\$750 CE = -\$1,400/QALY</p> <p>Lipid Control Treatment (Heart Protection Study) Incr QALY – 0.46 per patient Life Expect – 16.1 years Reduced by 1.7 mmol/l – from study Incr. Net Cost=-\$3780 CE = \$8230/QALY</p> <p>Overall Cost-Effectiveness BP CE (Clinic Plus Treatment) = $(5.7 \times 605) / (0.53 \times 1.2) - 1,400$ $= 5,420 - 1,400$ $= \\$4,020/QALY$</p> <p>Lipid CE (Clinic Plus Treatment) = $(1.7 \times 888) / (0.46 \times 0.28) - 8,230$ $= 11,720 + 8,230$ $= \\$19,950/QALY$</p> <p>Combined BP and Lipid Clinic CE estimated at \$9050/QALY</p>

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						Using \$50K as threshold, sensitivity analysis shows the likelihood of cost-effectiveness are: BP Clinic-77%; Lipid Clinic-99%; Combined Clinic-83% Overall CE is incorrectly reported in pounds.
<p>McGhee 1994</p> <p>Randomized Controlled Trial</p> <p>Cost-analysis</p>	<p>Glasgow, UK</p> <p>2 clinics associated with Glasgow BP Clinic affiliated with two large universities</p> <p>Well controlled HTN patients</p> <p>Recruit from outpatients paired by age, sex, years of enrollment for random assgnt to shared care and outpatient care groups. Also selected comparison group from nurse-led clinic.</p> <p>Greater # of nurse-led lived outside Glasgow Hlth Brd Female 52% Age 57-58 FT Empl-30-36%</p> <p>Shared Care began in 1986 with study over 1986-1989.</p>	<p>3 arms for LT care of well controlled HTN</p> <p>Nurse Practitioner Clinic [n=277]– routine management by nurse with specialist on call. Medical staff review of patients every year.</p> <p>Outpatient Clinic [n=277]- usual follow-up care</p> <p>Shared Care [n=277] – coordinate long term follow-up care of HTN patients receiving care from multiple sources including specialists Made up of patient, GP, specialist, and labs supported by computerized database. GP has control of care Registry prompts annual GP visit- exam, biochem, ECG Registry receives biochem from Lab and amended records from GP GP or registry arranges ECG All records flagged for abnormalities by clericals</p>	<p>Intent to treat analysis. Effectiveness defined as number of patients with complete annual review in 2nd year follow-up: BP, ECG, Serum Creatinine. BP target achievement in 5 categories from Very Good to Poor. Acceptability of care based on patient questionnaire at base and 2 years. Physician acceptability also based on questionnaire.</p> <p>Completed Review at 2 years (%): Shared Care- 82.4; NurseLed- 74.8; Outpatient- 54.1.</p> <p>Remained in Same Grade BP or Improved (%) (Diff not Sig): Shared-care-67.8 Outpatient-63.8 NurseLed- 69.9</p>	<p>Calculation of Cost Costs include medical, nursing, secretarial, administrative, investigation, patient travel measured in 2nd year. Cost of premises not included. Staff time based on observed medical, nursing, clerical activity within each visit and wage rates. Investigation costs from labs, clinic visits from hospital records, GP visits from receptionists, patient time self-reported.</p> <p>Cost per Visit, Routine, and Review Consultation Shared Care: 3.30 to 13.18 NurseLed: 7.59 for routine and (13.54 to 18.84) for review consultation</p>	<p>Health care costs averted not considered.</p> <p>No productivity improvements considered except travel and wait.</p> <p>Authors extrapolate resource needs for 2000 patients in Shared Care 0.5 FTE Nurse Computerized database 72 hrs specialist time 2000 GP visits</p> <p>Used CPI and year 1993 base year (PPP-0.62 CPI-1.509)</p>	<p>No economic summary measure.</p> <p>Authors refer to cost per completed review as cost-effectiveness.</p> <p>Calculated as cost per completed annual review, shared care where there is GP and specialist involvement in LT care can be cost-effective for urban patients with controlled BP.</p> <p>Sensitivity analysis based on varying lengths of consultations-5, 10, 20 min</p> <p>No comparison to GP care. BP measures in different settings.</p>

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	<p>Evaluated over 2 years</p>	<p>and sent to specialist Records and letter with recommendations or re-referral sent to GP by specialist</p>	<p>Preferences Among Shared Care Patients 48% prefer shared care to outpatient 29.8% prefer outpatient 225 no preference (Stated advantage was access to physician followed by care continuity. Disadvantage was more than 1 visit for annual review)</p> <p>Physician Preference 61.2% wanted shared care to continue. 13.6% did not.</p>	<p>OutPatient: 8.78 for routine and 13.19 for review consultation</p> <p>Overall Cost Shared 8988; Out-Patient 10412; Nurse-Led 8821 Cost Per Review Shared 40.86 Out-Patient 71.32 Nurse-Led 43.67</p> <p>Assuming highest 20 minute consultation with GP in Shared Care and low estimate for NurseLed: Cost per patient was 33.67 for Shared Care; 38.57 for OutPatient; 32.67 for NurseLed</p>		
<p>Munroe 1997</p> <p>Pre-Post with comparison</p> <p>Average Medical Costs</p>	<p>Richmond, VA</p> <p>Pharma retail setting for patients with hypertension, hyperlipidemia, diabetes, asthma. Patients using BC/BS of Virginia indemnity plans.</p> <p>Three interv. and 5 control retail sites identified from BC/BS claims. All patients with BC/BS in interv.</p>	<p>Pharmacist-led pharma disease management model (PM). In place since 1993. Pharmacists trained in disease and therapy, physical and lab assessments, patient communications, and national guidelines.</p> <p>Focus on drug use, behavior modification, monitoring, and early intervention. Patient-pharmacist meetings every 6-8 weeks</p>	<p>Patients with same conditions compared to each other. No effectiveness variables estimated.</p>	<p>Reported that program cost was \$27 per patient per month. No details provided.</p>	<p>Claims from patients with same conditions compared to each other – including prescription and medical costs.</p> <p>Unadjusted Costs per BP Prescription significantly higher for PM (\$36.72 vs. \$32.92). Similarly, for other diseases.</p> <p>Unadjusted monthly pharma costs not different for all but</p>	<p>No economic summary measures calculated.</p> <p>Focus is on health care and pharma utilization costs.</p> <p>Pharmacist-led intervention reduced medical care costs compared to usual care.</p> <p>Limitations: No effectiveness measures. Multiple diseases and meds. BP-specific measurement provided only for prescriptions.</p>

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	<p>sites invited.</p> <p># Patients Claims Data from BC/BS: PM – 232; Usual – 600</p> <p>Eligible Claims Analyzed PM – 188; Usual – 401.</p> <p>Age: 63-67 Male: 39-43% BP: 83-87% Diabetes: 26-30% # Prescriptions: 61-63 Analysis of claims from Sep '93 to Jan '95.</p>	<p>lasting 15-20 minutes. Physical assessment, readings taken and patient counseled.</p> <p>Results sent to physician by letter or by phone along with notes about non-adherence, suboptimal meds, and adverse effects.</p> <p>Quality control by random chart review by MedOutcomes.</p>			<p>asthma. For BP, it was Inter: \$93.36; Usual: \$84.10</p> <p>Adjusted monthly medical costs statistically lower for interv. group for all conditions. For all conditions, adjusted per member per month total costs was 647.08 vs. 853.25 (Not Significant).</p> <p>Base year not provided. Use middle year of economic data, 1994 and CPI (1.471)</p>	<p>Real world pharmacy setting The higher per prescription cost for intervention may be due to more expensive meds that are easier to adhere to.</p>
<p>Murray 2004</p> <p>Randomized Controlled Trial (By Sessions in 4 Clinics)</p> <p>Benefits Analysis</p>	<p>Indianapolis, IN</p> <p>Large internal medicine practice in 4 adjacent locations affiliated with Indiana University.</p> <p>Inner city population enrolled with practice and having BP Dx and Rx for antihypertensive. Exclude those with major complications. Female-75-81% Afr Amer-57-61% Age-54-56 years</p> <p>Recruitment</p>	<p>Note the health system had an existing comprehensive electronic information system for care and medical records. The RCT evaluates a system of electronic guideline-based (JNC6) BP management suggestions to primary care physicians writing orders and pharmacists dispensing drugs.</p> <p>Physician Led (n=181) – suggestions displayed on workstation during outpatient order Pharmacist Led (n=180) – suggestions displayed at Rx fill. Pharmacist could also suggest changes to</p>	<p>Intent to treat analysis.</p> <p>Generalized Estimating Equations and Random Effects Generalized Linear Models used.</p> <p>Main effects were: Compliance with JNC6 suggestions Quality of Life BP control ED visits Hospitalization Health care charges</p> <p>Intervention had no statistically significant effect on any of the effect measures.</p>	<p>The Medical Records System was fully developed prior to study The Pharmacist Intervention Recording System (PIRS) was coded for the study.</p> <p>Note that the paper does not provide any cost of intervention or of the legacy cost of EMR implementation or additional coding for the study.</p>	<p>Health care charges analyzed using Wald-type tests for log-normal data possibly with zeros.</p> <p>Direct health care lowest in the dual-intervention group but not statistically significant owing to the enormous variability in data.</p> <p>Outpatient Usual: 3005; Pharm: 2868; Phys: 2681; Com bined: 2229 Inpatient Usual: 2145; Pharm: 2577; Phys: 3519; Com bined: 893 Total</p>	<p>No summary economic measures.</p> <p>University affiliated system. One year may be too short for effects. Passive suggestions with escape key feature allowing suggestions screen to disappear. Pharmacist suggestions came from printer that directed pharmacist to go to workstation. Suggestions may have been too many and too complex for busy practice/pharmacy.</p>

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	<p>Jan'94-May'96</p> <p>Interv length 12 months.</p>	<p>physician. Combination (n=180) Usual (n=171)</p>			<p>Usual: 5149; Pharm: 5445; Phys: 6200; Combined: 3122</p> <p>Productivity effects not considered.</p> <p>Used CPI and 1997 as base year (1.359)</p>	
<p>Okamoto 2001</p> <p>RCT</p> <p>Cost Effectiveness</p>	<p>California?</p> <p>Based in managed care facility (MCO)</p> <p>Sample sizes listed in interv. are after losses to follow-up.</p> <p>=>18 years; diagnosed with essential HTN; at least one year with MCO; fill prescriptions at MCO's pharmacies; be on hypertensives.</p> <p>Mean age-62; Male-46-56%; Systolic: 142.91-144.23; Diastolic: 82.13-82.79.</p> <p>Interv year not provided? Probably 1998 based on vintage of health costs data.</p> <p>6 month interv</p>	<p>Pharmacist-Managed HTN Clinic (Pharmacist) [n=164] Clinical Pharmacist managed HTN care. Physicians contacted and provided consent for therapy changes. Physician or pharmacist could schedule additional visits. Pharmacist attempted to reduce number of drugs, or use more appropriate and less expensive drugs. Patients educated about non-pharma controls. Ordered lab tests.</p> <p>Physician Managed HTN Clinic (Physician) [n=166] Care managed by physicians without pharmacist intervention. Considered control group. Patients referred back to GP.</p>	<p>BP measurements and SF-36 at baseline and at 6 months.</p> <p>Reduction in BP Pharmacist Systolic: 9.13+-17.1 Diastolic: 5.14+-9.2</p> <p>Physician Systolic: 1.32+-15.7 Diastolic: 1.46+-10.1</p> <p>QOL Role-Physical significantly higher in Pharmacist Role-Emotional and Social Functioning higher in Pharmacist but not significantly.</p>	<p>Clinic Visits/Patient Pharmacist: 5.25+-2.3 Physician: 1.41+-1.7</p> <p>Prescriptions/Patient Pharmacist: 2.12+-1.1 Physician: 2.20+-1.1</p> <p>No hospitalizations occurred. Four ER visits occurred for Physician group.</p>	<p>BP related ER, hospital, and physician visits where GP visits had to include BP evaluation. Pharmacy fills used for hypertensives costs.</p> <p>No averted health or productivity costs estimated or reported.</p> <p>Per Patient Costs Pharmacist led Drugs: 390.24; Clinic: 130.67; ER:0; Total:520.91</p> <p>Physician led Drugs: 437.09; Clinic: 73.51; ER: 10.84; Total:521.44</p> <p>Higher cost per patient in pharmacist than physician group but not significant. Clinic visit costs were significantly more in pharmacist group.</p>	<p>CE measured as cost per mm Hg reduction.</p> <p>Average CE Systolic Pharmacist: 27 Physician: 193 Diastolic Pharmacist: 48 Physician: 151</p> <p>Incremental CE Systolic: 1.18 Diastolic: 2.51</p> <p>Cost per unit reduction in BP lower in Pharmacist group more due to greater effectiveness than lower cost.</p> <p>Note that drug costs were not reduced under pharmacist management (unexpected)</p>

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					Used CPI and 1998 as base year (1.338)	
<p>Pezzin 2011</p> <p>RCT</p> <p>Average Cost</p>	<p>New York (?)</p> <p>High risk patients receiving home-based post-acute care</p> <p>Low income, chronically ill, black patients.</p> <p>Major Medicare-certified home nurse agency in urban area.</p> <p>All field nurses eligible. All patients with HTN age 21-80.</p> <p>Nurses randomly assigned (with their patients)</p> <p>Total of 845 patients with 312 nurses. Analysis on 635 with 275 nurses and full data and F/U. Age-65; Female-66%; 50% on Medicaid</p> <p>3 month effectiveness and cost</p>	<p>3 arms to lower BP and improve control</p> <p>Usual Home Care (H) [n=217] – usual home post-acute care by home nurse. Clinical/functional assessment, medication review, patient/family edu, monitoring and JNC7 recs for nurse.</p> <p>Basic (B) [n=197] - 2 e-mails 1 week apart with HTN-specific detailed recs to the patient's home care nurse, plus a BP monitor and HTN guide to the patient, and BP log.</p> <p>Augmented (A) [n=221] – Basic plus study nurse and health educator providing extensive feedback to home nurse and patient. Enhance self-management skills, adherence, and communication with PCP. Bi-weekly phone calls over 12 week period for BP log and med review with nurse and PCP.</p>	<p>Baseline Overall SBP=155.4, DBP=87.2.</p> <p>Baseline JNC7 Stage 2 SBP=168.8, DBP=92.9</p> <p>Adjusted Effects Overall BP Control – U:20.7 B:23.2 A:25.2 SBP - U: 151.6 B: 149.8 A: 147.8 DBP - U: 84.6 B: 84.0 A: 83.3 SBP Effect of TBC=151.6-147.8=3.8 No significant difference across groups overall</p> <p>Adjusted Effects JNC7 Stage 2 BP Control – U: 8.9 B: 13.4 A: 17.6 SBP - U: 160.8 B: 158.5 A: 152.5 DBP - U: 86.9 B: 88.4 A: 85.5 SBP Effect of TBC=160.8-152.5=8.3 Significant difference across groups for JNC7 Stage 2</p>	<p>Costs are stated to be for the study period – 3 months?</p> <p>Program costs included intervention plus home care outpatient visits cost.</p> <p>U-\$3654 B-\$4348 A-\$4531 Difference v Usual B-\$694 A-\$877</p> <p>Computed the cost of TBC as the difference (A-U)=\$877 (\$3508) and (A-B)=\$183 (\$732 per year)</p>	<p>Overall healthcare costs included program cost plus self-reported ER and inpatient visits.</p> <p>Difference from Usual Care B-\$295 (JNC7 Stage 2) A-\$1079 [\$4316 per year] (Overall)</p> <p>Authors state difference less when all health care costs accounted. But this does not seem the case from the estimate for Group A.</p> <p>No base year provided. Used CPI and 2010 as base year (1.0)</p>	<p>No economic summary measure reported.</p> <p>Authors appear to pick what they report for overall health care costs</p> <p>High risk population in home-based care</p>

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<p>Reed 2010</p> <p>Take Control of Your BP (TCYB)</p> <p>RCT</p> <p>Cost Effectiveness</p>	<p>Durham, North Carolina?</p> <p>2 primary clinics in large academic health setting.</p> <p>636 assigned; 475 completed 24 month F/U.</p> <p>Samples: N-319; H-244; C-?; Usual-?.</p> <p>Mean age: 62; Male: 29-38%; Caucasian: 43-56%; Diabetes: 32-40%; Employed: 36-45% Systolic: 124-126; Diastolic: 70-72.</p> <p>Intervention year not provided. 24 month interv with baseline and followup every 6 months.</p>	<p>Nurse-led tailored behavioral (N) – 12 bimonthly telephone encounters. Questions and education module software driven at each call. Modules included medication, diet, and knowledge.</p> <p>Home BP monitoring (H) – 10 minute training and free instrument to measure BP 3 times a week. Retraining if necessary.</p> <p>Combination (C)</p>	<p>Usual care systolic BP unchanged. Change in mm Hg compared to usual care: Interv. H reduced by 0.6 Interv. N increased by 0.6 Interv. C decreased by 3.9</p>	<p>Interv. N Primarily Nurse time and Patient materials (Fixed cost was \$54404 per year for Nurse Intervention)</p> <p>Interv. H BP Monitor and Nurse Training Time</p> <p>Program Cost per Participant (24 Months): Interv. N: \$345 Interv. H: \$90 Interv. C: \$416</p> <p>Patient Time per Participant (24 Months): Interv. N: \$55 Interv. H: \$585 Interv. C: \$741</p>	<p>Health care includes outpatient and inpatient care. Excludes medication costs.</p> <p>Interv. C had highest outpatient and lowest inpatient costs.</p> <p>Per person cost in 24 months (Interv Minus Usual Care) InPatient: N: 1020; H: 1194; C: 201 OutPatient: N: -110; H: -247; C: 828 All Care: N: 910; H: 947; C: 627</p> <p>Used CPI and 2008 as base year (1.013)</p>	<p>Incremental cost per person over 24 months (Prog Cost + Patient Time + Medical Cost): N: \$1310; H: 1622; C: \$1783</p> <p>Incremental program plus patient time cost for Combination: \$1157 Incremental cost per BP reduction = 1157/3.9 = \$297 per mm Hg.</p> <p>They use BP outcomes (reduction of 2.7/1.9 mm Hg) from the ASCOT-BPLA study to estimate incr LY was 0.1. Hence based only on program cost, CEA = 416/0.1 = \$4160/LY. Assuming 12 year intervention sustained, and per year cost of \$211, CEA = \$23,000/LY</p> <p>If patient time is added to program cost, CEA = 1157/0.1 = \$11,570/LY If sustained over 12 years and discounted by 3%, CEA = \$64,000/LY</p> <p>Patient time costs are non-trivial. Medication costs not included</p>
<p>Wertz 2012</p> <p>Pre-post with control.</p>	<p>Cincinnati, OH</p> <p>Program is a partnership among health plan, employers, and</p>	<p>Cincinnati Pharmacy Coaching Program (CPCP) – comprehensive VBID plus medication therapy management for HTN,</p>	<p>Proportion Days Covered-DC Cohort v Control</p> <p>Antihypertensives- 0.85 to 0.91 v 0.85</p>	<p>Study reports average \$500 annual value of the program to employees.</p>	<p>Claims based data for in-patient, outpatient, ER, and pharmaceuticals</p> <p>HC Group v Control</p>	<p>No final economic measures provided.</p> <p>Limitations:</p>

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<p>Cost Analysis</p>	<p>large pharmacy.</p> <p>This evaluation appears to be for Kroger and City of Cincinnati (City) employees.</p> <p>Propensity-scored control group from non-participating employees from City who were offered program but declined. Kroger non-participants did not have claims data.</p> <p>Employees with HTN or diabetes invited to participate by health plan and employer communications. Eligibility determined by past claim in disease category including diabetes and CVD. Average age-57-59. Average program duration – 14 months. AfrAmer-33-37%; White-50-51%. 607 in interv (344 empl, 263 retirees)</p>	<p>diabetes, and dyslipidemia. Patients enrolled in one of diabetes or heart healthy coaching programs from clinical pharmacists. Additionally contributes to employee health savings accounts.</p> <p>Regular meeting with pharmacist for monitoring (assess feet, lipid, BP, weight, glucose), goals, and education. Pharmacist may suggest changes in prescriptions.</p> <p>Patients in 4 cohorts: Healthy Hearts Coaching Program (HC) Diabetes Coaching Program (DC) Hypertension Control Cohort (H) Diabetes Control Cohort (D)</p>	<p>to 0.85; Antidiabetic – 0.78 to 0.86 v 0.74 to 0.76; Statins – 0.71 to 0.82 v 0.70 to 0.78; Antihyperlipidemics- 0.76 to 0.84 v 0.76 to 0.79</p> <p>Proportion Days Covered-HC Cohort v Control</p> <p>Antihypertensives- 0.82 to 0.91 v 0.86 to 0.86; Antidiabetic – 0.68 to 0.88 v 0.64 to 0.70; Statins – 0.76 to 0.87 v 0.73 to 0.83; Antihyperlipidemics- 0.63 to 0.68 v 0.59 to 0.62</p> <p>Study also reports percent receiving meds but this is not repeated here.</p> <p>SBP/DBP (mmHg)</p> <p>136.1/83.5 to 129.5/79.3 for HC 136.1/81.0 to 130.4/76.3 for DC</p> <p>BP Control</p> <p>52% to 70% for HC; 25% to 37% for DC</p> <p>LDL (mg/dL)</p> <p>104.1 to 97.2 for HC; 91.6 to 84.0 for DC</p> <p>Controlled 71% to 84% in HC and 62% to 73% in DC</p>	<p>Some got contribution of \$100 to health savings account. Average program duration – 14 months. Average pharmacist encounters – 6 (9.5 for retirees)</p> <p>Study reports coaching program cost per person per year</p> <p>HC Group 493</p> <p>DC Group 552</p>	<p><u>HTN Related</u></p> <p>2114 to 1792 v 2021 to 1968</p> <p>Cost per person increased: OfficeVisits \$7; Other OutPatient \$95; and Pharma \$41</p> <p>Cost per person decreased: ER \$19; InPatient \$392</p> <p><u>All Cause</u></p> <p>7104 to 6541 v 6598 to 6316</p> <p>All Cause 7104 to 6541 v 6598 to 6316</p> <p>DC Group v Control</p> <p>Diabetes Related 2966 to 3950 v 3428 to 4140</p> <p>All Cause 9100 to 10934 v 11816 to 14283 (Interv. cost increase due to meds and outpatient while increase for control due to ER)</p> <p>CVD Related 965 to 1071 v 406 1619</p> <p>No productivity effects estimated.</p> <p>No base year provided.</p>	<p>Study has control group and reports both effects but does not report the DiD. Clinical results not available for control. Short F/U. Self-selection</p>

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	with 307 each in DC and HC. 557 in control with 274 for diabetes and 289 for heart. Program started Jan 2008 with continuous enrollment through 2008 and 2009. Baseline data from Jan-Dec 2007.		Non-HDL 131.3 to 122.2 for HC 120.7 to 111.2 for DC Controlled 60% to 75% in DC anHbA1c controlled 44% to 62%		Use year 2008 as base and CPI (1.013)	