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Test of an interprofessional collaborative practice model to improve obesity-related health outcomes in Michigan



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ABSTRACT

The purpose of the study was to test the effectiveness of an interprofessional collaborative practice (IPCP) education program on clinicians' and students' knowledge and attitudes toward IPCP and to determine the effectiveness of an IPCP weight loss program in two nurse-managed centers. The study team used the Midwest Interprofessional Practice, Education, and Research Center (MIPERC) collaborative practice education program that consists of online learning modules followed by daily huddles and collaborative care planning. The obesity intervention program was implemented by faculty and staff practitioners and students in two clinics with very different patient populations (community residents and college students). Staff/faculty practitioners and students demonstrated statistically significant knowledge gains as a result of online learning modules (Introduction to IPE $p < .05$; Motivational Interviewing $p < .001$; Safety Behaviors $p < .001$; Team Dynamics $p < .001$). Small, but not statistically significant changes in attitudes toward IPCP were seen with both groups. At program completion, enrolled patients showed statistical significant ($p < .001$) weight losses and decreases in body mass indices. Other health outcomes showed no significant changes (blood pressure, prevalence of smoking, exercise frequency or duration $p > .05$). The study demonstrated the potential of an IPCP program to affect weight loss in two populations.

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1. Introduction

Obesity is a major health problem and the USA has one of the highest rates of obesity when compared to other industrialized countries in the world.¹ In Michigan, the adult obesity rate is 30.7% and the state ranks as 17th in the USA.² Due to the high rate of occurrence and associated co-morbidities affecting population health, Michigan's governor has made obesity and team-based, patient-centered care a priority health care initiative.³ The Governor based his recommendations on a recent Institute of

Medicine report,⁴ page 2) which “stresses that, because obesity is such a complex and stubborn problem, a bold, sustained, and comprehensive approach is needed.”

To support these priorities and with a funding opportunity to test an interprofessional team-based approach (Health Resources and Services Administration [HRSA] of the U.S. Department of Health and Human Services [HHS], grant number UD7HP25052), a unique partnership was formed, founded on a belief that to be effective, weight management interventions should be interprofessional using collaborative approaches.⁵ The partnership included the Michigan Department of Health and Human Services (MDHHS) Primary Care Office (PCO), two universities and their nurse-managed centers, the Michigan Area Health Education Center (MI-AHEC), and an organization dedicated to developing a healthcare workforce, the Michigan Health Council (MHC). The goals of the partnership were in alignment with the mission of the *National Center for Interprofessional Practice and Education* to seek evidence to demonstrate a relationship between interprofessional collaborative care, health professions education and health outcomes.⁶ The PCO selected two universities, Grand Valley State (GVSU) and Wayne State (WSU), to participate in the implementation and evaluation of an interprofessional collaborative practice program (IPCP) at their nurse-managed sites. The PCO convened and GVSU provided the lead for the funded study with the goal of strengthening interprofessional collaborative practice statewide. This study was undertaken in coordination with the efforts of the Michigan Health Council (MHC) and Michigan Area Health Education Center (MI-AHEC) which have a mutual goal to spread interprofessional collaborative practice statewide.

2. Background

Currently, there is a renewal of interest in interprofessional education (IPE) and IPCP.⁷ IPE and IPCP requires collaborative skills including mutuality, shared leadership and responsibilities, and teamwork with good communication, clarity of roles and responsibilities, negotiation skills, and cooperation.^{8–10} Collaboration skills are founded on an understanding of team dynamics and the goals of collaborative care and patient safety.

Evidence for the effectiveness of IPE and IPCP to improve collaborative skills and positively affect patient outcomes is emerging.^{11–13} However, the IOM suggests that stakeholders need to commit resources to build the evidence-base for IPE and IPCP using a mixed methods approach in academic and practice settings and across a range of patient populations to measure the impact of interprofessional education (IPE) on collaborative practice behaviors and patient outcomes.¹⁴

To date, the majority of IPE and IPCP studies have focused on pre-licensure students and post-licensure practitioners using educational interventions (e.g., courses with or without field placements, workshops) and have documented improved attitudes toward IPE and/or IPCP.¹³ Nursing and medicine are two of the most common disciplines included in previous studies followed by physical therapy, pharmacy and social work.¹⁵ The majority of educational outcome studies used self-reports with few studies measuring actual behavior changes. A recent study showed that an interprofessional curricula with interactive sessions for social work, medicine, nursing, pharmacy and nutrition students improved participants' attitudes and values toward interprofessional practice but not their knowledge about other disciplines.¹⁶ From two recent scoping reviews,^{13,15} authors concluded that most research on IPE or IPCP emphasized the “intermediate” outcomes of changes in attitudes, values and knowledge and few studies focused on patient outcomes. The Cochrane Report¹³ shows that, of the fifteen qualifying studies for inclusion, seven produced positive patient

outcomes, four studies had neutral or positive patient outcomes and four studies reported no changes on patient outcomes.

Multi-disciplinary care has been shown to achieve clinically significant and substantial weight loss in obese and overweight adults.^{17–19} The majority of studies were randomized controlled trials^{17,18} and few took place in primary care settings. Randomized controlled trials, while the gold standard for proving the effectiveness of an intervention, often employ limited samples and are not easily translated into daily practice. In these studies it was not clear if practitioners used an IPCP approach or if patient subjects interacted with practitioners from various disciplines who, although working together, were not functioning as interactive team members. No identified study explored the effects of IPCP on weight loss specifically.

Given the statewide priority health initiative to address obesity coupled with multiple institutions desiring partnerships to pilot interprofessional experiences across the state for education and practice workforce, our team's overarching aim is to report on the clinical outcomes of these experiences. The purposes of this paper are to present study findings related to: 1) the effectiveness of the interprofessional collaborative practice (IPCP) educational program on clinician and student participants' knowledge and attitudes toward IPCP; and 2) the results of implementing the IPCP weight loss program on obesity health related outcomes in the two nurse managed centers.

3. Methods

Clinic participants (N = 290) were self-selected to participate in the weight loss program with the inclusion criteria of a BMI 25 or higher. Since the study design sought to satisfy a dual purpose, that of testing an interprofessional team approach for weight loss in two distinct populations and in two disparate physical locations, the research team used pre vs. post design for this study. Baseline values (pre-intervention) were recorded at the subject's first visit and values for these same variables tracked at each subsequent visit. Values recorded at program completion were used as the post-intervention variable set. Faculty, staff and students at the two College of Nursing's nurse managed centers and patients who enrolled in their IPCP weight loss programs participated in the study. The nurse managed centers included Grand Valley State University's Kirkhof College of Nursing's Family Health Center (FHC) in Grand Rapids, Michigan and Wayne State University College of Nursing's Campus Health Center (CHC) in Detroit, Michigan. The FHC serves approximately 5000 patients in an urban transition neighborhood population, of which, almost 80% of the residents live below the poverty line. The CHC is an on-campus facility available to the university population of over 33,000 students. Students utilizing the clinic are characteristically under- or uninsured, and are from medically underserved areas and diverse backgrounds.

3.1. IPCP education program

The interprofessional collaborative practice education program tested for this study was developed by the Midwest Interprofessional Practice, Education, and Research Center (MIPERC). The MIPERC was established in 2007 as a regional inter-institutional infrastructure to implement interprofessional education, collaborative practice and research for the improvement of healthcare in regional communities. The IPCP education program was developed in response to a need for interprofessional education for academic faculty/staff, students, and preceptors providing internship experiences for student learners at their assigned site. The MIPERC, on-line, IPCP educational core program contains foundational

information on interprofessional collaborative practice that includes four modules. Two additional modules have been developed for staff, faculty, and preceptors. The four foundational modules are Introduction to Interprofessional Education, Patient Safety, Team Dynamics, and Tips for Implementing Health Care Behavioral Changes. The additional two modules for faculty, staff, and preceptors are the Faculty Development and Preceptor Manual components. Each module was intentionally conceived, developed and assessed for face and content validity by members of the MIPERC (see Table 1 for a description of the modules). In addition to the modules, the IPCP program includes daily huddles, collaborative care planning and team case presentations. Although the modules were developed to be used in an asynchronous online learning platform, the content was delivered by key personnel to all student learners together on their first clinical day. The students were introduced to the educational program together as either face to face or virtually delivered via the “Go to Meeting” format. The key personnel trainer delivered all content to staff and faculty as face to face in the respective nurse-managed centers. Surveys, pre/post-tests, and evaluations were all completed electronically.

3.2. IPCP weight management program

The interprofessional team composition and the program intervention differed between sites due to university-specific factors. Although the approaches were different at each site (see below), common team members included a nurse practitioner and physician. Common data were recorded at each patient encounter.

3.2.1. Intervention at the Family Health Center (FHC)

The FHC weight management team consisted of a NP, MD, and Social Workers. The FHC provided student clinical rotations for baccalaureate nursing, social work, movement science, and di-

etetics students. Daily huddles, collaborative care planning, evaluation of patient goals and weekly case study presentations by the staff and students were the normal routine in care delivery. The program was comprised of four patient informational sessions focused on 1) overall wellness, 2) nutrition, 3) movement, and 4) behavioral emotional health. During the initial overall wellness visit, a patient met with a social worker to talk about setting lifestyle program goals. For the nutrition module, information on the food groups, portion and measurement, mindful eating, and nutrient properties was reviewed. The movement module focused on physical activity as key to weight loss for basal metabolism, strength, flexibility, and as a mood modulator. The behavioral health module presented content on social and emotional wellness and maintaining change. If the participant continued in the program beyond the four sessions, educational content was specific to the participant’s request. Baseline and laboratory tests were requested at the discretion of the primary provider and were not mandatory. A completer was defined as having 4 or more visits over 10 weeks.

3.2.2. Intervention at the Campus Health Center (CHC)

The CHC weight management program team consisted of NPs, an MD, and a Dietitian. The CHC provided student clinical rotations for nurse practitioner, baccalaureate nursing, and dietetics students. Daily huddles, collaborative care planning, evaluation of patient goals, weekly case study presentations by the staff and students were the normal routine in care delivery. At the CHC initial visit, patient information included program overview, program expectations and commitments; a goal worksheet; blank and sample food logs; and a “10 simple step” strategy plan. The program consisted of a minimum of nine visits over a 13 week time period. Baseline and post program completion laboratory tests were ordered for each study participant. Recorded food logs and team coaching were central to the weight management visits. The definition for a patient who had completed the program was 7 visits with no structured time frame.

The Program Components

The program requirements	FHC	CHC
Age of participants	Age 5 through life continuum	University students only
Informed consent	Yes	Yes
Types of clinicians	NP, MD, social work	NP, MD, dietitian
Baseline/post-program labs	Optional	Optional
Huddles,	Yes	Yes
Collaborative care plan with mutual goals at each visit	Yes	Yes
Weekly case study presentations	Yes	No (conducted every other week and monthly based on physician availability)
Length of program	4 visits over 10 weeks	9 visits over 13 weeks

etetics students. Daily huddles, collaborative care planning, evaluation of patient goals and weekly case study presentations by the staff and students were the normal routine in care delivery. The program was comprised of four patient informational sessions

3.3. Human subjects protection/recruitment

Participation in this study was part of the students’ curricula. For staff and faculty, interprofessional practice was considered part of

Table 1
Description of Foundational Interprofessional Collaborative Practice Modules.

Preceptor Manual Overview Module- was developed as a primer on foundational IPE concepts, IPEC competency domains and the importance of collaborative practice. IPE tools and activities are shared in the module and accompanying manual.
Faculty Development Module- focuses facilitation skills and the importance of understanding that each health profession’s roles. Examines hierarchies, bias, and communication affecting patient care. The adapted Camphina-Bacote model is introduced, a video “Through the Patient’s Eyes” is viewed and debriefed.
A Learner’s Introduction to IPE & Collaborative Practice Module- an intro to IPE and collaborative practice emphasizing the scope of practice of different disciplines. Roles, professional identity and role blurring are also covered.
Patient Safety Module- provides an overview of the importance of patient safety, team building, communication, and techniques to improve handoffs and transitions in care. The Swiss cheese model and an error prevention toolkit are presented. Exemplars of team based behaviors are presented through video vignettes.
Team Dynamics Module- describes the stages of a team, explores conflict resolution, and provides communication tools, daily huddle guidelines, and principles of developing a collaborative care plan. Information is provided on the potential harm of ineffective communication.
Tips for Implementing Health Care Behavioral Changes- provides a review of the characteristics and guiding principles of motivational interviewing using open-ended questions, agenda setting, and reflective listening. Discusses the use of Prochaska & DiClemente’s Stages of Change for goal setting.

their expected practice environment; therefore, both universities' and the MDHHS's human subject's internal review boards provided expedited human subjects protection review. Faculty, staff and students were told that their participation in the research would help evaluate the effectiveness of an IPCP program designed to improve patient care outcomes. Test results did not affect student grades or staff and faculty evaluations. Patients signed informed consents and HIPAA releases and were told that their participation in the research would help assess the effectiveness of a team-based care model.

For the FHC study, patients were recruited from the health center as well as from the community-at-large, and for the CHC study, patients were recruited from the clinic directly. All patients met the inclusion criteria of having a BMI of 25 or greater.

3.4. Tools and data collection

The faculty/staff and student data collection tools included: the Demographics Form, the Entry Level Interprofessional Questionnaire (ELIQ), and Knowledge Assessment pre- and post-tests. Patients data collection tools included: the Demographics Form and chart audit logs.

The *Demographics Form* for faculty/staff/students contained 30 questions relating to provider or learner type/program, gender, level of education, residential background, race/ethnicity, and previous participation in interprofessional collaborative practice or an IPE course. The form was developed by the study investigators and assessed for face and content validity. The *Demographics Form* for patients contained questions relating to age, gender, education, marital status, race/ethnicity, annual household income, employment, and insurance status. The forms were developed by the study investigators and assessed for face and content validity.

The *Entry Level Interprofessional Questionnaire* (ELIQ) is a three-

part self-administered tool comprised of a total of 27 items using a 4 or 5 point Likert-type scale (Range 27–126) and three nine-item subscales. The three subscales include communication and teamwork (Range 9–36; 1 = strongly agree and 4 = strongly disagree), interprofessional learning (Range 9–45; 1 = strongly agree and 5 = strongly disagree), and interprofessional interaction scales (Range 9–45; 1 = strongly agree and 5 = strongly disagree). A lower score on the total and subscale surveys indicates a more positive attitude toward interprofessional communication, learning and interaction; the ELIQ also allows for an evaluation of positive, neutral and negative attitudes. The ELIQ was assessed for reliability through test-retest methods (Pearson's correlation) and for internal consistency using Cronbach's alpha.²⁰ Both concurrent validity between the communication section of ELIQ and the Interpersonal Communication Competence Scale and the ELIQ's interprofessional learning portion against the readiness of the interprofessional learning have also been assessed.²⁰ The Interprofessional learning portion of the questionnaire was tested for concurrent validity against the Readiness for Interprofessional Learning scale using Pearson's correlation coefficient values as well.²⁰

Knowledge Assessment pre/post-tests were developed for each learning module (Introduction to IPE, Patient Safety, Team Dynamics, and Tips for Implementing Health Care Behavior Change, Faculty Development, and Preceptor Module Overview) by MIPERC faculty and consisted of 15 items, mixed with multiple choice, true/false, and essay questions. A higher score indicated greater knowledge of the content. MIPERC members and IPCP national leaders assessed the knowledge tests for both face and content validity.

The *Chart Audit Data* were collected from the sites in two formats: paper and pencil and electronic health record. The chart audit data collected included height, weight, BMI, waist circumference, blood pressure, smoking status, exercise frequency/duration/

Table 2
Demographics – Faculty/Staff and Students.

Variable	Faculty/Staff		Students	
	GVSU N = 8	WSU N = 7	GVSU N = 31	WSU N = 28
Age – mean (std dev) ¹	53.7 (13.8)	45.8 (16.5)	23.8 (3.8)	32.0 (9.5)
Gender				
Male	2	0	6	3
Female	6	7	25	25
Ethnicity				
Hispanic	0	0	2	1
Non-Hispanic	8	7	29	27
Race ²				
Black/African American	0	1	0	5
Asian American	0	0	0	5
Caucasian	8	6	30	18
Multiracial	0	0	1	0
Residential Background				
Urban	1	2	3	7
Suburban	4	4	17	17
Rural	2	1	11	4
Program				
Full-time	–	–	20	22
Part-time	–	–	9	6
Specialty/Discipline				
Health Education	0	0	0	1
Movement Science	0	0	1	0
Nursing – BSN RN	0	0	13	22
Nurse Practitioner	4	4	0	4
Social Work	3	0	9	0
Dietician/Nutrition	0	2	2	2
Physician	1	1	0	0
Other	0	0	5	0

1- Student Age, $p < 0.001$.

2 – Student Race, $p < 0.01$.

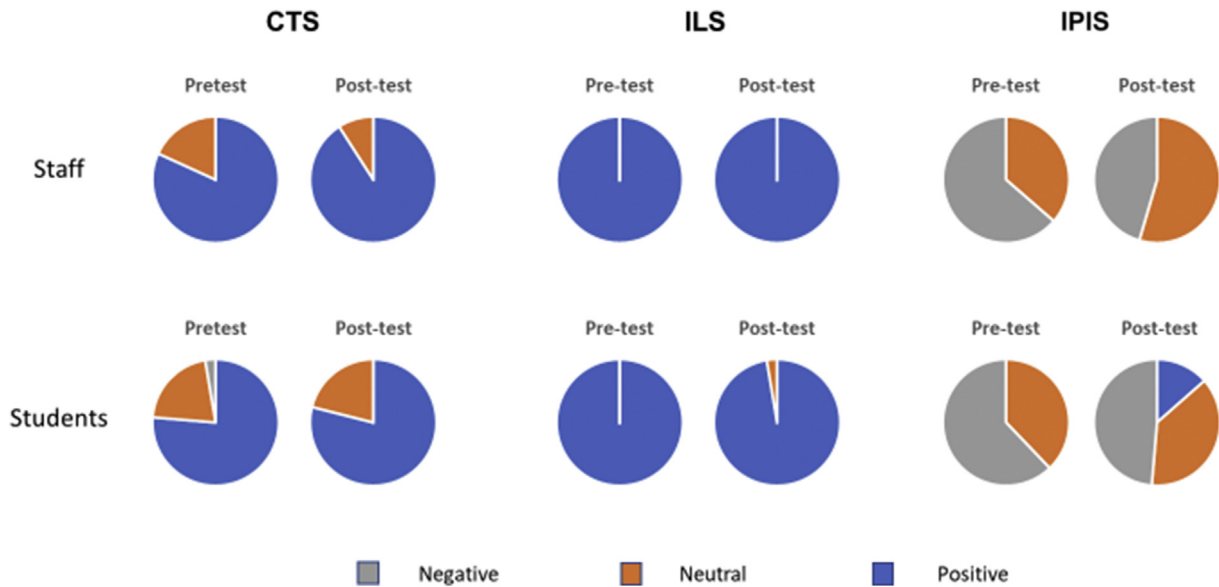


Fig. 1. ELIQ.

routine, sleep, water intake, and goals. Clinical indicators also recorded were hypertension, hyperlipidemia, diabetes, and depression diagnoses. If available, laboratory values collected were HgbA1c, blood glucose, total cholesterol and ratio, triglycerides, HDL, and LDL.

3.5. Data analysis

Descriptive statistics were used for demographic data. For the IPCP educational data, scores were calculated for the ELIQ and knowledge tests. For the weight management intervention, percentages were calculated for weight loss, change in BMI, and exercise frequency and duration.

To determine comparability between study sites (GVSU-FHC and WSU-CHC), student and patient demographics were compared using t-tests, chi-square, and Mann-Whitney U-tests where appropriate. To test for changes in attitude, knowledge and clinical variables, paired tests (paired t-tests, Wilcoxon Matched Pairs) were used for provider and patient parameters. Repeated measures analysis of variance was used to determine whether there were statistically significant differences in weight loss and BMI changes between the two study sites. Statistical analysis used SPSS version 23 and the level of statistical significance was set at $p \leq 0.05$.

4. Results

4.1. IPCP training program (component 1)

4.1.1. Demographics

The purposive sample of health care staff and faculty (n = 15)

was comprised of those practitioners in the nurse managed centers. In addition were health professions students (n = 59) assigned to the sites for their clinical rotations during the study period. Specific characteristics relating to age, gender, race, ethnicity, and disciplinary profession can be seen in Table 2. The staff/faculty were generally well-experienced, female, Caucasians who were either nurse practitioners or social workers. Students were predominately female, Caucasians, nursing full-time students. The WSU-CHC students were significantly older than GVSU-FHC students ($p < .001$) and, although predominantly Caucasian, had a greater racial diversity ($p < 0.01$).

4.1.2. Education module and assessments

The annual assessment (faculty/staff) or end of clinical rotation (students) survey as measured using the ELIQ failed to show significant changes, over pre-test assessment, in any of its three subscales: Communication and Teamwork (CTS), Interprofessional Learning (ILS), and Interprofessional Interaction (IPIS). For students, improvements in the Interprofessional Interaction scale approached statistical significance ($p < 0.10$) demonstrating that the activities may have shifted the staff and student attitudes from negative views of these interactions to more neutral (staff) and positive (students) attitudes (see Fig. 1).

Direct assessments of knowledge presented in the investigator-developed content modules demonstrated statistically significant gains by faculty/staff and students for all modules: Introduction to Interprofessional Education and Practice, Team Dynamics, Patient Safety, and Tips for Implementing Health Care Behavior Change. For the faculty/staff specific Faculty Development module all clinicians self-assessed their IP competency as “prepared”. An additional

Table 3 Faculty/Staff and Student Educational Data.

Education Module (% correct)	Faculty/Staff N = 14			Students N = 59		
	Baseline/Pretest	End/Post-Test	Sig. Level	Baseline/Pretest	End/Post-Test	Sig. Level
Intro to IPE	60.7 ± 8.0	70.7 ± 10.7	<.05	59.3 ± 9.3	66.0 ± 10.0	<.001
Team Dynamics	56.0 ± 13.3	76.0 ± 9.3	<.001	45.3 ± 11.3	62.7 ± 13.3	<.01
Patient Safety	60.7 ± 12.0	77.3 ± 10.0	<.001	62.7 ± 14.0	76.7 ± 11.3	<.001
Tips for Implementing Health Care Behavior Change	70.7 ± 12.0	84.7 ± 8.7	<.001	65.3 ± 11.3	77.3 ± 12.0	<.05
Preceptor Manual Overview	51.3 ± 8.0	64.0 ± 12.0	<.001	NA	NA	NA

query asked what could be changed in teams or healthcare systems to improve quality and safety, all respondents replied “improving communication”. Specific examples were to improve understanding of roles and hierarchies; lead by example; demonstrate an IP approach, and participation in team rounding, team meetings, and collaborative care planning. Scores for questions related to the Preceptor Manual overview were also significant (Table 3 $p < 0.001$) in a positive direction.

4.2. Clinical outcomes - weight management outcomes

4.2.1. Demographics

A total of 290 patients were enrolled in the study. Subjects enrolling at the GVSU-FHC site tended to be older, heavier (greater weight and BMI), wealthier, less well-educated and more diverse than those enrolled at WSU CHC (Table 4). Of those enrolling, 126 (43.4%) completed the program. Completion rates were similar between sites ($p > 0.6$). Although those completing the program at the GVSU-FHC site tended to be older than non-completers ($p < 0.01$), this finding was not similar at WSU-CHC ($p > 0.6$).

4.2.2. Obesity-related health outcomes

Program completers at FHC lost an average of 3.99 S.D. \pm 8.1 pounds and reduced their BMI an average of 0.60 points S.D. \pm 1.3. Program completers at CHC lost an average of 3.81 pounds S.D. \pm 8.3 and reduced their BMI an average of 0.59 points,

S.D. \pm 1.3. At program completion, both weight loss and decrease in BMI were statistically significant ($p < 0.001$) with no differences seen between sites ($p > 0.10$) (Table 5). No change was seen in blood pressure, prevalence of smoking, exercise frequency or duration ($p > .05$). The different program completion criteria between sites appeared to have no effect on health outcomes. Eighty subjects continued the program after their official completion visit and lost, on average, an additional 1.8 pounds.

5. Discussion

The purpose of the study was to 1) test the effectiveness of an interprofessional collaborative practice education program on clinicians' and students' knowledge and attitudes toward IPCP and 2) determine the effectiveness of an IPCP weight loss program in two nurse-managed centers. The interprofessional collaborative practice program was effective at increasing knowledge. Direct assessments of knowledge by faculty/staff and students had statistically significant gains for all education modules. The results of the education modules and interprofessional practice were less effective in changing pre to post attitudes toward IPCP. Using the ELIQ, the project failed to show significant changes in attitudes toward communication and teamwork, interprofessional learning, and interprofessional interaction, over pre-test assessment. Although the weight loss was modest at almost four pounds, approximately 70% of the participants did lose weight.

Table 4
Patient Demographics.

Variable	All Enrollees		Completers	
	GVSU N = 175	WSU N = 115	GVSU N = 78	WSU N = 48
Age – mean (std dev) ¹	49.9 (16.2)	26.1 (7.4)	53.8 (15.8)	26.6 (7.5)
Gender				
Male	37	22	19	13
Female	135	88	59	34
Ethnicity				
Hispanic	8	8	5	4
Non-Hispanic	157	90	70	38
Race ²				
Black/African American	24	48	9	18
Asian American	1	13	0	5
Caucasian	139	39	68	21
Multiracial	5	9	1	3
Other	1	1	0	0
Education Level - highest				
< High School	12	0	4	0
High School Graduate/GED	13	9	8	4
Trade School	4	1	2	0
Some College (<BS, BA)	34	48	22	28
Bachelors Level Graduate	41	18	20	9
Graduate School	54	14	22	6
Household Income ³ – median	40-59,000	20-39,000	40-59,000+	20-39,000+
Clinical Values at Enrollment				
Weight ³ - mean (std)	222.9 (55.9)	208.3 (50.9)	225.4 (61.2)	213.1 (54.7)
BMI ³ - mean (std)	36.4 (8.2)	34.1 (6.4)	36.6 (9.2)	34.1 (6.3)
Waist Circumference ³ – mean (std)	43.9 (6.6)	39.2 (5.8)	44.0 (7.0)	40.3 (5.0)
Smoking				
Yes	11	5	4	2
No	159	96	72	43
Diabetes ³				
Yes	23	2	15	2
No	145	98	60	43
Hypertension ³				
Yes	64	6	35	3
No	107	92	41	42
Exercise Frequency (episodes/wk)	3.2 (5.6)	3.3 (6.7)	4.2 (7.8)	2.6 (1.6)
Exercise Duration (min/episode)	34.7 (51.2)	33.1 (26.9)	38.1 (34.2)	38.3 (23.8)

1 – $p < 0.001$, Note: Completers at GVSU tended to be older than those not completing the program ($p < 0.01$), but not at WSU ($p > 0.50$).

2 – Patient Race, $p < 0.01$.

3 – Patient Weight, $p < 0.05$.

Table 5
Patient Outcome Variables at Completion (n = 126).

Variable	Mean \pm Std. Dev.	Median	Range
Weight Lost - #s ¹	3.9 \pm 8.2	3.6	-24.3 to 31.2
GVSU	4.0 \pm 8.1	2.8	-11.6 to 31.2
WSU	3.8 \pm 8.3	4.0	-24.3 to 24.1
BMI decrease ¹	0.60 \pm 1.3	0.52	-3.75 to 5.89
GVSU	0.60 \pm 1.3	0.41	-1.79 to 5.89
WSU	0.59 \pm 1.3	0.59	-3.75 to 2.78
Time to Completion - wks			
GVSU	14.0 \pm 3.0	13.0	10.1 to 26.8
WSU	13.4 \pm 10.3	11.0	6.0 to 70.1

1 -p < .001.

Key personnel were able to deliver the web-based educational modules to learners. Using asynchronous web-based technology, learners independently viewed the content in their interprofessional group on their first clinical day. They then viewed the embedded videos together, identifying key points generating dialogue and discussion. This way, each learner could move through the material at their own pace and reinforce the learning through group interaction. It is a well-known fact that barriers (i.e. academic schedules, precepting multiple student types) exist and challenge the implementation of the IP education in a practice setting, with web-based IPCP education and training is a viable option. Although a review of the literature is scant for implementing an interprofessional online curriculum, the researchers have observed through conference abstracts most notably the Collaborating Across Borders V, that indeed academic institutions have used foundational interprofessional online modules. These foundational modules have been successful at improving interprofessional knowledge, skills and attitudes reducing the scheduling barriers previously faced^{21,22}.

A common curricular barrier to learning about interprofessional care is the lack of a foundational, pedagogical background with an evaluation and assessment of IPE.²³ The current study sought to address these issues with a focus on obesity reduction using similarly trained interprofessional teams. All study staff and students had improved in knowledge at the end of the program modules. While the ELIQ failed to show significant changes over pre-test assessment, these findings differ from other research suggesting that IPE clinical experiences change attitudes and values toward interprofessional practice.^{13,15,20} One explanation may be that the faculty and students in the participating clinics already held positive views of teamwork and interprofessional learning as demonstrated by their fairly low (indicating more optima) scores at the pretest phase (17 & 18.6 and 14.6 & 13.3 respectively). In addition, the staff were well-experienced with an average of 22 years of experience and may have already valued these professional beliefs. The mean interprofessional interaction subscale scores were high (i.e. held negative attitudes) both pre- and post-test, possibly indicating that staff and students did not have sufficient IPCP interaction time to see a change over 15 weeks (typical length of a semester). A longer clinical rotation and more intentional IPCP interactions during the clinical placement may be needed to shift these scores. Qualitative approaches in future studies might determine if the negative views varied by discipline or were universally held by all.

The interprofessional intervention by practitioners and students oriented to interprofessional collaborative practice was effective at reducing weight in two different populations. Combined program subjects demonstrated weight loss 3.9 \pm 8.2 pounds and lower BMIs 0.60 \pm 1.3. Even though the GVSU-FHC site participants were older, heavier at study admission, less educated, and more diverse than the WSU-CHC population, the outcomes were similar

suggesting that the effective aspects of the intervention were probably similar.

While many studies achieve weight loss even with short term interventions, it is difficult to achieve significant change in lifestyle behaviors and other health outcomes in a program of short duration.²⁴ Our program was no different. No change was seen in blood pressure, prevalence of smoking, or in exercise frequency or duration (p > .05). The overall profile of the completers in the study was 35.0 BMI (obese range), 94.1% were non-smokers, who exercised 39.4 (mean) minutes 3.7 (mean) times a week, with approximately 12% experiencing a co-morbidity. Eighty subjects, who continued the program after their official study completion, lost, on average, an additional 1.8 pounds; however, no changes in other health outcomes were seen. Different program completion criteria appeared to have no effect on health outcomes, and the program completion rates were similar between sites (p > 0.6). Attrition rates in a weight loss program approach range from 10-80%,²⁵ and using our interprofessional approach did not change that.

No study is without limitations. Our project has two primary limitations: a moderately small sample size and unique setting locations. First, the sample size of staff, students and patients was moderate and second we used two different nurse-managed centers (NMCs). Given these two limitations, we must be cautious with our statements of causality. In addition, we cannot isolate the interventions from what else may have been occurring in these two different NMCs, particularly the campus-based NMC. Future studies could focus on larger samples of care providers and patients, such as those at federally qualified health centers (FQHCs). The sample locations also limits the generalizability of findings to other NMCs and/or small campus health centers.

Another limitation of our study was the lack of quantitative data on the content and frequency of interprofessional activities in the clinics. We were not able to determine if the self-reported changes in knowledge and attitudes (minor changes) translated into behavior changes. Similar to the recommendations posed by Reeves and colleagues,²⁶ future studies could benefit from a mixed-methods research approach for evaluating the specific effects IPE and IPCP strategies and behaviors. Future research could also monitor the activities of the care providers and identify the components of the overall intervention that could directly influence clinical outcomes.

6. Conclusion

This study supported the priorities of our statewide primary care initiative on obesity reduction using an interprofessional team-based care approach at two nurse-managed centers. The members representing this rich partnership, MDHHS, PCO, GVSU, WSU, MI-AHEC and MHC, developed a pilot study to build an innovative clinical interprofessional education model that could be adapted and implemented at primary care sites statewide. The authors believe that by capitalizing on the partnership to test the relationship between interprofessional collaborative care, health professions education while addressing the issue of obesity, it demonstrated that the team could adapt and implement the process at multiple primary care sites.

Ultimately, this is the story of a partnership with a shared goal of strengthening interprofessional collaborative practice across institutions and can be used as a template for other large IPCP health initiatives. The monthly meetings chaired by MDHHS provided a venue for all members to participate in the planning and progress of the activities at the nurse managed primary care centers developing a sense of "teamwork and collaboration" with the partners. Lessons learned from the project were disseminated through the pipeline channels of MI-AHEC and Michigan Health Council efforts.

Dialogue was established in settings that were seeking to implement team based care or were seeking efficiencies in streamlining their practice.

This study showed improvement in knowledge in all learner types in each of the educational modules, but did not show improvement on the ELIQ tool in interprofessional interaction, learning, communication and teamwork. Both staff and students used information from the interprofessional educational program to work collaboratively and commented that they valued working in a team based care environment. The lack of changes in interprofessional attitudes for staff may have been due, in part, to their previous experiences in team based care. For students, a longer immersive clinical rotation may provide more opportunities and time to explore interprofessional team based care environments. Even though there were no statistically significant changes in attitudes, students commented in their weekly team conferences that working in a team environment provided them the opportunity to explore disciplinary roles, role conflict and blurring. They valued the collaborative care planning, team conferences and patient visits.

As suggested in a recent IOM report¹⁴, there is a need to strengthen the evidence base for IPE and team based care. Therefore, in this study, we measured changes in attitude and knowledge gains, but also analyzed select clinical indicators. Based on the study findings, the authors believe there was a relationship between the interprofessional education intervention and teamwork improving patients' weight in two clinical environments. Although multi-disciplinary care has been shown to achieve clinically significant weight loss in obese and overweight adults,^{17,19} our pilot study is one of the first to test an IPCP approach to reduce weight in the "real world" of daily primary care practice.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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