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4 **Implementation of a Self-Measured Blood Pressure Program in a Community Pharmacy: A Pilot Study**

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21 The authors have no conflicting interests to report.

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32
33 **ABSTRACT**

34 **Background:** Hypertension is a leading cause of cardiovascular disease in the United States and is
35 costing the healthcare system billions of dollars annually. A health program that combines education,
36 empowerment, and blood pressure monitoring has shown to improve clinical outcomes and decrease
37 healthcare costs.

38
39 **Objective:** To describe the implementation and effectiveness of a self-measured blood pressure (SMBP)
40 program in a community pharmacy.

41
42 **Practice Description:** An independent community pharmacy located within rural, Southeast, Missouri.
43 Community pharmacists at the project site provide medication therapy management, adherence
44 monitoring, medication packaging, immunizations, and reimbursed clinical services.

45
46 **Practice Innovation:** Participants were eligible if they were over the age of 18 and fell into one of the
47 following categories: self-report a new hypertension diagnosis, self-report a desire to SMBP, or had a

48 medication change within the three months prior to enrollment. The program consisted of four patient
49 sessions. The first session obtained an initial blood pressure and provided patient education and
50 behavior counseling. The follow-up sessions obtained SMBP blood pressures and reinforced previously
51 learned concepts.

52
53 **Evaluation Methods:** Time, pharmacist interventions, blood pressures, pre/post test scores, and overall
54 satisfaction.

55
56 **Results:** Twenty patients enrolled and completed the study. It took approximately 63 minutes (SD±18)
57 per participant in staff time to complete recruitment, sessions, reminder calls, and documentation. All
58 patients had education and monitoring as a primary intervention and eleven additional interventions
59 were also documented. Systolic blood pressure decreased an average of 14 mmHg (p=0.016) and
60 diastolic blood pressure decreased an average of 12 mmHg (p<0.001). Confidence increased from 78%
61 to 92%, knowledge improved from 55% to 90%. All participants reported their overall satisfaction with
62 the program as “very satisfied” or “satisfied.”

63
64 **Conclusion:** A standardized SMBP program may reduce implementation costs, improve provider
65 confidence, and lend feasibility for pharmacies looking to expand clinical services within community
66 pharmacy.

67
68 **Keywords:** Independent pharmacy, community pharmacy, pharmacy services, hypertension, high blood
69 pressure, blood pressure monitoring, self-measured blood pressure, at-home blood pressure.

70
71 **Key Points (81)**

72 *What was already known*

- 73
- 74 • Hypertension is a leading cause of cardiovascular disease.
 - 75 • Cardiovascular disease is costing the healthcare system billions of dollars annually.
 - 76 • Health programs that combine education, empowerment, and self-measurement have proven
77 to improve clinical outcomes and decrease healthcare costs.

78 *What this study adds*

- 79 • A description of program components that can help pharmacies to implement a self-measured
80 blood pressure program at their practice site.
- 81 • Support that a self-measured blood pressure program implemented in a community pharmacy
82 can improve clinical outcomes.

83 **Background (545)**

84 According to the Centers for Disease Control (CDC), an estimated 75 million Americans suffer from
85 hypertension.¹ Approximately half of those with hypertension are uncontrolled.¹ Uncontrolled
86 hypertension is a leading contributor to cardiovascular disease, a major cause of morbidity and mortality
87 in the United States, and rising healthcare costs.^{2,3} Between 2005 and 2015, the rate of deaths
88 associated with hypertension increased by 10.5% and the actual number of deaths increased by 37.5%.²
89 Additionally, hypertension is estimated to cost \$131 billion annually, averaging an extra \$2000 per
90 hypertensive patient per year.^{2,4} By the year 2035, total annual costs for cardiovascular disease are
91 expected to exceed one trillion dollars.² To address the burden of uncontrolled hypertension on the
92 healthcare system, the American Heart Association and the American Medical Association created a
93 national initiative, Target:BP.⁵ Target:BP provides a number of resources and tools to assist clinicians in
94 developing patient programs focused on lowering blood pressure, including, self-measured blood
95 pressure (SMBP).⁵

96

97 According to the CDC, “self-measured blood pressure involves a patient’s regular use of personal blood
98 pressure monitoring devices to assess and record blood pressure across different points in time outside
99 of a clinical, community, or public setting, typically at home.”⁶ SMBP is recommended over in-office
100 blood pressure because of its accuracy.⁶⁻⁸ In-office blood pressure is typically taken at one moment in
101 time and may not reflect a patient’s true blood pressure. Patients can have falsely elevated blood
102 pressure in the office but be normotensive out of the office (white coat hypertension), or patients can
103 be normotensive in the office but be elevated outside the office (masked hypertension).⁶ Averaging
104 multiple blood pressure readings at different times of the day and over several weeks will better reflect
105 a patient’s true blood pressure, identify peaks and valleys, and help to rule out white-coat or masked
106 hypertension, optimizing patient therapy.

107

108 Due to enhanced accuracy, significant emphasis is being placed on SMBP nationally to help prevent
109 unnecessary healthcare costs^{2,5,9,10} and community pharmacies are ideal locations to support these
110 initiatives. In 2013, North Carolina Medicaid released claims data reporting that high-risk patients were
111 visiting their pharmacies 35 times per year compared to the 3.5 times they visited their primary care
112 physician.¹⁰ Additionally, a 2020 study reported that in a cohort of over 680,000 Medicare beneficiaries,
113 patients visited their pharmacies an average of thirteen times per year compared to seven visits with
114 their physician.¹¹ This data shows that community pharmacies are in a unique and convenient position to
115 provide sustained, longitudinal clinical services to patients. This is especially important in medically
116 underserved areas, such as Southeast Missouri, where lack of transportation or other social
117 determinants of health may further limit provider visits.¹²

118

119 Currently, no standardized SMBP program exists within community pharmacy practice. Developing a
120 standardized and streamlined process would assist community pharmacies looking to implement this
121 service by providing a starting point for implementation. Standardization facilitates consistent patient
122 care and can improve patient safety by minimizing errors of omission in education. While not all
123 pharmacies have the resources to create clinical programs, many have the capacity to implement one
124 that has already been developed. Furthermore, a clinical program has to be effective in providing clear
125 directions so that patients are more willing to take part in the intervention and become better
126 advocates in their own healthcare.

127

128 **Objective (19)**

129 This project sought to describe the implementation and effectiveness of a self-measured blood pressure
130 program in a community pharmacy.

131

132 **Practice description (98)**

133 L&S Pharmacy is an independent, community pharmacy located within rural Southeast, Missouri, known
134 for providing a range of patient care and community services. The pharmacy is located in a medical
135 desert serving an underserved, underinsured, patient population. At the time of this project, the
136 pharmacy dispensed approximately 1,000 prescriptions per week and had one full-time pharmacist, one
137 part-time pharmacist, and a full-time postgraduate year 1 community-based pharmacy resident. The
138 practice setting also served as a training site for several advanced practice pharmacy students
139 throughout the year. During the study, the resident pharmacist developed and implemented the SMBP
140 service.

141

142 **Practice innovation (497)**

143 This pilot study was approved through the University of Missouri-Kansas City Institutional Review Board
144 (IRB #271949). The SMBP program was created in collaboration with the Mississippi County Health
145 Department and CPESN-Missouri as part of a three-year Health Resources and Services Administration
146 grant (HRSA).

147
148 *Programming*

149 Patient folders were created to hold program information. One side of the folder included all items for
150 pharmacy use: patient consent, HIPPA release, a billing and reporting form, and two copies of the
151 pre/post test. The billing and reporting form was designed to collect demographic information, required
152 for grant billing, and provide a program checklist to maintain consistency. The other side of the folder
153 included all information provided to the patient: hypertension education and three copies of the patient
154 logs, adapted from Target:BP.⁵ Before program implementation blood pressure cuffs were calibrated
155 using the “SMBP Device Accuracy Test” form found on the Target:BP website.⁵

156
157 The program’s general structure included an initial session, two follow-up sessions, and a final session
158 conducted over five weeks in a week on week off format. During the initial session, consent, a pre-test
159 score, and a starting blood pressure was obtained. Patient education and program instructions were
160 provided. Patients were instructed to SMBP, twice in the morning and twice in the evening, one minute
161 apart, for one week and record their results using the paper log provided. During the follow-up and final
162 sessions, SMBP results were assessed and the pharmacist intervened if needed. A post-test and a
163 satisfaction survey were also administered during the final session.

164
165 The first SMBP week started the day after the initial session. Follow-up sessions were conducted the day
166 after an SMBP week or as soon the patient was available. Reminder calls were made the day before an
167 SMBP week to keep patients on schedule. A calendar system was used to keep track of patient
168 appointments and reminders. If a patient recorded less than seven blood pressure readings, they were
169 instructed to repeat the week. Referrals made to healthcare facilities or providers followed JNC-8
170 guidelines.¹³

171
172 *Recruitment*

173 Any patient who enrolled and completed the SMBP program between December 7, 2020 and April 30,
174 2021 were included in the study. The SMBP pilot was available to all L&S Pharmacy patients who chose
175 to participate, were over the age of 18, managed their own medications, and fell into one of the
176 following categories: self-report a new diagnosis of hypertension, self-report a desire to SMBP, were
177 referred by a healthcare provider, or had undergone an antihypertensive regimen change within the
178 three months prior to enrollment. During recruitment, we focused on patients who were seeking blood
179 pressure cuffs or were enrolled in our medication adherence program.

180
181 *Documentation*

182 SMBP blood pressures and session notes were documented in the pharmacy’s software system in the
183 form of e-care plans. The following SNOMED codes were used during the initial session: 3915509
184 (hypertension education), 46973005 (blood pressure taking), and 50723001 (blood pressure taking
185 education). For follow-up sessions, the SNOMED code 135840009 (blood pressure monitoring), was
186 used.

187
188 **Evaluation Methods (194)**

189 The primary outcomes for this project were to determine the following: (1) the time it took to complete
190 a self-measured blood pressure program in a community pharmacy, (2) the number and type of

191 interventions that resulted from the SMBP service, (3) the change in systolic and diastolic blood
192 pressures, (4) the change in pre/post test scores, and (5) overall patient satisfaction with the program.
193 Time was recorded for all session components using a stop watch and rounded to the next whole
194 minute. All interventions and blood pressures were documented in the patient profile. The pre/post test
195 had a total of six questions. Five were confidence-based using a numbered Likert scale, worth one to five
196 points, and one knowledge-based question, worth one point if answered correctly. The patient
197 satisfaction survey had a total of seven questions. Five questions used a Likert scale, answer choices
198 ranged from “Strongly Agree” to “Strongly Disagree,” and two questions were fill-in-the-blank. Change
199 in blood pressure and pre/post test scores were compared using paired-t-tests. Percent of patients
200 meeting the BP goal of <140/90 mmHg was determined using a Chi-squared test.^{13,14} Time and
201 satisfaction results were analyzed and reported using descriptive statistics.

202

203 **Results (513)**

204 Twenty participants enrolled and completed the study. Demographics include: 40% Black, 60% White,
205 70% women, and 70% under 65 years of age.

206

207 *Time*

208 The total time spent implementing the SMBP program, including documentation time, averaged 63.25
209 minutes (SD±18.38) and ranged from 35 to 101 minutes (refer to table 1). The initial session took an
210 average of 25.5 minutes (SD±7.02) and ranged from 14-37 minutes. Recruitment and reminders were
211 combined into “other” time which averaged 3.55 minutes (SD±3.99) and ranged from 0 to 14 minutes.
212 Several outliers resulted in longer time spent on program components. One recruitment cold-call took
213 over 10 minutes, one initial session was conducted via a home visit and required additional set-up time.
214 Other time considerations include the following: If a patient’s initial blood pressure was above 170
215 mmHg, a second BP reading was obtained after a short rest period; if a patient was not reached during a
216 follow-up call, that time was incorporated into their follow-up session time; If a patient chose to drop off
217 their data log, a minimum of 5 minutes was recorded to take into account the time it took to calculate
218 an average SMBP and document in an e-care plan.

219

220 *Interventions*

221 All patients received education and monitoring as a primary documented intervention. There were
222 eleven other documented interventions: 5 medication adjustments, 4 prescriber referrals, 1 re-started
223 abandoned medication, and 1 prescriber confirmed white-coat hypertension.

224

225 *Blood Pressure*

226 Average systolic blood pressure decreased from 148.95 mmHg (SD±22.08) at the initial session to 135.45
227 mmHg (SD±12.4) at the final session (refer to figure 1). Average diastolic blood pressure decreased from
228 88.6 mmHg (SD±13.81) to 76.35 mmHg (SD±6.45). Both systolic and diastolic blood pressures were
229 compared using a paired t-test and found to be statistically significant (p=0.016 and p<0.001,
230 respectively). Percent controlled systolic blood pressure increased from 30% at the initial session to 75%
231 at the final session (p=0.0044). Percent controlled diastolic blood pressure increased from 60% at the
232 initial session to 95% at the final session (p=0.0080).

233

234 *Pre/Post-Test Scores*

235 The score for confidence-based questions averaged 20.3 points (SD±4.51) at the initial session and 23.9
236 points (SD±1.48) at the final session. At the initial session, 55% of patients were able to select the best
237 blood pressure of those listed, by the end of the program that number increased to 90%. Confidence

238 and knowledge scores were compared using paired t-tests and found to be statistically significant
239 ($p=0.00065$ and $p=0.013$, respectively).

240

241 *Satisfaction*

242 All patients selected “strongly agree” or “agree” when asked if this SMBP program helped them to
243 better understand high blood pressure. All patients selected “strongly agree” or “agree” when asked if
244 participating in this study helped them to better understand how they can control their blood pressure.
245 All patients rated their overall experience with our SMBP program as “very satisfied” or “satisfied.” All
246 patients selected “strongly agree” or “agree” when asked if the instructions for this program were
247 clearly explained. All patients selected either “strongly agree” or “agree” when asked if they would
248 recommend this service to someone struggling with high blood pressure. Refer to table 2 for patient
249 comments.

250

251 **Practice implications (618)**

252 This study described the implementation of a self-measured blood pressure program using time,
253 interventions, change in blood pressure, change in pre/post test scores, and satisfaction. Taking into
254 account all of this information, pharmacies can decide if they have the necessary resources to
255 implement a SMBP program. Resources include printing patient information, purchasing blood pressure
256 cuffs, and staff time. Some staff time, such as follow-up sessions and reminder calls, may be delegated
257 to technicians or other support staff to keep costs down. Pharmacies can be confident that if they do
258 implement this standardized program, it will be effective in improving blood pressure control.
259 Additionally, patients left the program feeling confident they had the ability to improve their blood
260 pressure through behavioral modifications and medication adherence. An important consideration to
261 make before SMBP implementation includes reimbursement for service. Because the program has
262 associated costs, reimbursement for services is required for sustainability. Partnering with third party
263 payers, grant programs, and employers could provide the necessary funding for program maintenance.

264

265 *Lessons learned*

266 Lessons learned that benefitted the pharmacy include the following. Using a calendar/scheduler system
267 helped us to keep track of patient appointments and ensured that staff was available to cover the
268 service. Preparing for and accepting walk-ins, allowed for immediate patient engagement and
269 enrollment. Setting specific days for service assisted with follow-up care. Using a standardized program
270 checklist and documentation process helped to maintain quality control and efficiency. Lessons learned
271 that benefitted the patient include the following. As the program progressed, it was important to build
272 in flexibility and meet patients when they were able. It was also important to communicate with
273 patients depending on their preference. Communication was accomplished through email and text in
274 addition to phone and in-person. Patients were involved in creating their own behavior goals which
275 included walking, limiting salt intake, and meditation, which kept them engaged throughout the
276 program.

277

278 *Challenges to implementation*

279 Challenges to implementation include: staff familiarity with the new program process, a limited number
280 of blood pressure cuffs, recruitment, follow-up scheduling, and the COVID pandemic. New programs are
281 often a challenge to start because staff are unfamiliar with how the new process fits into current
282 workflow. Time needs to be spent training staff and familiarizing them with program components to
283 avoid delays in service implementation. Blood pressure cuffs are a barrier to implementation because
284 they are an added expense and a finite resource. Some patients did provide their own blood pressure
285 cuff and others were provided through grant funding. Though we were able to overcome this barrier,

286 this may be a challenge for other pharmacies looking to implement this service. Patient recruitment can
287 also be a challenge. Taking advantage of patient opportunities and utilizing staff during routine
288 pharmacy tasks will help overcome the barrier to recruitment. When we had more than five patients
289 enrolled in the program at once, flexibility in scheduling became cumbersome. Establishing set days and
290 hours helped to reduce this burden. Lastly, this program was implemented during the COVID-19
291 pandemic. This added an extra challenge as several patients had to delay enrollment or push back
292 follow-ups because they were quarantining. One patient's initial session was rescheduled four times
293 before she was able to enroll.

294

295 *Limitations*

296 The limitations of this study include: potential selection bias, a small sample size, and patients self-
297 reported their BP values. Most participants who enrolled in the study were looking for a BP cuff or were
298 part of an existing adherence program and were used to pharmacy outreach. A larger sample size may
299 show different clinical and statistical results. Patients self-measured their blood pressure and self-
300 reported those values to the pharmacist. It was possible that errors could have been made when taking
301 blood pressures and when reporting them.

302

303 **Conclusion (46)**

304 SMBP is a useful tool to help reduce the burden of uncontrolled hypertension. Developing a
305 standardized SMBP program may reduce implementation costs, improve provider confidence, and lend
306 feasibility for community pharmacies looking to expand clinical services. For future sustainability,
307 reimbursement models will need to be explored.

308

309

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