



# Continuity of Care in a Student-Run Free Clinic: Impact on Atherosclerotic Cardiovascular Disease Risk

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**BACKGROUND AND OBJECTIVES:** Medical student-run free clinics (SRFC) provide underserved patients access to health care. Few studies have examined the effects of specific care models implemented by these clinics. We looked at the impact of a continuity of care delivery model on chronic care outcomes at an SRFC sponsored by Ohio State University College of Medicine.

**METHODS:** Using the SRFC electronic medical records, we abstracted health records of patients at risk for atherosclerotic cardiovascular disease (ASCVD). We formed three study groups matched on age and gender. Group 1 were the patients enrolled in a continuity of care program, Group 2 were patients who visit the SRFC at 3-month intervals, and Group 3 were sporadic visitors. Authors compared groups' ASCVD risk score change over 12 months using a Group x Time Analysis of Variance.

**RESULTS:** We identified 81 subjects that met the qualifications for this study and assigned them to one of the three study groups. A Group x Time interaction showed that mean ASCVD risk scores improved significantly for continuity of care patients and regular visitor controls, but not for sporadic controls ( $F=3.82$ ;  $df=2/1.72$ ;  $P=.035$ ;  $es=1.28$ ).

**CONCLUSIONS:** This SRFCs continuity of care delivery had no appreciable impact on lowering ASCVD Risk scores over and above frequent regular visits to the clinic. This finding suggests that SRFCs should focus on getting their chronic patient population to maintain a schedule of frequent check-ups, without investing in continuity of care. Longer-term studies are needed to detect a continuity of care delivery model effect.

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The modern free health clinic movement originated in the 1960s, but did not become a common medical education venue until 2008.<sup>1-3</sup> By 2017, most (72%) graduating medical students reported participation in student-run free clinics (SRFCs),<sup>4</sup> that serve an estimated 10 million disadvantaged or uninsured Americans as their sole source of medical care.<sup>5-6</sup> The

early literature on SRFCs focused on learner benefits rather than care effectiveness.<sup>7-8</sup> More recently, there has been a shift toward the study of chronic care quality delivered at SRFCs.<sup>9-13</sup>

Beyond offering patient care experience to medical learners, SRFCs can teach new health care delivery models, including the patient-centered medical home (PCMH).<sup>14-15</sup> The

PCMH is defined by the core tenants of primary care, and emphasizes a physician-patient partnership that includes improved communication, coordination and continuity of care.<sup>14, 16</sup>

The purpose of this study was to compare the Atherosclerotic Cardiovascular Disease (ASCVD) Risk scores of chronic patients enrolled in our SRFC's Longitudinal Care Program (LCP) with two matched sample control groups: episodic visitors, and infrequent visitors. Our hypothesis was that LCP patients would show significantly reduced ASCVD risk scores compared to both control groups.

## Methods

### Program Setting

Our SRFC serves an average of 30 uninsured/underserved patients with chronic conditions per weekly session. During the study year, we adopted an LCP based on the tenets of PCMHs, which provided patients: (1) continuity—a relationship with a single student provider for 12 months, (2) coordination of care across the healthcare network, and (3) quarterly check-ups with coaching related to medication and lifestyle management.<sup>14,16-18</sup> Patients with chronic conditions who declined LCP participation received care under the previous episodic model.

From The Ohio State University

**Providers and Provider Training**  
LCP providers were volunteer fourth-year medical students supervised by attending physicians. Providers received training that covered topics related to treating patients with chronic diseases, including health coaching communication strategies.

### Study Procedures

We used the SRFCs dedicated electronic medical records (EMR) to retrospectively identify three patient types: LCP participants, episodic, and infrequent visitors; and to extract patient health records, including comorbidities, smoking status, blood pressure, high-density (HDL) and low-density (LDL) lipoprotein levels, and total cholesterol. We matched LCP participants to the other patient types by age, gender, and the presence of ASCVD risk factors. This provided two control groups: the episodic visitors (had similar visit patterns to the LCP) provided a comparison for evaluating the continuity-of-care effect; and infrequent visitors (visited twice, almost a year apart) provided a comparison for evaluating the effect of quarterly checkups. We excluded

LCP patients with incomplete health records or unsuitable matched controls (n=6).

We chose ASCVD risk as our primary outcome because it consists of modifiable risk factors susceptible to change through coaching, thus serving as a good measure of longitudinal chronic care benefits.<sup>19-21</sup> We used the ASCVD Risk Estimator Plus to calculate risk scores.<sup>22</sup> Our institutional review board approved this study as a retrospective chart review.

### Data Analysis

We compared ASCVD risk scores using a two-way (group by time) analysis of variance (ANOVA) with two repeated measures. Post hoc tests were conducted on significant main effects or interactions. Time between baseline (T1) and follow-up (T2) ASCVD risk scores was 12 months. We interpreted *P* values <.05 as significant.<sup>23</sup>

### Results

We identified 81 patients to create three matched groups of 27 subjects each (Table 1). The two-way ANOVA showed a main effect for time, ( $F=14.09$ ;  $df=1,26$ ;  $P=.001$ ; effect size [es]=.352) suggesting that ASCVD

risk scores declined significantly by the end of the study period for all three groups combined (Table 2). More importantly, we observed a significant time x group interaction ( $F=3.82$ ;  $df 2, 1.72$ ;  $P=.035$ ;  $es=.128$ ; Table 2, Figure 1) that indicated differences between groups in their rate of ASCVD Risk score decline. Post hoc analysis of the difference scores (Change from T1-T2) and Figure 1 showed that the significant interaction was driven by Group 3's zero rate of change.

### Discussion

Our results showed that LCP patients and patients who visited the SRFC at similar time intervals, lowered their ASCVD Risk scores at about the same rate. This finding suggests that continuity of care and our LCP program did not have an appreciable effect on improving patient outcomes over and above regular visits to the clinic. However, these two groups demonstrated improved outcomes when compared to the other control group who received episodic care at least 9 months apart, suggesting that SRFCs should focus on promoting quarterly check-ups among chronic care patients.

**Table 1: Patient Characteristics of Columbus Student-Run Free Clinic Who Received Care Under Three Conditions\***

Characteristic	Group 1: Longitudinal Care Program	Group 2: Regular Episodic Care	Group 3: Annual Transient Care
Age in years at end of study period, mean (SD)	57 (10)	57 (9.9)	56 (10)
Female gender, n (% of 27)	10 (37)	10 (37)	10 (37)
Number of visits, mean (SD)†	12.6 (5.7)	10.5 (3.6)	2 (0.0)
<b>Ethnicity and Race, n (% of 27)</b>			
Hispanic	0 (0)	3 (11.1)	1 (3.7)
Non-Hispanic White	12 (44.4)	11 (40.7)	11 (40.7)
African American	7 (25.9)	12 (44.4)	14 (51.9)
Non-Hispanic Other	8 (26.9)	1 (3.7)	1 (3.7)

\* Demographic characteristics of 81 Columbus Student Run Free Clinic patients who received care under three conditions: Group 1-longitudinal program group (n=27) received continuous care from the same provider team over a 12-month period; Group 2-regular episodic care (n=27) visited the clinic at least quarterly, receiving episodic care over the same period and Group 3-annual transient care (n=27) visited the clinic twice during the study period, once at the beginning—August, and once towards the end—July. Groups were matched on gender, age, and where possible, ethnicity.

† The number of visits included in-person visits to the clinic and telephone consultations.

Table 2: Two-Way (Group by Time) Analysis of Variance (ANOVA) With Two Repeated Measures\*

		ASCVD Risk Score at Time 1		ASCVD Risk Score at Time 2		ASCVD Risk Score Change From T1 to T2	
Group	n <sup>†</sup>	Mean	SD	Mean	SD	Mean	SD
1	27	16.6	11.6	13.2	9.9	-3.47	6.4
2	27	15.3	9.9	12.6	9.6	-2.63	3.77
3	27	13.9	11.5	13.6	11.6	-0.33	2.84
Source of Variance			df <sup>‡</sup>	Mean Square	F	P	Effect Size <sup>§</sup>
Time			1	123.6	14.09	.001	.352
Error (time)			26	8.8			
Group			2	20.94	.249	.76	.009
Error (group)			1.82	23.04			
Time x group			2	35.70	3.82 <sup>  </sup>	.04	.128
Error (time x group)			1.72	41.55			

\* Two-way (group by time) analysis of variance (ANOVA) with two repeated measures. \* Comparing ASCVD risk score at time 1 and time 2 (9-12 months apart) for 81 patients; matched on age, and gender across three groups who differed in how much continuity of care they received in a student-run free clinic during the academic year 2015-16.

<sup>†</sup>A power analysis using power=.95, and alpha error probability=.05; indicated that 18 subjects could detect a small effect.<sup>24</sup>

<sup>‡</sup>Corrections to degrees of freedom are due to the Huynh-Feldt adjustment for violation of the assumption of sphericity.<sup>25</sup>

<sup>§</sup>es=partial eta squared effect size. To interpret, move the decimal to the right two places and read as the percentage of variance associated with the main effect or interaction (sources of variance).<sup>26</sup>

<sup>||</sup> Pairwise comparisons of the difference scores (change in ASCVD Risk score over time) suggest that the significant interaction is being driven by the fact that Group 3 is significantly different from Group 1 ( $P=.03$ ) and from Group 2 ( $P=.01$ ).

Abbreviations: ASCVD risk, atherosclerotic cardiovascular disease risk.

This retrospective study builds on the work of others by evaluating an SRFC's implementation of a PCMH model for longitudinal patient care through direct measures of patient outcomes.<sup>16</sup> Although we were unable to document an effect related to continuity of care, we were able to show the importance of consistent, regular care of patients with chronic conditions related to ASCVD risk.

### Limitations

One explanation of our findings is that the study period was not long enough to detect the impact of continuity of care and adherence to a PCMH model. Another is that there was not an appreciable difference between the LCP and regular visit cohorts regarding motivation to improve their health. We did not monitor the performance of the SRFC providers, so we cannot say whether they established the rapport needed to promote treatment plan adherence.

We suggest that SRFCs continue to assess the patient care outcomes for two reasons. First, because a central tenet of service learning is a reciprocal benefit between both parties involved, and second, because evidence-based practice is a central tenet of modern patient care. Using fourth-year medical students with faculty oversight, SRFCs can provide value to both the community and students through the evaluation and implementation of new patient care models.

### Future Directions

These results merit further study of the potential long-term benefits associated with using a PCMH model with continuity of care in an SRFC. Further research should monitor patient outcomes of this care model for a longer period.

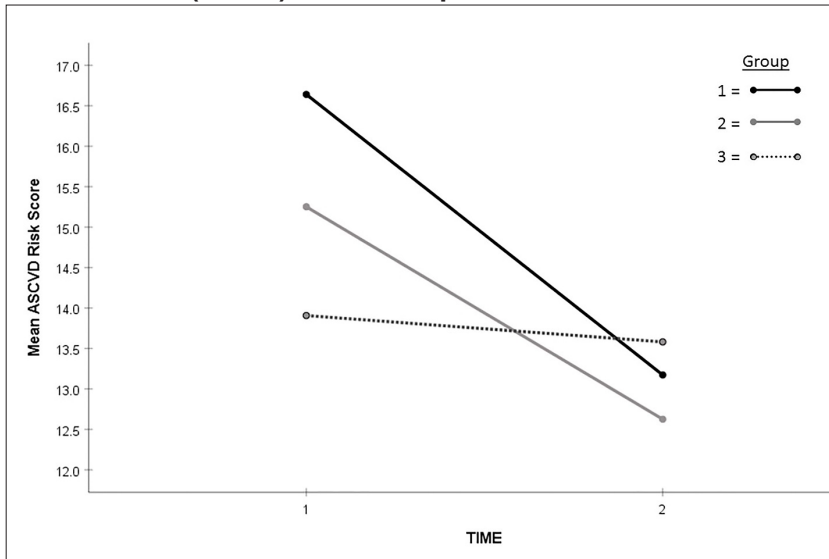
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**Figure 1: Time by Group Interaction Resulting From Two-Way (Treatment Group by Time) Analysis of Variance (ANOVA) With Two Repeated Measures.\***



\*Time by group interaction resulting from two-way (treatment group by time) analysis of variance (ANOVA) with two repeated measures: Group 1 represents the longitudinal care program group, Group 2 represents the control group with patients who received care at 3-month intervals, and Group 3 represents the control group who received sporadic care.

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