EVALUATION OF A COMMUNITY HEALTH WORKER PROGRAM TARGETING MEDICAID RECIPIENTS IN AN ORTHOPEDIC CLINIC

by

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Introduction: In Oregon, Medicaid benefits are managed by Coordinated Care Organizations (CCOs) that assist Medicaid members in navigating the healthcare system. A common form of assistance provided by CCOs is a Community Health Worker (CHW) program. There is a growing body of evidence that suggests CHW programs improve appointment-keeping behaviors, patient engagement, patient-provider communication, and health outcomes in a wide variety of clinics. However, this has yet to be examined in an orthopedic setting. The current study evaluates the effectiveness of a CHW program implemented by a CCO at an orthopedic clinic and surgical center. The study aims (1) to determine whether CHW outreach effectively reduced no-show rates among the CCO-member patient population and (2) to better understand the characteristics of CCO-member patients who are more likely to miss appointments as well as the characteristics of appointments that are more likely to be missed by CCO-member patients.

Methods: Existing medical records, appointment records, CHW outreach notes, and CCO-provided member information were used to conduct a retrospective cohort

study. Data included all appointments at the orthopedic clinic and physical therapy center between March 1, 2017 – September 30, 2017. De-identified data sets were cleaned and re-coded into variables for statistical analysis using STATA version 15.0 (Stata Corp, College Station, TX). A novel weighted no-show rate (WNSR) measure was created to describe a patient's propensity to consistently miss appointments. Univariate logistic regression was used to identify appointment characteristics that were associated with higher odds of missing a scheduled appointment, reported as an odds ratio (OR) with 95% confidence interval (CI).

Results: A total of 20,089 clinic patients (14% CCO members) had 52,877 clinic appointments and a total of 2,437 physical therapy patients (16% CCO members) had 14,540 appointments during the study period. CCO members missed a more-than-3-times higher percent of their appointments compared to all other patients in both clinic (10% CCO, 3% other, $p<0.0001$) and physical therapy (14% CCO, 4% other, $p<0.0001$). CCO patients also had significantly higher average WNSR values across nearly every patient characteristic (ANOVA, all $p<0.05$). About 8% of CCO clinic patients received at least one CHW outreach (n=228) compared to about 42% of CCO therapy patients (n=164). CHW-outreached patients did not have significantly different average WNSR values across nearly any patient characteristic compared to CCO-member patients who did not receive outreach in either clinic or therapy (ANOVA, all $p>0.05$). The CCO patient characteristics found to be most strongly associated with higher odds of a no-show in therapy were current tobacco use (OR = 2.39, 95% CI 1.87-3.05), recent non-emergency medical transport usage (OR = 1.55, 95% CI 1.19-2.01), and upper body injury (OR = 1.34, 95% CI 1.06-1.71). Those found to be most strongly

associated with lower odds of a no-show in therapy were recent specialty clinic visitation (OR = 0.49, 95% CI 0.31-0.78), recent primary care provider visitation (OR = 0.52, 95% CI 0.40-0.69), surgical patient status (OR = 0.70, 95% CI 0.54-0.91), and lower body injury (OR = 0.74, 95% CI 0.58-0.94).

Discussion and Conclusions: The current study confirms that CCO-member patients tend to no-show at a higher rate than other patients. Analysis of the effectiveness of CHW outreach on CCO member's no-show rates was inconclusive due to selection bias introduced in the program's methodology. Characteristics of patients receiving CHW outreach did not align well with characteristics associated with no-shows, suggesting room for improvement in the selection of patients to contact. Further studies of CHW programs in orthopedic clinics that employ more consistent and well-defined patient selection methods are needed to determine the effectiveness of CHW outreach in this setting. Future programs of this type are recommended to use characteristics associated with no-shows as criteria for selecting patients in order to target the appropriate subpopulations and most effectively improve appointment-keeping behaviors.

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INTRODUCTION

Ensuring patients follow through on their treatment plan and keep recommended follow-up appointments is an essential part of effective and efficient health care. Missed appointments lead to loss of time and money for health care providers and have detrimental effects on the quality of care and health outcomes of patients [1]–[3]. Avoiding missed appointments in primary care and specialty clinics can prove more difficult for patient populations with fewer resources, such as low-income patients enrolled in publicly-funded Medicaid programs [4]–[7]. Historically, care for Medicaid populations has been fragmented and offered too few supports for overcoming barriers to receiving timely, coordinated care.

In 2011, this issue was addressed in the state of Oregon with the passing of House Bill 3650, a bill which introduced a set of criteria for Coordinated Care Organizations (CCOs) [8]. CCOs consist of medical, mental health, and behavioral health providers who work together to organize and provide care to beneficiaries of Oregon Health Plan (OHP, Oregon's Medicaid Program) in a specific county or community. OHP pays for beneficiaries' doctor visits, prescriptions, hospital stays, dental care, mental health services, and addiction counseling and can also provide medical equipment and transportation when necessary. CCOs assist OHP beneficiaries with finding a primary care provider and coordinating care between their various health care providers when they require specialty care or surgery [9]. Notably, House Bill 3650 requires that CCOs provide their members with "assistance in navigating the health care delivery system" by employing teams of qualified health professionals [8].

This assistance aims to enable OHP beneficiaries to access the resources and services they need to effectively follow through on their care plans, which includes keeping scheduled appointments.

Community Health Workers (CHWs) are a prominent example of utilizing qualified health professionals, in Oregon and around the world, to assist members in following through on post-surgical treatment plans or managing their chronic diseases [10]. A CHW is a lay health worker, usually of similar socioeconomic status to the target patient population, that seeks to develop a trusting relationship with patients in order to act as a bridge between the patient and the healthcare provider [10], [11]. Though it varies depending on the specific program, CHWs typically build relationships with patients through phone calls, home visits, and hospital visits in which they discuss treatment plans and potential barriers to keeping appointments [11]. There is a growing body of research that suggests CHW interventions lead to more consistent patient adherence to treatment plans and appointments, higher levels of patient engagement and patient-provider communication, increased patient satisfaction with care, improved clinical outcomes, and decreased number of subsequent hospitalizations [10]–[19].

The purpose of this study was to explore the impact of a CCO's CHW intervention at a single orthopedic clinic and surgical center. Historically, the proportion of Medicaid beneficiaries at this orthopedic clinic who failed to complete their scheduled clinic and physical therapy follow-up appointments has been significantly higher than that of other payer types (e.g., commercial or Medicare). Poor adherence to rehabilitative treatment plans following orthopedic treatments or surgeries puts patients at risk for sub-optimal outcomes such as blood clotting, tissue scarring leading to

limited range of motion, osteolysis stemming from immune rejection of implants, and non-union or delayed-union fractures that can result in development of osteoarthritis and chronic pain [20]–[22]. To combat this, the orthopedic clinic and CCO collaborated to test a CHW intervention in March 2017 with the goals of ensuring Medicaid beneficiaries understand the importance of keeping follow-up appointments, identify and troubleshoot barriers to appointment attendance, have access to pain management resources, and have the support necessary to maintain healthy behaviors before and after surgery [23]. To accomplish these goals, the CHW was employed by the local Medicaid CCO but performed patient outreach from within the orthopedic clinic.

The CHW who worked at the clinic during the study period made outreach attempts almost exclusively by phone. Individual CCO-member patients were initially chosen to receive outreach based on prior history of missing physical therapy appointments. At some point during the first six months of the program, this criterion was abandoned and patients were selected for outreach before they had any appointment at the clinic. Assistance with keeping appointments was offered to patients including shuttle or bus passes to overcome transportation barriers, and reminder calls. Most patients declined assistance, but the CHW reports some accepted a shuttle or bus pass. If a patient failed to answer outreach phone calls but kept several appointments during this time, the CHW stopped attempting outreach and it was considered an effective outreach. After the first six months, the program was suspended because leadership at the orthopedic clinic were not realizing reductions in missed appointment rates in the clinic or therapy settings utilizing internal reporting processes.

The current study analyzes the six months of data following the implementation of the CHW program with the goal of determining whether the CHW intervention was effective in reducing the "no-show" rates among the CCO-member patient population. In addition, this study aims better understand the characteristics of patients who are more likely to miss scheduled follow-up appointments, so that future CHW interventions can target patients at the highest risk for missing appointments. A retrospective analysis was conducted using existing medical records, appointment records, CCO member records, and CHW notes created in the practice's electronic health record between March 1, 2017 and September 31, 2017. This project will provide insight into the differences in appointment completion patterns between Medicaid beneficiaries and other payer types, better define characteristics of patients who do not keep scheduled appointments, and propose informed changes to better focus CHW efforts in the future.

SPECIFIC AIMS

1. To determine whether CHW outreach effectively reduced no-show rates among the CCO-member patient population during the study period.

2. To better understand the characteristics of CCO-member patients who are more likely to miss appointments as well as the characteristics of appointments that are more likely to be missed by CCO-member patients.

HYPOTHESES

The hypotheses for this study are based on the review of the current literature.

1. **CCO-member patients who received one or more outreach attempt from the CHW had a significantly lower no-show burden than those who did not receive an outreach attempt.** This is based on the demonstrated association between CHW intervention and increased compliance with follow-up appointments [10], [12], as well as with related variables patient activation [11], [17], [19] and patient-provider communication [11], [13], [18].

2. **Younger age, race/ethnicity other than non-white and Non-Hispanic, current tobacco use, and specific body parts are associated with higher odds of no-showing among CCO-member patients.** This is based on the demonstrated associations of younger age and non-white race/ethnicity with increased no-show rate across various medical specialties [24] and the demonstrated associations of tobacco use and appointments for specific body parts, such as hip and back, with increased no-show rate in orthopedic clinics [25], [26].

LITERATURE REVIEW

CHW Intervention. Previous studies have analyzed the effect that CHW intervention has on patient care, exploring variables such as patient compliance with follow-up appointments, patient activation scores, patient-provider communication, health outcomes, and subsequent hospitalizations. Most of these studies have been done on populations very similar to the one for this study, including low-income patients and patients that are publicly insured or not insured at all. All of these studies, however, have involved a different healthcare specialty than the one this study will focus on; to our knowledge, no studies like this have been conducted in an orthopedic setting.

CHWs and Adherence to Treatment Plans. Much research has been done on the relationship between CHW intervention and patient compliance with scheduled appointments. A 2017 review looked at 24 studies on patients with various types of cancer -- most of which involved low-income, urban, or uninsured populations -- and found all 24 of these studies resulted in improved compliance with follow-up screenings when CHW or similar interventions were used [12]. This shows a clear, reproducible link between CHW intervention and an increased proportion of kept follow-up appointments. In 2016, Mundorf et al. showed low-income pregnant women who self-reported a better relationship with the CHW were more likely to keep all of their appointments [10]. Mundorf's study suggests patient compliance may not only be linked to CHW

intervention in general, but also to quality of CHW intervention, i.e. the degree to which they are able to develop a relationship with the patient.

CHWs and Patient Engagement. Some researchers have looked at the effect of CHW intervention on patient activation, a measure of a patients' "knowledge, confidence, and skills for self-management" [19]. This is often used as a measure of a patient's engagement in their treatment because it reflects their belief that the patient's role is important and their confidence to take action. Patient activation is measured using the Patient Activation Measure (PAM) test for self-management. Three studies have investigated the relationship between CHW intervention and PAM scores in populations of low-income or Medicaid patients with chronic diseases, all finding higher PAM scores in CHW intervention groups [11], [17], [19]. While these studies didn't directly measure patients' tendencies to keep or miss scheduled appointments, they do provide evidence that CHW intervention increases patients' engagement in their care which is likely associated.

Similarly, other studies have shown CHW intervention influences patient-provider communication. Like the patient activation studies mentioned above, these studies don't directly measure patient compliance with appointments but do provide more reason to believe that patients tend to be more actively engaged in their treatment when CHWs reach out to them. A 2007 study on Medicaid-enrolled pregnant women found that a nurse-CHW home visit program resulted in significantly more contact between patients and

providers and was effective in "reaching women who had barriers to participation" such as difficulty forming relationships or fearfulness of professionals [13].

In 2016, Ibe et al. looked at a population of low-income patients with hypertension and found that longer duration of CHW exposure and larger number of topics discussed with the CHW resulted in greater patient participation in dialogue with health care providers [18]. Ibe's study suggests the duration and depth of the interaction with the CHW is correlated with the patient's level of engagement as well. Lastly, a 2014 study on uninsured or Medicaid patients in an urban hospital found that CHW intervention resulted in higher quality patient-provider communication, as rated by the patients [11]. This study suggests that CHWs positively affect the quality, not just the quantity, of patient-provider communication.

CHWs and Quality of Care. Some research done on CHWs does not directly relate to the concepts of patient compliance or engagement but does have implications for the overall quality of care. For instance, two studies have looked directly at changes in health outcomes resulting from CHW intervention in low-income and Medicaid-enrolled populations, collectively finding improvements in outcomes for asthma, diabetes, obesity, and smoking, but not for hypertension [14], [15]. Other researchers have focused on subsequent hospitalizations after discharge from care. A 2011 study investigated exclusively hospitalizations and claims after release from care in a population of Medicaid

patients and found CHW intervention to result in significant reductions in these numbers [16]. A few of the previously-mentioned studies also explored the number of hospitalizations after discharge, all finding that CHW intervention tended to reduce this number [11], [14], [15]. The reason behind our study's focus on follow-up appointment compliance is ultimately to ensure better health outcomes and fewer subsequent hospitalizations, so these are relevant.

Specifics of CHW Outreach Methods. Recently, Justvig et al. (2017) focused on the intricacies of CHW outreach in a population of primarily Medicaid-enrolled families in need of pediatric care. The researchers aimed to identify specific CHW tasks that consistently helped patients of various demographics to complete recommended care. They found that the most consistently effective tasks were reviewing appointment logistics, assisting with medication maintenance, and providing general health education. Additionally, Justvig and her team aimed to identify characteristics of patients that were predictors of successful treatment plan completion. The characteristics that they identified were Hispanic ethnicity and self-reported goals of keeping track of medical information or newborn-specific care [27]. In the discussion section of the paper, the authors stated that "our findings support continued efforts to ensure [CHWs] are targeting populations most likely to benefit" from their services [27].

The current body of literature suggests that CHW programs have a positive effect on patient adherence to treatment plans, patient engagement and

overall quality of care. This study will add to the current body of literature by describing the impact of a CHW program on patients' appointment adherence in an orthopedic clinic, a setting which has not yet been examined in this context.

Predictors of Missed Appointments. Many studies have analyzed the correlation between various patient characteristics and higher likelihood of missing scheduled medical appointments. A 2018 review of 105 studies across various specialties, primarily in North America, found that the patient characteristics most frequently correlated with increased no-show rate were younger age, public health insurance, and non-white race/ethnicity [24]. Notably, the two exclusively-orthopedic studies in this review did not find significant correlation with either age or race/ethnicity. Rather, these studies highlighted strong associations between increased no-show rates and tobacco use [25], [26]. These two orthopedic studies also analyzed no-show rates of appointments scheduled for various body parts, with one finding hip/pelvis appointments to be the most likely to be no-showed [25] and the other finding back/spine injuries to be the most likely [26]. Also of note, the 2018 review of studies found physical therapy appointment no-show rates to be dramatically higher than that of any other specialty, with an average no-show rate of 57% compared to the overall average of 23% [24]. This is of importance to our study since ours involves both physical therapy and clinic appointments.

The current body of literature suggests that young age, public health insurance, and non-white race/ethnicity are associated with a higher likelihood of missing

appointments in a medical clinic of nearly any specialty. It also suggests tobacco use and hip or back injuries are associated with the likelihood of missing appointments in orthopedic clinics. This study will add to the current body of literature by either confirming or contradicting these previously suggested predictors of missed appointments and by identifying other predictors in an orthopedic setting. Importantly, it will also identify predictors of missed appointments in an exclusively-Medicaid patient population, as opposed to a multi-payer population like those in the above-mentioned studies.

METHODS

Study Design. The current study is a retrospective cohort study of data collected between March 1, 2017 and September 31, 2017. No new data collection occurred for this study.

Study Population. The cohort included every clinical and physical therapy appointment that was scheduled at Slocum Center for Orthopedics and Sports Medicine between March 1, 2017 and September 31, 2017, and every patient corresponding to those appointments. Patients under the age of 18 were excluded from the study.

Protection of Human Subjects. The study was approved by the PeaceHealth Oregon Institutional Review Board (IRB). All patient data was de-identified with study-specific ID numbers so that no link could be made between the data and the specific person.

Additionally, all data were stored on passphrase-protected computers behind a limited access, key-entry door in a HIPAA-compliant facility and were only accessed by analysts who had completed requisite human subjects training. All this was done to minimize the risk of a breach of confidentiality, which was the only identified risk to the human subjects in this retrospective study.

Data Collection and Sources. Patient and appointment data were received in the form of multiple Excel™ files from data analysts at the orthopedic clinic and CCO. Clinic and CCO data analysts matched patients by health plan identification number before de-identifying. Only de-identified data were provided in research files. All data used were collected per standard of care at the clinic or standard administrative operations at the CCO. Demographic data originated from patient self-identified characteristics and health history during check-in at the clinic. The data received are summarized here:

<u>From Orthopedic Clinic:</u>

- Clinic and Physical Therapy Appointments
    - Patient ID
    - Appointment ID
    - Date of appointment
    - Age of patient in days
    - Kept, cancelled, and rescheduled indicators
    - Body part of interest

- Clinic and Physical Therapy Patients
    - Patient ID
    - Gender
    - Race
    - Ethnicity
    - Preferred language
    - Marital status
    - Payer classification
    - Health history
        - Chronic diseases
        - Surgeries/procedures
        - Date of procedure
    - Alcohol use status, types, and frequency
    - Recreational drug use status and types
    - Tobacco use status
- CHW Outreach Attempts
    - Patient ID
    - Encounter ID
    - Note creation date and time

<u>From CCO:</u>

- CCO-Member Patients
    - Patient ID

- CCO product description
- Medicaid utilization history*
    - PCP, Specialist, Inpatient, and ED
- Months as member*
- Non-emergency medical transport use indicator*
- Rural/urban address designation

* During 12 months prior to first appointment in study period

All data cleaning and recoding was conducted on STATA version 15.0 (Stata Corp, College Station, TX).

Primary Outcome Variables. The outcome of interest for this study was the frequency of "no-show" appointments. A no-show appointment was defined as lack of patient presence at the scheduled appointment time, in which no attempts to cancel or reschedule the appointment were documented. This was necessarily measured in different ways at the patient level and appointment level.

Patient Level. To effectively measure the no-show burden that a given patient contributed during the study period, a weighted no-show rate (WNSR) statistic was developed. The equation for WNSR is shown here:

$$WNSR = \frac{(Number\ of\ no-shows)^2}{Number\ of\ viable\ appointments}$$

The WNSR is a unit-less number that describes a patient's no-show burden relative to that of other patients, with a higher WNSR indicating a higher propensity to consistently miss scheduled appointments. As opposed to a raw rate of no-showed appointments, WNSR differentiates two patients who failed to show up for the same proportion of their appointments but had a different overall number of appointments. For instance, a patient who missed 1 of 2 appointments (50% no-show rate, 0.5 WNSR) is distinguishable by WNSR from a patient who missed 10 of 20 appointments (50% no-show rate, 5.0 WNSR). While these two patients both missed half their scheduled appointments, the latter represents a much greater impact on the clinic and on the patient's treatment plan, and thus should not be taken as equivalent to the former. WNSR calculations for clinic patients only took into account their clinic appointments and WNSR calculations for therapy patients only took into account their therapy appointments, regardless of whether a given patient had both types of appointments. Mean WNSR rates are reported with the standard deviation (sd).

At some points during patient-level analysis, raw counts of no-shows and appointments were used to provide a more natural representation of no-show tendencies.

Appointment Level. No-show frequency at the appointment level was simply measured as counts of kept and no-showed appointments, since keeping or no-showing an appointment are mutually exclusive outcomes.

Independent Variables. Patient characteristics and appointment characteristics were examined separately throughout the project. This was necessary in order to describe both the type of patient that tends to miss appointments and the type of appointment that tends to be missed. Most characteristics were cleaned and recoded to create consistent result categories, which are described below.

Primary Independent Variable of Interest

CHW outreach status was a binary indicator of attempted outreach during the study period, derived from a full list of CHW outreach attempts. Some outreach attempts were mistakenly made to non-CCO members whose membership had expired recently and was not yet renewed. These outreach attempts were ignored for the purposes of our study.

Patient Characteristics.

Payer classification identified each patient's primary payer as "Medicaid," "Medicare," "Commercial," or "Other." These were collapsed and recoded from a more specific list received from the orthopedic clinic. Included in the "Other" category were motor-vehicle accident insurance (MVA), Tricare/veterans affairs (VA), self-pay, and worker's compensation.

CCO member status identified each patient as either a CCO member or not. This was derived from the list of patients for whom we received data from the CCO. All CCO members fell within the "Medicaid" primary payer

classification. Some CCO members were both “Medicaid” and “Medicare” since they were reported by the CCO to be dually eligible, but they were still included in the CCO member Medicaid patient group.

Patient demographics consisted of:

- **Age** was defined as the patient’s age in years at their first appointment during the study period. Since the study period is only six months long, patients’ ages changed only minimally after their first appointment; the age distributions of first appointments and all appointments were nearly identical. Therefore, age was examined as a patient characteristic since it is demographic and considered at the patient level in practice.
- **Gender** was simply male or female, as self-reported by each patient.
- **Marital status** was either “Married/Life Partner,” “Single,” “Divorced,” or “Widowed.” These remained as self-reported by each patient except that “Married” and “Life Partner” were combined into the same group. “Single,” “Divorced,” and “Widowed” were kept separate throughout much of the analysis since they could reasonably be believed to represent a functional difference, though in some cases they were combined as “Unmarried.”
- **Race and ethnicity** were self-reported by patients as two separate variables but were recoded to a single variable reported as either “White, Non-Hispanic,” “Other,” “Declined to Specify.” This is because white non-Hispanics make up a large majority of the overall patient population

at the orthopedic clinic and other specific racial or ethnic subpopulations were too small for meaningful analysis. “Declined to Specify” was kept separate from a missing response because the active choice to decline could represent a distinct population characteristic that may be of interest in our study.

- **Tobacco, alcohol, and recreational drug statuses** all showed either “Current,” “Former,” or “Never.” Alcohol status was changed to “Current” if their status was “Never” but alcohol type and frequency were specified, assuming an accidental incorrect status response. Alcohol type was omitted since responses were too varied for meaningful analysis. Alcohol frequency was used occasionally in analysis as a binary variable indicating “Frequent” use of more than 3 days a week or otherwise. Recreational drug type was omitted since roughly 97% of responses included marijuana and other counts of drug types were insignificant.

Patient health history consisted of binary indicators for three things:

- **Surgical patient:** at least one surgery undergone at the orthopedic clinic during the study period
- **Procedure history:** at least one procedure of any kind undergone anywhere prior to their first appointment during the study period. Derived from a list of procedures undergone by each patient. The most

common procedures undergone were knee, hip, shoulder, hand, wrist, and back surgeries but a wide variety of other procedures were included as well including cesarean sections, appendectomies, heart stents, oral surgeries, exploratory surgeries, and many more.

- **Chronic disease history:** at least one chronic disease diagnosed prior to the study period. Derived from a list of chronic diseases diagnosed for each patient. Diseases included cancer, diabetes, cardiovascular diseases, asthma, kidney disease, liver disease, mental diseases among others.

CCO patient information was available only for patients whose CCO member status was verified by the CCO. This information consisted of:

- **Member months:** number of months enrolled as a CCO member out of the 12 months prior to their first scheduled appointment during the study period. If this was not 12, it was either because the patient is a new CCO member or because they allowed their membership to lapse by failing to fill out the correct renewal paperwork on time and later completed this process.
- **Medicaid utilization history:** binary indicators of at least one PCP, specialist, inpatient, and ED encounter in the 12 months prior to their first scheduled appointment during the study period. Derived from the raw count of encounters for each patient.

- **Non-Emergency Medical Transport (NEMT):** binary indicator of non-emergency medical transport utilization in the 12 months prior to their first scheduled appointment during the study period.
- **Residence Type:** designation of the patient's address as rural or urban.

Appointment characteristics.

Body part of interest was the only appointment-specific characteristic used for our study. A given patient may have received treatment for multiple body parts during the study period, so this variable could not be analyzed at the patient level. This variable took the form of a binary indicator for each body part derived from a text variable that described the body part in a non-uniform manner. There were 14 specific body part indicators in total which were collapsed to three categories:

1. Upper body
    - Clavicle
    - Shoulder
    - Arm (in-between joints)
    - Elbow
    - Wrist
    - Hand (fingers or palm)

2. Lower body
    - Hip (joint)
    - Pelvis (non-joint)
    - Leg (in-between joints)
    - Knee
    - Achilles
    - Ankle
    - Foot (toes or heel)
3. Back, Neck, Spine, or Head

Many appointments were for multiple body parts, so the 'Hip' indicator variable, for instance, was positive whether the body part of interest was "hip," "hip/ knee," "arm/ hip," "back/ hip/ leg," or anything else which contained a hip. Additionally, a patient with a body part of interest of "arm/ hip," for instance, was positive for both the 'Upper body' and 'Lower body' indicators. A bilateral indicator was also used for appointments which had at least one body part of interest that was a bilateral issue (on both the right and left side of the body).

Descriptive Statistics. Proportions (for categorical variables) or means and standard deviations (for continuous variables) are reported for each variable. Proportions and means in different groups were compared using appropriate measures of central tendency to test statistical significance. Categorical variables were compared using chi-squared tests for cell counts above five observations. If one of the frequencies was below five, the non-parametric Fisher's exact test was used instead. Continuous

variables were compared using either t-tests (two group comparison) or analysis of variance (ANOVA) tests (> two group comparison). The threshold for statistical significance was set at $p = 0.05$ for the purposes of our study.

Data Analysis. Analysis was stratified by type of appointment (clinic or physical therapy) throughout the study. This is because the two are fundamentally different types of appointments and consequently have considerably different rates of no-shows, as established in prior literature [24]. Patients who had at least one clinic and at least one therapy appointment during the study period were included in both groups.

Total Patient Population: CCO Members vs. Other

Baseline characteristics. The patient and appointment characteristics of the CCO patient population were compared to those of all other payer types combined in order to understand how the two populations differ. Because the orthopedic clinic had previously identified CCO patients as having a higher frequency of no-shows from internal reporting processes, primary outcome variables were also compared between the two groups.

No-show burden. The average WNSR values of characteristic subpopulations of the CCO patient population were compared to those of all other payer types combined in order to describe how no-show tendencies varied by patient characteristic and how each characteristic may contribute to the difference in overall no-show tendencies between the two populations. No-show rates by

different body parts were also compared between appointments belonging to a CCO patient versus all other payer types combined.

CCO Patient Population: CHW-Outreached vs. Other

Baseline Characteristics. The patient and appointment characteristics of the CHW-Outreached CCO patient population were compared to CCO patients who did not receive any documented intervention in order to understand how the two populations differed.

No-show burden. The average WNSR values of characteristic subpopulations of CCO patients receiving CHW outreach were compared to those of CCO patients who did not receive outreach in order to explore the impact of CHW outreach on no-show tendencies. For this analysis, WNSR values were calculated using only appointments scheduled after the date of the patient's first CHW outreach attempt if they had one. This approach reduced the available sample size, but ensures CHW efforts occurred before a scheduled appointment.

CCO Patient Population: Characteristics Associated with No-shows

Characteristics by no-show frequency. The patient characteristics of CCO patients were compared across three no-show categories: zero no-shows, exactly one no-show, and multiple no-shows. These categories were divided up in this way because of the functional difference they represent: no-showing once is minimally impactful both in terms of the patient's health outcome and the

clinic's operations, but no-showing repeatedly is much more impactful to clinical operations, and potentially to the patient health outcomes. Thus, we described the characteristics of the CCO patients who constitute the largest no-show burden, of the CCO patients who contribute minimal no-show burden, and of the CCO patients who don't contribute any no-show burden.

Characteristics associated with no-shows. Univariate logistic regression was used to identify patient and appointment characteristics associated with odds of a no-show for a given appointment among the CCO patient population. The outcome for this association is binary: kept appointment or no-show. The odds ratio (OR) was also used in analysis to describe the association between various characteristics and odds to no-show a given appointment. The OR calculates the odds that a no-show will occur given a particular characteristic compared to the odds that it will occur given the absence of that characteristic. In general, ORs for categorical variables were calculated by dividing the product the number of no-shows given a characteristic and the number of kept appointments given the absence of said characteristic by the product of the number of no-shows given the absence and the number of kept appointments given the characteristic. As an example, the formula of an OR for male gender is shown below:

$$OR = \frac{(\#\ of\ no-shows\ by\ males)(\#\ of\ kept\ apts\ by\ females)}{(\#\ of\ no-shows\ by\ females)(\#\ of\ kept\ apts\ by\ males)}$$

These ORs represent the increase or decrease in the odds of a no-show occurring when the characteristic is added. An OR of 1.50 for the 'male' characteristic indicates that a male has 1.50 times higher odds of missing an appointment than a non-male (female), whereas an OR of 0.50 indicates the opposite; the odds of males no-showing are 0.50 times less, or 50% less, compared to females. ORs for continuous variables, such as age, are interpreted as the association of a one-unit increase in age on the outcome (odds of no-show). For example, an OR of 1.50 would indicate for each one-year increase in age, the odds of no-show are 1.50 times greater.

For each OR presented, the 95% confidence interval is presented with it. The 95% confidence interval provides the upper and lower limits of the OR estimate, in which we can be 95% confident the true association between our independent variable and outcome is likely. For example, an OR of 1.50 for patients who are not married with a 95% confidence interval of 1.20 – 1.80 indicates the odds of no showing for an appointment are 1.50 times greater among unmarried patients compared to married patients and that we can be 95% confident the true association is between 1.20 and 1.80. Any confidence interval that includes 1.0 means the association is not statistically significant, as indicated by their respective p-value, since an OR equal to 1.0 indicates no association is present.

RESULTS

Total Patient Population: CCO Members vs. Other

Baseline Characteristics. Table 1 compares the patient characteristics of the CCO patient population to that of the remainder of the patient population for both clinic and physical therapy appointments. There were 20,089 clinic patients (2,848 CCO and 17,241 other) and 2,437 therapy patients (386 CCO and 2,051 other) in the study. There were 2,268 patients (370 CCO and 1,898 other) that had at least one clinic appointment and at least one therapy appointment during the study period and are therefore included in both groups.

In both clinic and therapy, CCO patients had a significantly lower mean age, lower proportion of married patients, higher proportion of current smokers, lower proportion of current alcohol drinkers, and higher proportion of recreational drug users compared to other types of patients ($p < 0.0001$ for all). The CCO patient population also had a significantly higher proportion of patients with at least one no-show, a significantly higher average no-show count, and a significantly higher average WNSR value in both clinic and therapy ($p < 0.0001$ for all). Notably, CCO patients had a significantly higher average number of clinic appointments (2.80 CCO, 2.61 other, $p < 0.0001$) but had a significantly lower average number of therapy appointments (5.79 CCO, 6.00 other, $p = 0.047$). Other patient characteristics were significantly different between CCO and other in clinic, but not therapy. For example, 66% of CCO clinic patients were white and non-Hispanic compared to 71% of other clinic patients ($p <$

0.0001) while 68% of CCO therapy patients were white and non-Hispanic compared to 72% of other therapy patients ($p = 0.275$). Along with race/ethnicity, this applied for gender, proportion of surgical patients, proportion of patients with one or more past procedure, and proportion of patients with one or more chronic disease. Nearly every comparison between CCO and other in clinic yielded a significant p-value, with only two not yielding one less than 0.0001.

Table 2 compares the appointment characteristics of the CCO patient population's appointments to that of the remainder of the patient population's appointments in both clinic and therapy. There were 52,877 clinic appointments (7,962 CCO and 44,915 other) and 14,540 therapy appointments (2,236 CCO and 12,304 other) in the study.

The CCO patient population and the remainder of the patient population had significantly different body parts of interest for both clinic and therapy appointments. CCO patients had a significantly higher percentage of upper body appointments and a significantly lower percentage of lower body appointments than other patients ($p < 0.0001$ for all). The difference in upper body appointment frequency is attributable to higher frequencies of elbow, wrist and hand appointments among CCO patients, which all yielded p-values < 0.0001 in both clinic and therapy. Likewise, the difference in lower body appointments can be largely accounted for by lower frequencies of hip appointments among CCO patients, each yielding p-values < 0.0001 in both clinic and therapy as well. The frequency of leg appointments among CCO patients was significantly higher than among other patients in both clinic and therapy ($p < 0.0001$ for

both). CCO patients also had appointments, both clinic and therapy, for bilateral issues significantly less often than other patients (clinic $p = 0.042$, therapy $p < 0.0001$).

CCO patient no-showed their clinic and therapy appointments significantly more often than other patient's appointments during the study period ($p < 0.0001$ for both). The difference was greatest for therapy appointments, where the frequency of no show appointments was 10% higher among CCO patients than by patients with another payer type.

No-show Burden. Table 3 compares the mean weighted no-show rate (WNSR) values by patient characteristic, comparing CCO patients and other patients in clinic and in therapy, respectively. The WNSR represents the overall burden of missed appointments. With very few exceptions, CCO patients of every demographic and health-history background had significantly higher mean WNSR values than other patients in both clinic and therapy. In the few cases where the difference was not found to be significant, sample size was small (< 25). No comparison in a certain patient characteristic was insignificantly different in both clinic and therapy; one or the other was always found to be significantly higher for CCO patients.

For both CCO patients and other patients, mean therapy WNSR values were considerably higher than mean clinic WNSR values in nearly every patient characteristic. The highest mean clinic WNSR values were those for CCO patients with no procedure history (0.349 ± 0.511), with non-white race or non-Hispanic ethnicity (0.287 ± 0.465), and with no chronic disease history (0.248 ± 0.465). The highest mean therapy WNSR values, excluding those with sample sizes below 25, were those for

CCO patients with current tobacco use noted (0.541 ± 0.759) with ages under 45 (0.500 ± 749) with current recreational drug use noted (0.436 ± 0.813) and with non-white race or non-Hispanic ethnicity (0.408 ± 794).

Table 4 compares the proportion of no-showed clinic and therapy appointments for various body parts between CCO patients and patients with other payer types. In clinic and therapy, both upper body appointments and lower body appointments were missed significantly more often by CCO patients than by other patients ($p < 0.0001$ for all). All body parts with appointment volumes greater than 25 yielded significantly higher mean WNSR values for CCO patients. Additionally, clinic and therapy appointments for bilateral issues were missed significantly more often by CCO patients than patients with other payer types ($p < 0.0001$ for both).

Upper body, lower body, and bilateral therapy appointments were missed considerably more often by CCO patients than their respective clinic appointments. The body parts for which clinic appointments were missed most often by CCO patients, excluding those with sample sizes below 25, were hand (12%) and wrist (11%), which account for nearly one-quarter of all missed appointments (22%). The body parts for which therapy appointments were missed most often, excluding those with sample sizes below 25, were hand (19%) and shoulder (16%).

CCO Patient Population: CHW-Outreached vs. Other

Baseline Characteristics. Table 5 compares the characteristics of clinic and therapy CCO patients that received CHW outreach during the study period to those that did not.

There were 2,848 clinic patients during the study period and 8% received at least one outreach attempt from the CHW (228 outreached and 2,620 not). In therapy, 386 patients were scheduled during the study period and 42% received at least one outreach attempt from the CHW (164 outreached and 222 not). There were 370 patients that had at least one clinic appointment and at least one therapy appointment during the study period (163 outreached and 207 not) and were therefore included in both groups.

The characteristics of outreached patients and non-outreached patients had very few significant differences in either clinic or therapy. The proportion of surgical patients were significantly different in both groups (clinic $p < 0.0001$, therapy $p = 0.009$), with a notable difference in clinic (outreached: 48% surgical, not: 5% surgical). In clinic, the two also had significantly different proportions of patients with at least one procedure in their health history (outreached: 95%, not: 87%, $p = 0.001$), of patients with at least one specialist visit in the past year (outreached: 93%, not: 98%, $p < 0.0001$), and of patients with rural residence (outreached: 20%, not: 26%, $p = 0.049$). In therapy, the two had significantly different proportions of patients who were inpatients in the past year (outreached: 13%, not: 21%, $p = 0.033$).

Table 6 compares the appointment characteristics of the CHW-outreached CCO patient population's appointments to that of the non-outreached CCO patient population's appointments in both clinic and therapy. There were 7,962 clinic appointments, 14% of which were for outreached patients (1,093 outreached, 6,869 not), and 2,236 therapy appointments, 47% of which were for outreached patients (1,042 outreached, 1,194 not).

CHW-outreached patients and non-outreached patients did not have significantly different proportions of upper body or lower body clinic appointments (upper $p = 0.340$, lower $p = 0.351$), but they did have significantly different proportions of both in therapy ($p < 0.0001$ for both). In clinic, outreached patients had significantly lower proportions of clavicle ($p = 0.027$), elbow ($p < 0.0001$), wrist ($p = 0.005$), leg ($p = 0.001$), ankle ($p = 0.008$), and foot appointments ($p = 0.002$) and significantly higher proportions of arm ($p = 0.036$), hand ($p = 0.001$), and knee appointments ($p < 0.0001$). In therapy, outreached patients had significantly lower proportions of elbow ($p = 0.001$), wrist ($p < 0.0001$), hand ($p < 0.0001$) and pelvis appointments ($p = 0.005$) and significantly higher proportions of leg ($p = 0.014$), knee ($p < 0.0001$), and foot appointments ($p = 0.030$). Outreached patients had a significantly lower proportion of bilateral clinic appointments ($p = 0.016$) but there wasn't a significant difference in bilateral therapy appointments ($p = 0.104$).

No-show Burden. Table 7 compares the mean WNSR values with characteristics of CCO patients who received CHW outreach to those who did not in both clinic and therapy. In order to accurately portray the no-show behavior of patients after they received CHW outreach, only appointments occurring after the date of a patient's first CHW outreach were used in calculations. Because of this, some patients who received CHW outreach and did not have a subsequent appointment were not included in the analysis. There were 2,760 clinic patients (140 outreached, 2,620 not) and 367 therapy patients (145 outreached, 222 not) included in this analysis. There were 315 patients

that had at least one clinic appointment and at least one therapy appointment during the study period and were therefore included in both groups.

Comparisons within very few patient characteristics yielded a significant p-value. Male therapy patients receiving CHW outreach had a significantly higher average WNSR than those who did not ($p = 0.028$), as did married therapy patients ($p = 0.018$) and non-white or non-Hispanic therapy patients ($p = 0.021$). In therapy, those comparisons that did not yield a significant result also followed this trend of higher WNSR values among CHW-outreached patients, almost without exception. CHW-outreached clinic patients with a PCP visit in the 12 months before their first appointment had a significantly lower average WNSR value than the analogous non-outreached patients ($p = 0.015$). In clinic, those comparisons that did not yield a significant result almost always followed this trend of lower WNSR values among CHW-outreached patients.

CCO Patient Population: Characteristics Associated with No-shows

Characteristics by No-show Frequency. Table 8 compares the characteristics of CCO clinic and therapy patients in three no-show categories: zero no-shows, exactly one no-show, and multiple no-shows. Of the 2,848 clinic CCO patients in the study, 2,235 (78%) were in the zero category, 503 (18%) were in the one category, and 110 (4%) were in the multiple category. Of the 386 therapy CCO patients in the study, 207 (54%) were in the zero category, 100 (26%) were in the one category, and 79 (20%) were in the multiple category. There were 370 CCO patients (96% of the therapy patients) who

had at least one clinic appointment and at least one therapy appointment during the study period and were therefore included in both groups (clinic: 284 zero, 67 one, 19 multiple; therapy: 198 zero, 96 one, 76 multiple).

Five patient characteristics were significantly different across the three categories in both the clinic and therapy groups: age, tobacco status, surgical patient status, chronic disease history, and recent Medicaid usage at a specialty clinic. Mean age progressively decreased as number of no-shows increased (clinic: 48.0 zero, 42.3 one, 42.0 multiple; therapy: 47.9 zero, 43.6 one, 37.7 multiple). Similarly, the proportion of patients who report current tobacco usage increased as number of no-shows increased (clinic: 33% zero, 47% one, 47% multiple; therapy: 26% zero, 39% one, 51% multiple). The proportion of patients with no chronic disease history was higher in the categories with at least one no show than in the zero no-show category (clinic: 20% zero, 34% one, 30% multiple; therapy: 21% zero, 23% one, 35% multiple), as did the proportion of surgical patients (clinic: 7% zero, 10% one, 13% multiple; therapy: 54% zero, 52% one, 70% multiple). Lastly, the proportion of patients who had seen a specialist in the past year was higher in the zero no-show category than in the others (clinic: 99% zero, 94% one, 96% multiple; therapy: 98% zero, 92% one, 94% multiple).

Some characteristics showed a similar trend in the clinic and therapy groups but were only found to be significant in the clinic group. For instance, the proportion of male patients was notably higher in the multiple no show category in both groups, but significantly higher in clinic (clinic $p < 0.0001$, therapy $p = 0.088$). The same is true for the proportion of patients who hadn't seen a PCP in the past year (clinic $p = 0.001$,

therapy $p = 0.111$) and the proportion of patients who had used non-emergency medical transport in the past year (clinic $p = 0.002$, therapy $p = 0.152$). Similarly, the average number of months out of the last 12 months that patients were a CCO member decreased steadily in both groups as number of no-shows increased, but this was only significant in the clinic group (clinic $p = 0.002$, therapy $p = 0.055$).

Other characteristics showed different trends in the clinic and therapy groups, leading to a significant result in clinic but an insignificant one in therapy. For instance, the proportion of single patients increased steadily as number of no-shows increased in the clinic group but remained much more constant in the therapy group (clinic $p < 0.0001$, therapy $p = 0.137$). The same is true for the proportion of patients who had visited the ED in the past year, and even more extremely so (clinic $p < 0.0001$, therapy $p = 0.942$).

Characteristics Associated with No-shows. Table 9 presents odds ratios (ORs) describing the association of various CCO patient and appointment characteristics with the odds any no-showing a clinic or therapy appointment, respectively. There were 7,962 clinic appointments and 2,236 therapy appointments included in the analysis.

In clinic, decreased age, male gender, unmarried status, non-white race or non-Hispanic ethnicity, current tobacco usage, and non-alcohol usage were all patient demographics significantly associated with increased odds of no-showing. Unmarried status was the most extreme among these, with an OR of 1.53 ($p < 0.0001$) indicating to the odds of no-show a given clinic appointment are 1.53 times greater among appointments belonging to unmarried patients relative to married individuals. In

therapy, decreased age, current tobacco usage, and non-alcohol usage were the only patient demographics significantly associated with increased odds of no-showing. Tobacco usage was associated with the greatest odds of no show with an OR of 2.39 ($p < 0.0001$), indicating a more-than-two-fold increase in odds to no-show a given therapy appointment relative to non-tobacco users.

Analysis of patient health history showed status as a surgical patient, history of procedures, and history of chronic diseases to all significantly decrease the odds of no-showing a given clinic appointment. In therapy, though, procedure history did not give a significant result ($p = 0.243$). The most protective characteristic in clinic was procedure history (OR 0.27, $p < 0.0001$) and in therapy was status as a surgical patient (OR 0.70, $p = 0.006$). Patients with a history of surgical procedures prior to being a Slocum patient have 0.27, or 73% less odds of missing their scheduled appointment compared to patients with no prior procedure history. Similarly, having a recent orthopedic surgery is also protective; patients with recent orthopedic surgery have 30% less odds of no-showing compared to non-surgical patients.

In both clinic and therapy, increased number of months as a CCO member, recent PCP visitation, and recent specialist visitation were found to significantly decrease the odds of no-showing a given appointment. In both cases, recent specialist visits were the most extreme (clinic OR 0.52, $p < 0.0001$; therapy OR 0.49, $p = 0.002$). Recent utilization of specialty services in the 12 months prior to the first scheduled orthopedic clinic reduces no-show odds by approximately half across both places of service. Meanwhile, recent emergency department visitation and NEMT usage in the prior 12 months were found to significantly increase the odds of no-showing a given

appointment. Recent ED visitation is associated with the highest odds of not showing up for a clinic appointment (OR 1.51, $p < 0.0001$). In therapy, history of utilizing NEMT in the 12 months before the first scheduled appointment in the study window was associated with the highest odds of missing a scheduled appointment (OR 1.55, $p = 0.001$), compared to patients with no prior history of using the NEMT benefit provided by the CCO.

Lastly, upper body part of interest and lower body part of interest were found to be inversely associated with the odds of no-shows in both clinic and therapy. Upper body was found to increase the odds of a no-show by around 1.3 times in each compared to other body parts (clinic OR 1.32, $p < 0.0001$; therapy OR 1.34, $p = 0.016$). In contrast, appointments for lower extremity appointments was associated with decreased odds of a no-show by around 25% in each (clinic OR 0.75, $p < 0.0001$; therapy OR 0.74, $p = 0.13$). Bilateral body part of interest did not yield a significant result in either type of appointment (clinic $p = 0.687$, therapy $p = 0.928$).

Table 1: Comparison of Baseline Patient Characteristics in Medicaid versus Other Payer Types, Stratified by Appointment Type (N = 20,258),[1] 1 of 3.

	Clinic Patients [2] (n = 20,089)					Therapy Patients [2] (n = 2,437)				
	Medicaid Target Population (n = 2,848)		Other Payer Types (n = 17,241)		P-value	Medicaid Target Population (n = 386)		Other Payer Types (n = 2,051)		P-value
Patient Demographics	n	%	n	%		n	%	n	%	
Age, y (mean ± sd)	46.7	±14.4	59.7	±16.9	<0.0001	44.7	±15.2	59.1	±16.3	<0.0001
Sex										
Male	1,197	(42)	7,861	(46)	<0.0001	154	(40)	927	(45)	0.054
Female	1,651	(58)	9,380	(54)		232	(60)	1,124	(55)	
Marital Status										
Single	1,326	(50)	3,169	(19)	<0.0001	192	(53)	402	(20)	<0.0001
Married / Life Partner	677	(25)	10,321	(63)		89	(24)	1,236	(63)	
Divorced	524	(20)	1,652	(10)		64	(18)	203	(10)	
Widowed	130	(5)	1,332	(8)		17	(5)	128	(7)	
Race/Ethnicity										
White, Non-Hispanic	1,886	(66)	12,228	(71)	<0.0001	262	(68)	1,467	(72)	0.275
Other	499	(18)	2,136	(12)		58	(15)	254	(12)	
Declined to Specify	463	(16)	2,877	(17)		66	(17)	330	(16)	
Tobacco Status										
Current	974	(35)	2,291	(14)	<0.0001	132	(35)	271	(13)	<0.0001
Former	760	(28)	4,966	(29)		97	(25)	576	(29)	
Never	1,015	(37)	9,570	(57)		154	(40)	1,162	(58)	
Alcohol Status										
Current	1,095	(40)	9,660	(57)	<0.0001	149	(39)	1,169	(57)	<0.0001
Frequent [3]	150	(5)	2,087	(12)		17	(4)	290	(14)	
Former	176	(6)	512	(3)		25	(6)	50	(3)	
Never	1,501	(54)	6,885	(40)		212	(55)	823	(40)	

Table 1: Comparison of Baseline Patient Characteristics in Medicaid versus Other Payer Types, Stratified by Appointment Type (N = 20,258),[1] 2 of 3.

	Clinic Patients [2] (n = 20,089)					Therapy Patients [2] (n = 2,437)				
	Medicaid Target Population (n = 2,848)		Other Payer Types (n = 17,241)		P-value	Medicaid Target Population (n = 386)		Other Payer Types (n = 2,051)		P-value
	n	%	n	%		n	%	n	%	
Recreational Drug Status										
Current [4]	325	(14)	795	(6)	<0.0001	42	(15)	97	(6)	<0.0001
Former	125	(5)	342	(2)		22	(8)	33	(2)	
Never	1,916	(81)	12,695	(92)		219	(77)	1,398	(92)	
Patient Health History										
Surgical Patient [5]	232	(8)	1,205	(7)	0.026	220	(57)	1,142	(56)	0.633
Procedures [6]										
None	352	(12)	1,192	(7)	<0.0001	17	(4)	96	(5)	0.813
One or more	2,496	(88)	16,049	(93)		369	(96)	1,955	(95)	
Chronic Diseases [7]										
None	650	(23)	3,588	(21)	0.015	95	(25)	452	(22)	0.266
One or more	2,198	(77)	13,653	(79)		291	(75)	1,599	(78)	
Insurance Payer Classification										
Medicaid	2,848	(100)	475	(3)	N/A	386	(100)	50	(2)	N/A
Medicare [8]	410	(14)	7,632	(45)		52	(14)	894	(44)	
Commercial	--	--	6,775	(40)		--	--	787	(39)	
Other [9]	--	--	2,011	(12)		--	--	303	(15)	

Table 1: Comparison of Baseline Patient Characteristics in Medicaid versus Other Payer Types, Stratified by Appointment Type (N = 20,258),[1] 3 of 3.										
	Clinic Patients [2] (n = 20,089)					Therapy Patients [2] (n = 2,437)				
	Medicaid Target Population (n = 2,848)		Other Payer Types (n = 17,241)		P-value	Medicaid Target Population (n = 386)		Other Payer Types (n = 2,051)		P-value
	n	%	n	%		n	%	n	%	
Patient Compliance										
>0 No Show	613	(22)	1,330	(8)	<0.0001	179	(46)	341	(17)	<0.0001
Apt Count (mean ± sd)	2.80	±2.39	2.61	±2.27	<0.0001	5.79	±4.77	6.00	±5.27	0.047
No Show Count (mean ± sd)	0.27	±0.59	0.09	±0.32	<0.0001	0.81	±1.12	0.23	±0.61	<0.0001
WNSR (mean ± sd) [10]	0.150	±0.38	0.049	±0.22	<0.0001	0.341	±0.61	0.080	±0.28	<0.0001

[1] Values will not always sum to n due to unavailability of data from some patients. [2] 2,268 patients (370 Medicaid Target Population and 1,898 Other) had at least one clinic apt and therapy apt and are therefore included in both groups. [3] 'Frequent' defined as at least three days per week. The alcohol p-values do not take frequency into account. [4] 96% of current drug users noted using marijuana. [5] Had surgery during study period. [6] All procedures underwent anywhere before study period. Most common procedures: knee, hip, shoulder, hand/wrist, back surgeries. [7] Chronic diseases diagnosed before study period. Diseases include cancer, diabetes, cardiovascular diseases, asthma, kidney disease, liver disease, mental diseases, and many others. [8] Medicaid target population patients may be dual eligible for Medicaid and Medicare. [9] Other payer classifications include MVA, Tricare/VA, Self-Pay, and Workers Comp. [10] See methods section for calculation of WNSR.

Table 2: Comparison of Baseline Appointment Characteristics in Medicaid versus Other Payer Types, Stratified by Appointment Type (N = 67,417), 1 of 2

	Clinic Appointments (n = 52,877)					Therapy Appointments (n = 14,540)				
	Medicaid Target Population (n = 7,962)		Other Payer Types (n = 44,915)		P-value	Medicaid Target Population (n = 2,236)		Other Payer Types (n = 12,672)		P-value
Appointment Information	n	%	n	%		n	%	n	%	
Body Part [1]										
Upper Body	3,325	(42)	15,008	(33)	<0.0001	932	(42)	4,143	(34)	<0.0001
Clavicle	67	(1)	280	(1)	0.026	--	(<1)	20	(<1)	0.235
Shoulder	902	(11)	6,036	(13)	<0.0001	363	(16)	1,946	(16)	0.248
Arm	130	(2)	671	(1)	0.350	33	(1)	218	(2)	0.323
Elbow	324	(4)	1,094	(2)	<0.0001	79	(4)	228	(2)	<0.0001
Wrist	946	(12)	3,196	(7)	<0.0001	142	(6)	511	(4)	<0.0001
Hand	1,055	(13)	4,090	(9)	<0.0001	347	(16)	1,288	(10)	<0.0001
Lower Body	4,654	(58)	29,927	(67)	<0.0001	1,302	(58)	7,956	(65)	<0.0001
Hip	551	(7)	4,993	(11)	<0.0001	96	(4)	1,575	(13)	<0.0001
Pelvis	20	(<1)	86	(<1)	0.272	9	(<1)	--	--	<0.0001
Leg	288	(4)	1,284	(3)	<0.0001	63	(3)	187	(2)	<0.0001
Knee	2,327	(29)	16,369	(36)	<0.0001	1,002	(45)	5,382	(44)	0.348
Achilles	39	(<1)	377	(1)	0.001	16	(1)	52	(<1)	0.062
Ankle	813	(10)	3,768	(8)	<0.0001	77	(3)	469	(4)	0.400
Foot	727	(9)	3,639	(8)	0.002	54	(2)	323	(3)	0.565
Back/Neck/Spine/Head	16	(<1)	136	(<1)	0.118	--	(1)	214	(2)	<0.0001
Bilateral [2]	658	(8)	4,027	(9)	0.042	95	(4)	829	(7)	<0.0001

Table 2: Comparison of Baseline Appointment Characteristics in Medicaid and Other Payer Types, Stratified by Appointment Type (N = 67,417), 2 of 2										
	Clinic Appointments (n = 52,877)					Therapy Appointments (n = 14,540)				
	Medicaid Target Population (n = 7,962)		Other Payer Types (n = 44,915)		P-value	Medicaid Target Population (n = 2,236)		Other Payer Types (n = 12,672)		P-value
	n	%	n	%		n	%	n	%	
Appointment Status										
Kept	7,201	(90)	43,402	(97)	<0.0001	1,923	(86)	11,823	(96)	<0.0001
No Show	761	(10)	1,513	(3)		313	(14)	481	(4)	

[1] Values will not sum to n because a given appointment can be for multiple body parts. [2] Indicates that at least one body part of interest for the appointment was a bilateral issue.

Table 3: Comparison of WNSR values within Patient Characteristic Groups in Medicaid versus Other Payer Types, Stratified by Appointment Type (N = 20,258) [1], 1 of 3						
	Clinic Patients [2] (n = 20,089)			Therapy Patients [2] (n = 2,437)		
	Medicaid Target Population (n = 2,848)	Other Payer Types (n = 17,241)	P-value	Medicaid Target Population (n = 386)	Other Payer Types (n = 2,114)	P-value
Patient Demographics	Mean WNSR (± sd)			Mean WNSR (± sd)		
Age, y						
< 45	0.199 (± 0.434)	0.098 (± 0.303)	<0.0001	0.500 (± 0.749)	0.164 (± 0.394)	<0.0001
≥ 45	0.115 (± 0.333)	0.038 (± 0.186)	<0.0001	0.186 (± 0.384)	0.060 (± 0.238)	<0.0001
Sex						
Male	0.178 (± 0.427)	0.058 (± 0.237)	<0.0001	0.365 (± 0.667)	0.083 (± 0.274)	<0.0001
Female	0.130 (± 0.343)	0.042 (± 0.194)	<0.0001	0.325 (± 0.575)	0.078 (± 0.282)	<0.0001
Marital Status						
Single	0.150 (± 0.404)	0.074 (± 0.259)	<0.0001	0.338 (± 0.626)	0.151 (± 0.372)	<0.0001
Married / Life Partner	0.100 (± 0.303)	0.025 (± 0.142)	<0.0001	0.393 (± 0.649)	0.050 (± 0.199)	<0.0001
Divorced	0.102 (± 0.278)	0.046 (± 0.196)	<0.0001	0.232 (± 0.419)	0.114 (± 0.375)	0.034
Widowed	0.062 (± 0.216)	0.053 (± 0.227)	0.693	0.321 (± 0.650)*	0.088 (± 0.347)	0.023
Race/Ethnicity						
White, Non-Hispanic	0.122 (± 0.358)	0.034 (± 0.172)	<0.0001	0.333 (± 0.552)	0.065 (± 0.234)	<0.0001
Other	0.287 (± 0.465)	0.147 (± 0.377)	<0.0001	0.408 (± 0.794)	0.124 (± 0.347)	<0.0001
Declined to Specify	0.119 (± 0.340)	0.042 (± 0.194)	<0.0001	0.314 (± 0.666)	0.114 (± 0.377)	0.001
Tobacco Status						
Current	0.167 (± 0.384)	0.084 (± 0.267)	<0.0001	0.541 (± 0.759)	0.147 (± 0.359)	<0.0001
Former	0.106 (± 0.348)	0.031 (± 0.159)	<0.0001	0.199 (± 0.366)	0.070 (± 0.268)	<0.0001
Never	0.096 (± 0.296)	0.032 (± 0.167)	<0.0001	0.265 (± 0.560)	0.069 (± 0.255)	<0.0001

Table 3: Comparison of WNSR values within Patient Characteristic Groups in Medicaid versus Other Payer Types, Stratified by Appointment Type (N = 20,258) [1], 2 of 3						
	Clinic Patients [2] (n = 20,089)			Therapy Patients [2] (n = 2,437)		
	Medicaid Target Population (n = 2,848)	Other Payer Types (n = 17,241)	P-value	Medicaid Target Population (n = 2,848)	Other Payer Types (n = 17,241)	P-value
	Mean WNSR (± sd)			Mean WNSR (± sd)		
Alcohol Status						
Current	0.118 (± 0. 314)	0.033 (± 0.168)	<0.0001	0.256 (± 0.524)	0.071 (± 0.267)	<0.0001
Frequent [3]	0.145 (± 0.373)	0.025 (± 0.143)	<0.0001	0.115 (± 0.262)*	0.043 (± 0.245)	0.243
Former	0.182 (± 0.472)	0.093 (± 0.270)	0.003	0.572 (± 0.924)*	0.176 (± 0.362)	0.010
Never	0.126 (± 0.366)	0.044 (± 0.198)	<0.0001	0.374 (± 0.619)	0.085 (± 0.280)	<0.0001
Recreational Drug Status						
Current [4]	0.096 (± 0.269)	0.079 (± 0.272)	0.346	0.436 (± 0.813)	0.113 (± 0.268)	0.001
Former	0.202 (± 0.522)	0.086 (± 0.285)	0.002	0.476 (± 0.888)*	0.220 (± 0.566)	0.197
Never	0.125 (± 0.352)	0.038 (± 0.180)	<0.0001	0.300 (± 0.570)	0.070 (± 0.253)	<0.0001
Patient Health History						
Surgical Patient? [5]						
Yes	0.100 (± 0.266)	0.018 (± 0.088)	<0.0001	0.349 (± 0.600)	0.064 (± 0.239)	<0.0001
No	0.155 (± 0.389)	0.052 (± 0.221)	<0.0001	0.330 (± 0.632)	0.100 (± 0.320)	<0.0001
Procedures [6]						
None	0.349 (± 0.511)	0.200 (± 0.435)	<0.0001	0.113 (± 0.337)*	0.139 (± 0.362)	0.784
One or more	0.122 (± 0.350)	0.038 (± 0.183)	<0.0001	0.352 (± 0.621)	0.077 (± 0.273)	<0.0001
Chronic Diseases [7]						
None	0.248 (± 0.465)	0.101 (± 0.311)	<0.0001	0.391 (± 0.578)	0.101 (± 0.315)	<0.0001
One or more	0.121 (± 0.348)	0.036 (± 0.179)	<0.0001	0.325 (± 0.624)	0.074 (± 0.267)	<0.0001

Table 3: Comparison of WNSR values within Patient Characteristic Groups in Medicaid versus Other Payer Types, Stratified by Appointment Type (N = 20,258) [1], 3 of 3

[1] See methods section for calculation of WNSR.[2] 2,268 patients (370 Medicaid Target Population and 1,898 Other) had at least one clinic apt and therapy apt and are therefore included in both groups. [3] 'Frequent' defined as at least three days per week. The alcohol p-values do not take frequency into account. [4] 96% of current drug users noted using marijuana. [5] Had surgery at Slocum during study period. [6] All procedures underwent anywhere before study period. Most common procedures: knee, hip, shoulder, hand/wrist, back surgeries. [7] Chronic diseases diagnosed before study period. Diseases include cancer, diabetes, cardiovascular diseases, asthma, kidney disease, liver disease, mental diseases, and many others. * Sample size under 25.

Table 4: Comparison of Percent Appointments No-showed Types by Appointment Characteristic in Medicaid versus Other Payer, Stratified by Appointment Type (N = 67,417)

	Clinic Appointments (n = 52,877)					Therapy Appointments (n = 14,540)				
	Medicaid Target Population (n = 7,962)		Other Payer Types (n = 44,915)		P-value	Medicaid Target Population (n = 2,236)		Other Payer Types (n = 12,672)		P-value
Appointment Information	No-shows	%	No-shows	%		No-shows	%	No-shows	%	
Body Part										
Upper Body	365	(11)	576	(4)	<0.0001	150	(16)	222	(5)	<0.0001
Clavicle	7	(10)	22	(8)	0.491	--	(0)	0	(0)	--
Shoulder	91	(10)	208	(3)	<0.0001	57	(16)	88	(5)	<0.0001
Arm	13	(10)	25	(4)	0.002	--	(12)	6	(3)	0.030
Elbow	34	(10)	48	(4)	<0.0001	7	(9)	19	(8)	0.885
Wrist	101	(11)	108	(3)	<0.0001	18	(13)	21	(4)	<0.0001
Hand	126	(12)	177	(4)	0.002	67	(19)	90	(7)	0.010
Lower Body	397	(9)	938	(3)	<0.0001	162	(12)	245	(3)	<0.0001
Hip	52	(9)	176	(4)	<0.0001	17	(18)	44	(3)	<0.0001
Pelvis	--	(25)	--	(5)	0.011	0	(0)	--	--	--
Leg	26	(9)	78	(6)	0.068	15	(24)	11	(6)	<0.0001
Knee	178	(8)	447	(3)	<0.0001	113	(11)	160	(3)	<0.0001
Achilles	--	(10)	11	(3)	0.042	--	(19)	7	(13)	0.689
Ankle	72	(9)	113	(3)	<0.0001	--	(5)	19	(4)	0.551
Foot	74	(10)	132	(4)	<0.0001	14	(26)	--	(2)	<0.0001
Back/Neck/Spine/Head	0	(0)	--	(1)	1.000	--	--	14	(7)	--
Bilateral [2]	60	(9)	134	(3)	<0.0001	13	(14)	27	(3)	<0.0001

[1] Values will not sum to n because a given appointment can be for multiple body parts. [2] Indicates that at least one body part of interest for the appointment was a bilateral issue.

Table 5: Comparison of Baseline CCO Patient Characteristics by CHW Outreach Status, Stratified by Appointment Type (N = 2,864) [1], 1 of 3										
	Clinic Patients [2] (n = 2,848)					Therapy Patients [2] (n = 386)				
	No CHW Outreach (n = 2,620)		>0 CHW Outreach (n = 228)		P-value	No CHW Outreach (n = 222)		>0 CHW Outreach (n = 164)		P-value
	n	%	n	%		n	%	n	%	
Patient Demographics										
Age, y (mean ± sd)	46.8	± 14.4	45.7	± 14.6	0.254	45.1	± 15.7	44.1	± 14.5	0.499
Sex										
Male	1,094	(42)	103	(45)	0.316	83	(37)	71	(43)	0.242
Female	1,526	(58)	125	(55)		139	(63)	93	(57)	
Marital Status										
Single	1,207	(49)	119	(54)	0.441	107	(52)	85	(55)	0.149
Married / Life Partner	625	(26)	52	(24)		51	(25)	38	(24)	
Divorced	488	(20)	36	(17)		42	(20)	22	(14)	
Widowed	118	(5)	12	(5)		6	(3)	11	(7)	
Race/Ethnicity										
White, Non-Hispanic	1,734	(66)	152	(67)	0.838	153	(69)	109	(66)	0.623
Other	462	(18)	37	(16)		30	(13)	28	(17)	
Declined to Specify	424	(16)	39	(17)		39	(18)	27	(17)	
Tobacco Status										
Current	886	(35)	88	(39)	0.293	66	(30)	66	(40)	0.117
Former	707	(28)	53	(23)		60	(27)	37	(23)	
Never	930	(37)	85	(38)		93	(43)	61	(37)	

Table 5: Comparison of Baseline CCO Patient Characteristics by CHW Outreach Status, Stratified by Appointment Type (N = 2,864) [1], 2 of 3										
	Clinic Patients [2] (n = 2,848)					Therapy Patients [2] (n = 386)				
	No CHW Outreach (n = 2,620)		>0 CHW Outreach (n = 228)		P-value	No CHW Outreach (n = 222)		>0 CHW Outreach (n = 164)		P-value
	n	%	n	%		n	%	n	%	
Alcohol Status										
Current	1,002	(39)	93	(41)	0.894	82	(37)	67	(41)	0.554
Frequent [3]	139	(5)	11	(5)		9	(4)	8	(5)	
Former	162	(6)	14	(6)		13	(6)	12	(7)	
Never	1,381	(54)	120	(53)		127	(57)	85	(52)	
Recreational Drug Status										
Current [4]	295	(14)	30	(17)	0.286	23	(14)	19	(15)	0.963
Former	113	(5)	12	(7)		12	(8)	10	(8)	
Never	1,779	(81)	137	(76)		124	(78)	95	(77)	
Patient Health History										
Surgical Patient [5]	123	(5)	109	(48)	<0.0001	114	(51)	106	(65)	0.009
Procedures [6]										
None	340	(13)	12	(5)	0.001	9	(4)	8	(5)	0.697
One or more	2,280	(87)	216	(95)		213	(96)	156	(95)	
Chronic Diseases [7]										
None	607	(23)	43	(19)	0.137	59	(27)	36	(22)	0.297
One or more	2,013	(77)	185	(81)		163	(73)	128	(78)	
Trillium Data										
Member Months [8]	10.07	± 3.2	9.69	± 3.5	0.103	10.3	± 3.1	9.64	± 3.5	0.055

Table 5: Comparison of Baseline CCO Patient Characteristics by CHW Outreach Status, Stratified by Appointment Type (N = 2,864) [1], 3 of 3										
	Clinic Patients [2] (n = 2,848)					Therapy Patients [2] (n = 386)				
	No CHW Outreach (n = 2,620)		>0 CHW Outreach (n = 228)		P-value	No CHW Outreach (n = 222)		>0 CHW Outreach (n = 164)		P-value
	n	%	n	%		n	%	n	%	
Recent Medicaid Usage [9]										
PCP	2,144	(82)	179	(79)	0.215	178	(80)	129	(79)	0.714
Specialist	2,572	(98)	212	(93)	<0.0001	216	(97)	153	(93)	0.058
Inpatient	435	(17)	30	(13)	0.177	47	(21)	21	(13)	0.033
ED	1,528	(58)	133	(58)	0.997	132	(59)	94	(57)	0.673
NEMT [10]										
Yes	693	(26)	64	(30)	0.237	66	(30)	42	(27)	0.229
No	1,927	(74)	148	(70)		156	(70)	111	(73)	
Residence Type [11]										
Rural	693	(26)	43	(20)	0.049	34	(15)	31	(20)	0.214
Urban	1,927	(74)	169	(80)		188	(85)	122	(80)	

[1] Values will not always sum to n due to unavailability of data from some patients. [2] 370 patients had at least one clinic apt and therapy apt and are therefore included in both groups. [3] 'Frequent' defined as at least three days per week. The alcohol p-values do not take frequency into account.[4] 96% of current drug users noted using marijuana[5] Had surgery at Slocum during study period. [6] All procedures underwent anywhere before study period. Most common procedures: knee, hip, shoulder, hand/wrist, back surgeries. [7] Chronic diseases diagnosed before study period. Diseases include cancer, diabetes, cardiovascular diseases, asthma, kidney disease, liver disease, mental diseases, and many others. [8] Number of months as a CCO member out of the 12 months prior to their first Slocum appointment in the study period. [9] Number of patients who had at least one healthcare encounter of the type indicated in the 12 months prior to their first Slocum appointment in the study period. [10] Number of patients who used Non-Emergency Medical Transport at least once in the 12 months prior to their first Slocum appointment in the study period. [11] CCO's designation of member's primary address. [12] See methods section for calculation of WNSR. * Sample size under 25.

Table 6: Comparison of Baseline CCO Appointment Characteristics by CHW Outreach Status, Stratified by Appointment Type (N = 10,198)										
	Clinic Appointments (n = 7,962)					Therapy Appointments (n = 2,236)				
	No CHW Outreach (n = 6,869)		>0 CHW Outreach (n = 1,093)		P-value	No CHW Outreach (n = 1,194)		>0 CHW Outreach (n = 1,042)		P-value
Appointment Information	n	%	n	%		n	%	n	%	
Body Part [1]										
Upper Body	2,833	(42)	442	(40)	0.340	582	(49)	350	(34)	<0.0001
Clavicle	64	(1)	--	(<1)	0.027	--	(0)	--	(<1)	0.284
Shoulder	773	(11)	129	(12)	0.595	199	(17)	164	(16)	0.553
Arm	104	(1)	26	(2)	0.036	22	(2)	11	(1)	0.124
Elbow	309	(5)	15	(1)	<0.0001	57	(5)	22	(2)	0.001
Wrist	844	(12)	102	(9)	0.005	109	(9)	33	(3)	<0.0001
Hand	874	(13)	181	(17)	0.001	221	(18)	126	(12)	<0.0001
Lower Body	4,001	(58)	653	(60)	0.351	611	(51)	691	(66)	<0.0001
Hip	479	(7)	72	(7)	0.640	44	(4)	52	(5)	0.129
Pelvis	17	(<1)	--	(<1)	0.869	9	(1)	--	(0)	0.005
Leg	267	(4)	21	(2)	0.001	24	(2)	39	(4)	0.014
Knee	1,924	(28)	403	(37)	<0.0001	458	(38)	544	(52)	<0.0001
Achilles	30	(<1)	9	(1)	0.089	12	(1)	--	(<1)	0.082
Ankle	726	(11)	87	(8)	0.008	46	(4)	31	(3)	0.256
Foot	655	(10)	72	(7)	0.002	21	(2)	33	(3)	0.030
Back/Neck/Spine/Head	15	(<1)	--	(<1)	0.384	--	(0)	--	(0)	--
Bilateral [2]	588	(9)	70	(6)	0.016	43	(4)	52	(5)	0.104

[1] Values will not sum to n because a given appointment can be for multiple body parts. [2] Indicates that at least one body part of interest for the appointment was a bilateral issue.

Table 7: Comparison of Temporal WNSR values within CCO Patient Characteristic Groups by CHW Outreach Status, Stratified by Appointment Type (N = 2,812) [1], 1 of 4						
	Clinic Patients [2] (n = 2,760)			Therapy Patients [2] (n = 367)		
	No CHW Outreach (n = 2,620)	>0 CHW Outreach (n = 140)	P-value	No CHW Outreach (n = 222)	>0 CHW Outreach (n = 145)	P-value
Patient Demographics	Mean WNSR (± sd)			Mean WNSR (± sd)		
Age, y						
< 45	0.206 (± 0.443)	0.196 (± 0.351)	0.858	0.392 (± 0.593)	0.514 (± 0.737)	0.218
≥ 45	0.119 (± 0.343)	0.048 (± 0.157)	0.082	0.165 (± 0.342)	0.180 (± 0.375)	0.770
Sex						
Male	0.183 (± 0.436)	0.174 (± 0.334)	0.866	0.238 (± 0.386)	0.439 (± 0.693)	0.028
Female	0.136 (± 0.354)	0.074 (± 0.210)	0.129	0.299 (± 0.548)	0.280 (± 0.529)	0.804
Marital Status						
Single	0.156 (± 0.415)	0.147 (± 0.311)	0.860	0.292 (± 0.518)	0.328 (± 0.600)	0.665
Married / Life Partner	0.103 (± 0.312)	0.099 (± 0.259)	0.942	0.235 (± 0.407)	0.538 (± 0.745)	0.018
Divorced	0.101 (± 0.281)	0.065 (± 0.150)	0.609	0.233 (± 0.378)	0.101 (± 0.257)*	0.204
Widowed	0.068 (± 0.226)	0 (± 0)*	0.371	0.087 (± 0.178)*	0.278 (± 0.556)*	0.433
Race/Ethnicity						
White, Non-Hispanic	0.125 (± 0.367)	0.120 (± 0.263)	0.895	0.300 (± 0.493)	0.332 (± 0.578)	0.648
Other	0.299 (± 0.472)	0.211 (± 0.404)*	0.384	0.171 (± 0.297)	0.531 (± 0.766)	0.021
Declined to Specify	0.126 (± 0.353)	0.017 (± 0.075)*	0.166	0.263 (± 0.608)	0.216 (± 0.500)*	0.753
Tobacco Status						
Current	0.176 (± 0.398)	0.173 (± 0.352)	0.959	0.470 (± 0.699)	0.550 (± 0.698)	0.532
Former	0.106 (± 0.356)	0.095 (± 0.218)	0.846	0.164 (± 0.302)	0.172 (± 0.290)	0.893
Never	0.099 (± 0.303)	0.073 (± 0.196)	0.535	0.218 (± 0.377)	0.257 (± 0.607)	0.630

Table 7: Comparison of Temporal WNSR values within CCO Patient Characteristic Groups by CHW Outreach Status, Stratified by Appointment Type (N = 2,812) [1], 2 of 4						
	Clinic Patients [2] (n = 2,760)			Therapy Patients [2] (n = 367)		
	No CHW Outreach (n = 2,620)	>0 CHW Outreach (n = 140)	P-value	No CHW Outreach (n = 222)	>0 CHW Outreach (n = 145)	P-value
	Mean WNSR (± sd)			Mean WNSR (± sd)		
Alcohol Status						
Current	0.121 (± 0.319)	0.124 (± 0.274)	0.954	0.220 (± 0.475)	0.278 (± 0.584)	0.518
Frequent [3]	0.154 (± 0.386)	0 (± 0)*	0.293	0.056 (± 0.167)*	0.170 (± 0.347)*	0.390
Former	0.184 (± 0.490)	0.593 (± 0.514)*	0.016	0.263 (± 0.369)	0.864 (± 0.984)*	0.051
Never	0.130 (± 0.375)	0.065 (± 0.182)	0.128	0.314 (± 0.516)	0.321 (± 0.511)	0.926
Recreational Drug Status						
Current [4]	0.089 (± 0.244)	0.350 (± 0.497)*	<0.0001	0.255 (± 0.374)*	0.620 (± 0.922)*	0.091
Former	0.215 (± 0.545)	0.143 (± 0.378)*	0.730	0.656 (± 1.012)*	0.192 (± 0.467)*	0.243
Never	0.128 (± 0.360)	0.091 (± 0.224)	0.367	0.233 (± 0.464)	0.318 (± 0.560)	0.234
Patient Health History						
Surgical Patient? [5]						
Yes	0.112 (± 0.315)	0.119 (± 0.257)	0.854	0.272 (± 0.449)	0.347 (± 0.589)	0.296
No	0.158 (± 0.394)	0.121 (± 0.312)	0.503	0.281 (± 0.539)	0.350 (± 0.645)	0.477
Procedures [6]						
None	0.359 (± 0.516)	0.300 (± 0.447)*	0.799	0.010 (± 0.030)*	0.262 (± 0.508)*	0.156
One or more	0.125 (± 0.359)	0.113 (± 0.270)	0.704	0.287 (± 0.501)	0.353 (± 0.613)	0.276
Chronic Diseases [7]						
None	0.258 (± 0.474)	0.195 (± 0.360)	0.470	0.288 (± 0.469)	0.486 (± 0.598)	0.088
One or more	0.125 (± 0.356)	0.099 (± 0.248)	0.448	0.272 (± 0.504)	0.311 (± 0.607)	0.562

Table 7: Comparison of Temporal WNSR values within CCO Patient Characteristic Groups by CHW Outreach Status, Stratified by Appointment Type (N = 2,812) [1], 3 of 4						
	Clinic Patients [2] (n = 2,760)			Therapy Patients [2] (n = 367)		
	No CHW Outreach (n = 2,620)	>0 CHW Outreach (n = 140)	P-value	No CHW Outreach (n = 222)	>0 CHW Outreach (n = 145)	P-value
	Mean WNSR (± sd)			Mean WNSR (± sd)		
Trillium Data						
Member Months [8]						
< 10	0.194 (± 0.451)	0.130 (± 0.278)	0.382	0.411 (± 0.600)	0.372 (± 0.509)	0.738
>= 10	0.142 (± 0.365)	0.116 (± 0.279)	0.491	0.234 (± 0.449)	0.338 (± 0.647)	0.119
Recent Medicaid Usage [9]						
PCP	0.147 (± 0.376)	0.059 (± 0.161)	0.015	0.270 (± 0.490)	0.241 (± 0.427)	0.598
Specialist	0.149 (± 0.384)	0.107 (± 0.259)	0.216	0.282 (± 0.499)	0.309 (± 0.544)	0.638
Inpatient	0.167 (± 0.406)	0.168 (± 0.354)*	0.986	0.246 (± 0.370)	0.772 (± 0.962)*	0.002
ED	0.193 (± 0.441)	0.126 (± 0.292)	0.175	0.287 (± 0.506)	0.398 (± 0.633)	0.160
NEMT [10]						
Yes	0.200 (± 0.466)	0.103 (± 0.260)	0.203	0.378 (± 0.661)	0.334 (± 0.628)	0.748
No	0.140 (± 0.359)	0.109 (± 0.261)	0.415	0.233 (± 0.398)	0.301 (± 0.515)	0.239
Residence Type [11]						
Rural	0.154 (± 0.365)	0.136 (± 0.333)	0.800	0.249 (± 0.379)	0.451 (± 0.808)	0.199
Urban	0.156 (± 0.400)	0.099 (± 0.237)	0.154	0.281 (± 0.513)	0.270 (± 0.442)	0.852

Table 7: Comparison of Temporal WNSR values within CCO Patient Characteristic Groups by CHW Outreach Status, Stratified by Appointment Type (N = 2,812) [1], 4 of 4

[1] See methods section for calculation of WNSR. Due to temporal considerations, appointments before each patient's first CHW intervention, if any, were dropped before calculations. [2] 315 patients had at least one clinic apt and therapy apt and are therefore included in both groups. [3] 'Frequent' defined as at least three days per week. [4] 96% of current drug users noted using marijuana[5] Had surgery at Slocum during study period. [6] All procedures underwent anywhere before study period. Most common procedures: knee, hip, shoulder, hand/wrist, back surgeries. [7] Chronic diseases diagnosed before study period. Diseases include cancer, diabetes, cardiovascular diseases, asthma, kidney disease, liver disease, mental diseases, and many others. [8] Number of months as a CCO member out of the 12 months prior to their first Slocum appointment in the study period. [9] Number of patients who had at least one healthcare encounter of the type indicated in the 12 months prior to their first Slocum appointment in the study period. [10] Number of patients who used Non-Emergency Medical Transport at least once in the 12 months prior to their first Slocum appointment in the study period. [11] CCO's designation of member's primary address. * Sample size under 25.

Table 8: Comparison of CCO Patient Characteristics by Number of No-shows, Stratified by Appointment Type (N = 2,864) [1], 1 of 3														
	Clinic Patients [2] (n = 2,848)							Therapy Patients [2] (n = 386)						
	0 No Shows (n = 2,235)		1 No Show (n = 503)		>1 No Show (n = 110)		P-value	0 No Shows (n = 207)		1 No Show (n = 100)		>1 No Show (n = 79)		P-value
Patient Demographics	n	%	n	%	n	%		n	%	n	%	n	%	
Age, y (mean ± sd)	48.0	±14.3	42.3	±13.8	42.0	±13.0	<0.0001	47.9	±14.9	43.6	±14.2	37.7	±14.7	<0.0001
Sex														
Male	904	(40)	228	(45)	65	(59)	<0.0001	78	(38)	36	(36)	40	(51)	0.088
Female	1,331	(60)	275	(55)	45	(41)		129	(62)	64	(64)	39	(49)	
Marital Status														
Single	1,034	(48)	225	(55)	67	(69)	<0.0001	106	(54)	45	(48)	41	(58)	0.137
Married / LP	564	(26)	99	(24)	14	(14)		43	(22)	24	(25)	22	(31)	
Divorced	430	(20)	78	(19)	16	(16)		38	(19)	21	(22)	--	(7)	
Widowed	119	(6)	10	(2)	--	(1)		9	(5)	--	(5)	--	(4)	
Race/Ethnicity														
White, Non-H	1,521	(68)	288	(57)	77	(70)	<0.0001	134	(65)	75	(75)	53	(67)	0.465
Other	327	(15)	156	(31)	16	(15)		33	(16)	13	(13)	12	(15)	
Declined	387	(17)	59	(12)	17	(15)		40	(19)	12	(12)	14	(18)	
Tobacco Status														
Current	725	(33)	200	(47)	49	(47)	<0.0001	53	(26)	39	(39)	40	(51)	0.002
Former	632	(28)	101	(24)	27	(26)		59	(29)	25	(25)	13	(16)	
Never	861	(39)	126	(29)	28	(27)		93	(45)	35	(35)	26	(33)	

Table 8: Comparison of CCO Patient Characteristics by Number of No-shows, Stratified by Appointment Type (N = 2,864) [1], 2 of 3														
	Clinic Patients [2] (n = 2,848)							Therapy Patients [2] (n = 386)						
	0 No Shows (n = 2,235)		1 No Show (n = 503)		>1 No Show (n = 110)		P-value	0 No Shows (n = 207)		1 No Show (n = 100)		>1 No Show (n = 79)		P-value
	n	%	n	%	n	%		n	%	n	%	n	%	
Alcohol Status														
Current	891	(40)	159	(37)	45	(43)	0.150	89	(43)	35	(35)	25	(32)	0.191
Frequent [3]	122	(5)	19	(4)	9	(8)		12	(6)	--	(4)	--	(1)	
Former	130	(6)	37	(9)	9	(8)		10	(5)	10	(10)	--	(6)	
Never	1,212	(54)	237	(55)	52	(49)		108	(52)	55	(55)	49	(62)	
Recreational Drug Status														
Current [4]	268	(14)	45	(12)	12	(14)	0.447	21	(13)	11	(16)	10	(19)	0.854
Former	94	(5)	24	(7)	7	(8)		12	(8)	6	(9)	--	(7)	
Never	1,550	(81)	299	(81)	67	(78)		127	(79)	52	(75)	40	(74)	
Patient Health History														
Surgery Patient [5]	166	(7)	52	(10)	14	(13)	0.020	112	(54)	52	(52)	56	(70)	0.019
Procedures [6]														
None	217	(10)	122	(24)	13	(12)	<0.0001	14	(7)	--	(2)	--	(1)	0.067
One or more	2,018	(90)	381	(76)	97	(88)		193	(93)	98	(98)	78	(99)	
Chronic Diseases [7]														
None	448	(20)	169	(34)	33	(30)	<0.0001	44	(21)	23	(23)	28	(35)	0.041
One or more	1,787	(80)	334	(66)	77	(70)		163	(79)	77	(77)	51	(65)	

Table 8: Comparison of CCO Patient Characteristics by Number of No-shows, Stratified by Appointment Type (N = 2,864) [1], 3 of 3														
	Clinic Patients [2] (n = 2,848)							Therapy Patients [2] (n = 386)						
	0 No Shows (n = 2,235)		1 No Show (n = 503)		>1 No Show (n = 110)		P-value	0 No Shows (n = 207)		1 No Show (n = 100)		>1 No Show (n = 79)		P-value
	n	%	n	%	n	%		n	%	n	%	n	%	
CCO Patient Info														
Member Months (mean ± sd) [8]	10.2	±3.2	9.7	±3.5	9.4	±3.4	0.002	10.4	±3.2	9.9	±3.3	9.3	±3.5	0.055
Recent Medicaid Usage [9]														
PCP	1,852	(83)	391	(78)	80	(73)	0.001	172	(83)	78	(78)	57	(72)	0.111
Specialist	2,206	(99)	472	(94)	106	(96)	<0.0001	203	(98)	92	(92)	74	(94)	0.034
Inpatient	352	(16)	93	(18)	20	(18)	0.280	34	(16)	21	(21)	13	(16)	0.587
ED	1,242	(56)	338	(67)	81	(74)	<0.0001	120	(58)	60	(60)	46	(58)	0.942
NEMT [10]														
Yes	567	(25)	147	(30)	43	(39)	0.002	51	(25)	31	(33)	26	(35)	0.152
No	1,660	(75)	349	(70)	66	(61)		155	(75)	64	(67)	48	(65)	
Residence Type [11]														
Rural	574	(26)	142	(29)	20	(18)	0.076	35	(17)	17	(18)	13	(18)	0.980
Urban	1,653	(74)	354	(71)	89	(82)		171	(83)	78	(82)	61	(82)	

[1] Values will not always sum to n due to unavailability of data from some patients. [2] 370 patients had at least one clinic apt and therapy apt and are therefore included in both groups. [3] 'Frequent' defined as at least three days per week. The alcohol p-values do not take frequency into account. [4] 96% of current drug users noted using marijuana. [5] Had surgery at Slocum during study period. [6] All procedures underwent anywhere before study period. Most common procedures: knee, hip, shoulder, hand/wrist, back surgeries. [7] Chronic diseases diagnosed before study period. Diseases include cancer, diabetes, cardiovascular diseases, asthma, kidney disease, liver disease, mental diseases, and many others. [8] Number of months as a CCO member out of the 12 months prior to their first Slocum appointment in the study period. [9] Number of patients who had at least one healthcare encounter of the type indicated in the 12 months prior to their first Slocum appointment in the study period. [10] Number of patients who used Non-Emergency Medical Transport at least once in the 12 months prior to their first Slocum appointment in the study period. [11] CCO's designation of member's primary address.

Table 9: Univariate Association between CCO Patient Characteristics and Odds of No-show, Stratified by Appointment Type (N = 10,198), 1 of 2				
	Clinic Appointment (N = 7,962)		Therapy Appointments (N = 2,236)	
	OR (95% CI) [8]	P-value	OR (95% CI) [8]	P-value
Patient Demographics				
Age, y	0.98 (0.97 – 0.98)	<0.0001	0.97 (0.96 – 0.98)	<0.0001
Male	1.33 (1.14 – 1.55)	<0.0001	1.17 (0.92 – 1.48)	0.209
Not married [1]	1.53 (1.26 – 1.86)	<0.0001	1.03 (0.79 – 1.35)	0.829
Non-white /non-Hispanic [2]	1.43 (1.22 – 1.67)	<0.0001	0.96 (0.74 – 1.23)	0.730
Current tobacco user	1.34 (1.15 – 1.56)	<0.0001	2.39 (1.87 – 3.05)	<0.0001
Current alcohol user	0.75 (0.64 – 0.87)	<0.0001	0.71 (0.55 – 0.91)	0.006
Current recreational drug user [3]	0.78 (0.61 – 1.01)	0.060	1.22 (0.84 – 1.77)	0.283
Patient Health History				
Surgical patient [4]	0.62 (0.49 – 0.77)	<0.0001	0.70 (0.54 – 0.91)	0.006
>0 Procedure [5]	0.27 (0.22 – 0.34)	<0.0001	1.77 (0.63 – 4.96)	0.243
>0 Chronic Disease [6]	0.57 (0.49 – 0.67)	<0.0001	0.74 (0.57 – 0.96)	0.023
CCO Patient Information [7]				
Number of months as CCO member	0.96 (0.94 – 0.98)	0.001	0.96 (0.92 – 0.99)	0.015
>0 PCP visit	0.75 (0.63 – 0.89)	0.001	0.52 (0.40 – 0.69)	<0.0001
>0 specialist visit	0.52 (0.36 – 0.73)	<0.0001	0.49 (0.31 – 0.78)	0.002
>0 Inpatient visit	1.07 (0.88 – 1.30)	0.502	1.19 (0.86 – 1.63)	0.291
>0 ED visit	1.51 (1.28 – 1.77)	<0.0001	1.32 (1.03 – 1.68)	0.027
Used NEMT	1.30 (1.10 – 1.52)	0.002	1.55 (1.19 – 2.01)	0.001
Rural residence	0.96 (0.80 – 1.14)	0.619	1.04 (0.75 – 1.45)	0.805

Table 9: Univariate Association between CCO Patient Characteristics and Odds of No-show, Stratified by Appointment Type (N = 10,198), 2 of 2				
	Clinic Appointment (N = 7,962)		Therapy Appointments (N = 2,236)	
	OR (95% CI) [8]	P-value	OR (95% CI) [8]	P-value
Appointment Characteristics				
Upper body	1.32 (1.14 – 1.53)	<0.0001	1.34 (1.06 – 1.71)	0.016
Lower body	0.75 (0.65 – 0.88)	<0.0001	0.74 (0.58 – 0.94)	0.013
Bilateral	0.95 (0.72 – 1.25)	0.687	0.97 (0.54 – 1.77)	0.928

Note: OR = Odds ratio; CI = Confidence Interval.

[1] Includes single, divorced, and widowed patients. [2] Includes patients who declined to specify. [3] 96% of current drug users noted using marijuana. [4] Patient had surgery at Slocum during study period. [5] All procedures underwent anywhere before study period. Most common procedures: knee, hip, shoulder, hand/wrist, back surgeries. [6] Chronic diseases diagnosed prior to study period. Diseases include cancer, diabetes, cardiovascular diseases, asthma, kidney disease, liver disease, mental diseases, and many others. [7] In the 12 months prior to first appointment during study period. [8] See methods section for calculation of OR.

DISCUSSION

The current study is the first known evaluation of a CCO's Community Health Worker Program in an orthopedic clinic and surgery center. CCOs in the state of Oregon are tasked with assisting their members with navigating the health care system through programs such as this, with the goal of improving quality of care and health outcomes. While the effectiveness of CHW Programs have been demonstrated by many recent studies [10]–[19], there are no known publications regarding the outcomes of CHW programs in an orthopedic setting. The current study adds to this body of literature by describing the effectiveness of a CHW program in improving CCO members' appointment-keeping tendencies in an orthopedic clinic.

Follow-up appointments to rehabilitate and monitor recovery are key in orthopedic care as they can prevent poor outcomes such as blood clotting, tissue scarring, osteolysis, and non-union or delayed-union fractures [20]–[22]. Additionally, missed appointments negatively impact the clinic by costing them time and money [1]–[3]. No-show burden contributed by each given patient was measured using a novel weighted no-show rate (WNSR), which marks the first known use of this measure in a study of this kind. This measure describes a combination of the proportion of their appointments that they missed and how many no-show accrued to estimate the magnitude of effect on potentially compromising patient outcomes and on the burden on clinical operations.

The current study not only investigates the effectiveness of an orthopedic CHW program in reducing no-show rates, but also identifies specific subpopulations of

patients who are likely to no-show appointments and specific types of appointments that are likely to be missed. Past studies have similarly investigated characteristics associated with no-shows in a wide variety of specialties including orthopedic, but the current study is the first to do so in an exclusively Medicaid patient population at an orthopedic clinic [24]–[26]. This study will inform recommendations for future efforts to reduce no-show rates at an orthopedic clinic by prioritizing subpopulations to target with an intervention such as CHW outreach.

Study Populations. The patient and appointment populations, across all payer types, for this study have sufficiently large sample sizes to be considered reasonably representative of the total orthopedic clinic and physical therapy patient populations in the state of Oregon. Regional variance in demographics may inhibit this study's patient population from being representative of orthopedic patient populations elsewhere in the United States. Specifically, the proportion of white, non-Hispanic people in the state of Oregon (76%) and in Lane County (83%) in 2016 differed substantially from that of the United States as a whole (61%) [28]. In the current study, 70% of the population self-reported as white, Non-Hispanic. The study population was also considerably older than the population of Lane County; 18.5% of people in Lane County were 65 years of age or older [28] compared to 40% of the study population. This likely reflects the high proportion of older patients in orthopedic surgery; 69% of the orthopedic surgery patient population in the US in 2010 were at least 45 years of age, and that number continues to grow [29], [30].

The target population for the CHW intervention, the CCO patient population, was very similar in terms of gender and race/ethnicity to the published 2013 Medicaid population in Oregon. The total Oregon Medicaid population was comprised of primarily females (56%) and white, non-Hispanics (63%) [31], [32]. The same was true of the current CCO patient population, with proportions differing only slightly (58% female, 66% white, non-Hispanic). The CCO patient population differed greatly, however, in terms of age; 58% of CCO patients were at least 45 years of age compared to 23% of the 2013 Oregon Medicaid population [33]. Once again, this is likely attributable to higher proportions of older patients seeking orthopedic care [29], [30].

The CCO patient population differed characteristically from other payer types in a number of ways. The sample size of clinic patients was large enough to amplify the significance of every comparison made between CCO patients and other patients such that nearly every comparison yielded a p-value of less than 0.0001, even if the near-identical respective comparison in therapy were not significant. The characteristics' means and proportions are very similar across the two appointment types, as roughly 93% of the therapy patients were also clinic patients. With this in mind, compared to all other payer types combined, the CCO patient population was significantly younger and had a significantly higher proportion of single patients, tobacco users, alcohol non-users, and recreational drug users. These differences are supported by a 2008 study comparing a Medicaid population to other payer type populations in an orthopedic setting, except for the alcohol use which was not found to be significantly different across payer types [34]. CCO patients also had a higher proportion of upper body clinic appointments and lower proportions of lower body appointments and bilateral

appointments than other patients in both clinic and therapy. There are no known prior studies that make this comparison in an orthopedic clinic setting.

As expected from previous reports from the orthopedic clinic and past studies across several health specialties [4]–[7], CCO-member patients tended to miss appointments significantly more often than other patients. CCO patients had significantly higher proportions of patients with at least one no-show and average no-show counts compared to other patients in both clinic and therapy. While CCO patients did have a significantly higher mean total appointment count in clinic and therefore more opportunities to no-show, the difference in total appointment count (7% higher in CCO) is negligible compared to the difference in therapy appointment no-show count (200% higher in CCO). In therapy, CCO patients had 3.5% fewer opportunities to no-show on average but still averaged 252% more no-shows.

Appointment-level analysis revealed that appointments scheduled for CCO patients were missed at a rate more than three-times higher than appointments scheduled for other patients in both clinic and therapy. The higher propensity of CCO patients to no-show appointments is also reflected by their WNSR values; CCO patients had significantly higher average WNSR values in both clinic and therapy, not only overall but also in nearly every individual characteristic subpopulation. These data reaffirm efforts to target the CCO patient population to reduce no-show burden at orthopedic clinics should be sustained.

It should be noted CCO patients consistently had higher WNSR values in therapy compared to clinic. In general, patients had more scheduled appointments in therapy than in the clinic setting, presenting more opportunities to no-show. However,

the rate at which these appointments were missed by CCO patients was also higher in therapy than in clinic, contributing to these higher weighted no-show rates. In fact, CCO patients averaged just over twice as many therapy appointments as clinic appointments but averaged three-times as many no-shows.

Regardless of the underlying numbers constituting them, the higher WNSR rates in therapy confirm that therapy CCO patients are contributing considerably more no-show burden than clinic and, therefore, therapy would be the more fruitful area to target in the hopes of reducing overall no-show burden. These results are not unexpected; higher rates of no-shows in physical therapy compared to clinic have been demonstrated in previous studies [24]. Physical therapy appointments are much longer than clinic appointments and pose much more significant a financial and temporal loss to the clinic when they are missed. Therapy appointment average 45 minutes, and therapists being paid an hourly wage are therefore receiving wages with no billable appointment to offset the expense. For these reasons, the current study primarily focused on therapy appointments.

Impact of CHW Outreach. The primary aim of this study was to determine if CHW outreach was effective in reducing no-show burden among CCO-member patients at the orthopedic clinic. Based on the data presented in Table 7, it appears CHW outreach was not significantly associated with lower WNSR values in nearly any clinic CCO patient characteristic. On the contrary, patients with at least one documented CHW outreach effort had higher WNSR values in a few therapy CCO stratified patient characteristics.

The comparisons in this table, though, are imperfect and may well be misleading. The change in workflow and approach over the study period likely influenced study results.

The CHW stationed at the orthopedic clinic initially chose to contact a patient if they had already missed a physical therapy appointment at some point in the past. Midstream, this approach shifted to contacting patients before their first scheduled appointment. This fact presents challenges for the interpretation of the data in Table 7. By selecting patients who had previously no-showed a therapy appointment, the CHW may have selected a group of patients who were predisposed to no-show therapy appointments and therefore had a higher 'baseline' therapy no-show burden than those who were not selected. It is therefore possible that, even though the selected group had higher WNSR rates than the unselected group, the selected group's WNSR rates could have been significantly higher than they were had they not received outreach, which would indicate the CHW outreach was actually effective. This selection bias makes interpretation of Table 7 extremely uncertain, especially on the therapy side. In addition, the switch in selection criteria during the study period makes it challenging to draw conclusions regarding program effectiveness or impact. In a more ideal approach, a patient selected for outreach randomly would be treated differently in analysis than a patient selected because of previous no-shows, but there were no data provided that would allow CCO patients to be categorized based on historical no-show patterns.

The consistently lower WNSR values among CHW-outreached patients with clinic appointments (the type of appointment for which there was no direct selection of no-show-prone patients) in Table 7 do provide some reason to think CHW outreach had

a positive effect, even if the differences were not statistically significant in all but one case (patients with recent PCP Visits). Additionally, the current body of literature has consistently established the effectiveness of CHW outreach in engaging patients in their treatment plans [10]–[13], [18], [19]. The lack of anticipated effectiveness in the current population brings into question whether the results differ due to programmatic limitations or whether orthopedic populations are different from other sub-specialty or illness-specific populations previously published. To help answer this question, a more robust statistical approach (univariate logistic regression) was utilized to better understand the characteristics of CCO patients who tended to no-show more often.

Characteristics Associated with No-Shows. The secondary aim of this study was to better understand the characteristics of CCO-member patients who are more likely to miss appointments as well as the characteristics of appointments which are more likely to be missed by CCO-member patients.

Many previous studies have used logistic regression to identify patient characteristics which are associated with improved or worsened treatment plan adherence among medical patients [24]–[27]. The current body of literature most frequently identifies young age and non-white race as characteristics associated with no-shows across many specialties [24]. This study confirms by univariate logistic regression that increasing age was associated with decreased odds of a no-show in both clinic and physical therapy appointments. In the clinic setting, race/ethnicity other than non-white, non-Hispanic also had higher odds of no-show, but these results were not consistent in the therapy setting. Past studies in orthopedic settings have also identified

current tobacco use as being associated with no-shows [25], [26]. This association between tobacco use and increased no-show odds was confirmed in the current study with a significant association in clinic and the strongest association by far in physical therapy.

The same orthopedic studies also identified patients with hip and back injuries as most likely to no-show a given appointment [25], [26]. The orthopedic clinic for the current study does not directly treat back injuries. Patients may have been presenting to a hip specialist, who identified the back was the primary driver of the patient's pain or disability, leading to small numbers of back diagnoses in the appointment data. This made it impossible to confirm or oppose the association between back injuries and increased no-show rates in the current study. Hip appointments were missed at an un-notable rate during the study period, so they were not analyzed by logistic regression. The body parts for which physical therapy appointments were missed most frequently by CCO patients were hand and shoulder. Largely for the purpose of simplifying future recommendations, body parts were limited to upper body, lower body, and bilateral appointments for logistic regression. Upper body appointments were found to be significantly associated with increased odds to no-show in either place of service. Conversely, lower body appointments were protective against no-shows (with decreased odds), and bilateral appointments were not significantly associated.

Other patient characteristics that the current study found by logistic regression to be associated with increased odds of a no-show in both clinic and physical therapy were recent emergency department visitation and recent usage of non-emergency medical transport. No other studies examining characteristics of no-show patients have reported

historical utilization history prior to becoming an orthopedic patient. The use of non-emergency medical transport warrants further discussion. The current body of literature has identified transportation as a potential barrier to accessing timely care and keeping scheduled appointments [24]. It would stand to reason, therefore, that solving transportation problems is a potential intervention for a CHW. However, the current study reports increased odds of no-showing among patients who had accessed non-emergency transport services through the CCO in the 12 months prior to their first scheduled appointment at the orthopedic clinic in the study period. These results are contrary to anticipated and suggest access to transportation may not be the primary barrier to CCO patients keeping scheduled appointments.

Additionally, the current study found the following patient characteristics to be associated with decreased odds of a no-show in both clinic and physical therapy: current alcohol use, surgical patient status, history of chronic disease, increasing number of months as a CCO member, and recent PCP or specialist visitation. All these characteristics were analyzed infrequently or not at all in the current body of literature. When alcohol use was tracked, it was often lumped together with tobacco and recreational drugs into a 'substance abuse' category, making it not easily comparable [24]. The data received for alcohol use were not uniformly captured in the practice electronic health record and may be misleading. The indicated association between current alcohol use and decreased odds of a no-show should be interpreted with caution. The current study's direct collaboration with a CCO allowed for the analysis of a host of variables tracked by the CCO which aren't usually available in similar studies. The current study suggests that the longer a patient has been continuously enrolled in the

CCO programs, the lower the odds of no-show. Though there aren't any known studies that investigate the effects of this particular variable on no-show rates, it's possible that increased length of enrollment increases the chances of establishing a primary care provider and thus being more involved in one's own medical care. An association between enrollment in Medicaid and more frequent kept appointments at specialty clinics relative to uninsured patients has been previously demonstrated in the state of Oregon [35]. It's reasonable, then, to think that length of time enrolled may be related to this as well, as the current study seems to suggest.

Other characteristics were identified in the current study by high WNSR rates and/or high frequency in subpopulations with one or more no-shows. Many of the characteristics identified in this way were in agreement with the logistic regression results; however, some were not. The WNSR takes into account the impact of missing several appointments (as opposed to just one) on both the patient's treatment plan and the clinic's operations. This approach allows for identification of the patients who present the greatest no-show-related issue to the clinic over time, as opposed to patients who have the highest odds of sustaining one no-show. Similarly, identification of characteristics by frequency in subpopulations with multiple no-shows indicates that they are prevalent among patients who have a tendency to no-show often, rather than just once. Characteristics that were either (1) significantly more common among patients with multiple no-shows than patients with one or zero no-shows in clinic and therapy or (2) associated with among the four highest average WNSR values in clinic or therapy were: young age, non-white, non-Hispanic race/ethnicity, surgical patient status, lack of chronic disease or procedure history, current tobacco use, current

recreational drug use, fewer months as a CCO member, and lack of a recent specialist visit.

Something of note here is that non-surgical patients were identified as more likely to no-show by logistic regression, but surgical patients were identified as contributing a higher no-show burden by these other approaches. This seems contradictory at first, but it can be explained. Surgical patients averaged considerably more appointments (mea 5.94 clinic, 7.34 therapy) than non-surgical patients (mean 2.51 clinic, 3.74 therapy), thus giving them more opportunities to no-show. This resulted in surgical patients averaging considerably more no-shows (mean 0.39 clinic, 0.94 therapy) than non-surgical patients (mean 0.26 clinic, 0.64 therapy). This is a 137% increase in clinic appointment count, a 50% increase in clinic no-shows, a 96% increase in therapy appointment count, and a 47% increase in therapy no-show count for surgical patients compared to non-surgical patients. The no-show counts for each type of appointment did not increase proportionally to total appointment counts, indicating that surgical patients actually no-show less often per appointment than non-surgical patients. However, surgical patients contributed more to total no-shows than non-surgical patients simply due to their higher average appointment counts.

This raises an interesting question: should a program aimed at reducing no-shows target subpopulations who are more likely to no-show a given appointment or subpopulations whose patients each tend to contribute more total no-shows to the clinic? Since decisions are ultimately made at the appointment level (i.e. whether it is worth the effort to contact a patient before his or her specific appointment), it seems more logical to choose patients who are more likely to no-show that specific

appointment. Therefore, non-surgical patients should probably be prioritized for outreach over surgical patients. Similarly, since lack of recent PCP visitation was found to be associated with no-shows by appointment-level data, it should be considered when prioritizing patients for outreach despite not having been identified by patient-level data. Lack of procedure history and recreational drug use, on the other hand, should not be considered since they were only identified at the patient level. Even though non-alcohol use was identified by appointment-level data, it cannot be reasonably related to a higher propensity to miss appointments by logic, so it should not be considered when prioritizing patients.

Alignment of CHW-Outreached Population with the At-Risk Population. The characteristics associated with no-shows can be compared to the characteristics of the CCO patients who were received outreach during the study period to determine whether the CHW was outreaching to the patients who have the most potential to no-show. As mentioned above, the appointment-level nature of outreach suggests patient characteristics with higher odds of no-showing a given appointment should be targeted.

The population of CCO physical therapy patients that were selected for CHW outreach differ from the unselected therapy CCO patient population in very few characteristics. The CHW-outreached population had a significantly higher proportion of surgical patients, which is not ideal since surgical patients were found by logistic regression to be associated with lower odds of a no-show. This higher proportion of surgical patients is probably due to the fact that patients were selected from the pool of physical therapy patients, who are much more likely to be surgical than clinic patients,

but the proportion among CHW-outreached CCO therapy patients (65%) is still much higher than the proportion among all CCO therapy patients (57%). The CHW outreach would likely be more effective if non-surgical patients were prioritized for outreach. The only other characteristic in which the therapy patient population who received at least one outreach from a CHW differed significantly from the population without CHW intervention was in recent inpatient hospitalizations, which was not found to be associated with odds of no-showing.

There was poor alignment between the population at risk for no-showing and the population who receive outreach on other characteristics. Current tobacco usage is associated with 2.39-times higher odds of missing a therapy appointment, but the majority of therapy patients who received outreach were not current tobacco smokers (60%). Likewise, recent NEMT usage was associated with 1.55-times higher odds of missing a therapy appointment, but the majority of therapy patients contacted did not use NEMT in the past year (73%). Conversely, recent specialist visitation and recent PCP visitation were each associated with a roughly-50% decrease in odds of missing a therapy appointment, but the vast majority of therapy patients contacted had visited specialists or PCPs in the past year (93% and 79%, respectively). The same was true of patients with chronic disease history which were associated with a roughly-25% decrease in odds of missing a therapy appointment but made up 78% of the therapy patients contacted.

These characteristic proportions of outreached patients are all more-or-less in line with the baseline characteristics of the CCO- member therapy patient population, which is to be expected since they were not strategically selected for when choosing

patients to receive outreach. Consistent with this, the average age and months as a CCO member among CHW-outreached therapy patients were not notably different from those of the overall CCO-member therapy patient population (mean ages: 44.1 ± 14.5 CHW-outreached, 44.7 ± 15.2 overall; mean member months: 9.6 ± 3.5 CHW-outreached, 10.0 ± 3.2 overall). Selecting patients to receive outreach based on characteristics that are associated with higher odds of no-showing a given appointment would likely increase the effectiveness of this CHW program in reducing CCO patient no-show rates.

There was also a discrepancy between the body-parts-of-interest for CHW-outreached therapy patient's appointments and those that were found to be associated with higher odds of a no-show. Upper body therapy appointments were associated with a 1.34-fold increase in odds to no-show while lower body therapy appointments were associated with a 26% decrease in odds to no-show; having a lower-body part scheduled for treatment was protective against no-showing. However, the proportion of upper body appointments were significantly lower among outreached patients than among non-outreached patients, and the proportion of lower-body appointments higher. Lower body appointments were almost twice as common in therapy than upper body appointments (66% lower body, 34% upper body). This lack of congruence likely explains why the CHW outreach efforts appear ineffective at first glance – the population who received the majority of outreach attempts was not the population at the highest risk for missing an appointment.

LIMITATIONS AND FUTURE STUDIES

The largest limitation in the evaluation of this CHW program was the criteria by which patients were selected for outreach. The mid-study-period shift in criteria at an unknown time made it extremely difficult to draw any meaningful conclusions from the data. It would be more useful from a study perspective to establish a method for choosing patients to outreach (be it random, based on certain characteristics, or otherwise) and keep it consistent throughout a set period of time. This would allow for a clear evaluation of the effectiveness of that method, which could then be altered if it was found to not be impactful. Another factor limiting our evaluation was the way in which an outreach attempt was classified. Due to limitations in data capture and documentation, this study was unable to quantify the intensity or duration of the CHW outreach to a CCO member. Some members may have received a single CHW documented phone call, while another member may have received more intensive engagement and CHW services over a period of time. Future studies should seek to better understand if there is a dose-response relationship between CHW outreach and missed appointments.

Some of the variables used in the study were limiting as well. Self-reported demographics were often messy and non-uniform. For instance, frequency of alcohol was reported as a wide variance of answers that jeopardize the validity of the variable. Inconsistencies such as a “Never” response for alcohol use, but a specified type and/or frequency of alcohol use on the same patient made accurate classification of characteristics challenging. There were also missing elements of some variables which

could have been useful in analysis. Surgical patient status was binary, with no indicator of type or severity of surgery which could have impacted no-show tendencies. Right-or-left-handed dominance was not recorded for patients, which could have been used along with the side of the body on which their injury occurred to investigate if that effected no-show rates.

The primary outcome of interest was imperfect, as well. While a no-show was designated as an appointment that was not cancelled or rescheduled but was not kept, an appointment that was cancelled in less than 24 hours of the appointment time, for instance, can be just as impactful to the clinic and to the patient as a no-show. Some other studies on no-show rates considered this in their calculations [5]. The date and time of cancellation was not available for this study, so these instances could not be included. Similarly, the first appointment to occur within the study period (CHW intervention period) was identified; however, patients may have exhibited prior history of no-show behavior, which was not accounted for in this study. Availability of these data is important for future studies on no-shows in order to accurately measure the impact on patient and clinic that no-shows represent. Lastly, since the ultimate outcome of interest for CHW programs is improved health outcomes for patients, it would be ideal to know how missing appointments impeded rehabilitation and recovery. This was not feasible for this study, but it would be valuable in future studies to further investigate the relationship between CHW outreach, no-shows, and health outcomes.

RECOMMENDATIONS AND CONCLUSIONS

Despite the inconclusive evaluation of the effectiveness of the CHW program at this orthopedic clinic and surgery center, there is a large body of evidence supporting the effectiveness of CHW interventions in improving patient appointment adherence [10], [12] as well as related variables patient activation [11], [17], [19] and patient-provider communication [11], [13], [18] in a wide variety of medical specialties. Future CHW programs implemented in orthopedic clinics are advised to take steps to allow for effective evaluation of the program in order to determine their impact in an orthopedic setting. These steps would include implementing consistent criteria for selecting patients to receive outreach, committing to these criteria for a set period of time, and defining the metrics for how the program will be evaluated beforehand.

The current study yielded a number of patient and appointment characteristics which are associated with either an increase or decrease in odds of no-showing a given appointment in a Medicaid patient population at an orthopedic clinic. Yet, the CHW outreach program at the orthopedic clinic was not well-aligned with targeting at-risk patients. To guide future CHW outreach efforts, a standardized system for selecting and prioritizing patients to receive outreach ahead of their scheduled appointments should be piloted.

A potential CHW outreach screening system of this kind is described here. Since physical therapy appointments tend to be no-showed more often than other types of appointments, as shown by the current study and past studies [24], only characteristics associated with therapy appointment no-shows are used. In this system, points are

ascribed to characteristics based on the fold-increase or fold-decrease in odds of no-shows that they are associated with. For instance, a 1.5-fold increase in odds translates to a 5-point increase while a 50% decrease in odds translates to a 5-point decrease. Fold-increases and -decreases were rounded to the nearest multiple of ten when ascribing point values. Characteristics which were not found to be significantly associated with odds to no-show were ascribed a point value of zero. For continuous variables, the mean value is considered a point value of zero and the given increase or decrease is in relation to the mean value. For instance, 3 points would be added to a patient's total for every 10 years younger a given patient is compared to the mean age for the population. Point values for associated characteristics are displayed in Table 10.

Table 10. Point Value System for Prioritized Selection of CCO Physical Therapy Patients for CHW Outreach

Characteristic	**Point Value**
Current Tobacco Use	+ 14
Recent NEMT Usage [1]	+ 5
Recent PCP Visitation [1]	- 5
Recent Specialist Visitation [1]	- 5
Recent ED Visitation [1]	+ 3
History of Chronic Disease [2]	- 3
10 years younger [3]	+ 3
10 years older [3]	- 3
Upper Body Injury [4]	+ 3
Lower Body Injury [4]	- 3
Surgical Patients	- 3
2 fewer months as CCO member [5]	+ 1
2 more months as CCO member [5]	- 1

[1] Recent = in the 12 months prior to the appointment. [2] At least one chronic disease diagnosed prior to the appointment. [3] Mean age, representing the point value of zero, for this population was roughly 45. [4] An appointment for both an upper body part and a lower body part would be ascribed zero points for body part of interest. [5] Months out of the 12 months prior to the appointment. Mean number of months, representing the point value of zero, for this population was roughly 10.

Using this system, point totals would be added up for each upcoming appointment and patients would be contacted in decreasing order of total points, since the highest point total indicates the highest relative odds of a no-show. Because time is the limiting factor forcing decisions to be made regarding which patients to contact, as many patients as time allows for would be contacted in this order.

Appointments with higher point values using this system were no-showed much more frequently than those with lower point values during the study period. Therapy appointments for CCO patients with point values of at least 10 were missed 28% of the time (N = 126), those with positive point values below 10 were missed 21% of the time (N = 433), those exactly 0 were missed 17% of the time (N = 111), those between -1 and -10 were missed 13% of the time (N = 671), and those lower than -10 were missed 9% of the time (N = 895). However, patients who received at least one CHW outreach during the study period had appointments with an average point value of -5.96 (± 9.92), which was lower than the average of appointments for CCO patients who did not receive outreach (-4.03 ± 6.96). Contacting patients in decreasing order of their upcoming appointments' point values would better align the patients receiving outreach with the patients who are more likely to no-show appointments.

A system such as this could be piloted in a wide variety of medical clinics and tailored to fit the patient populations for those clinics using similar studies to identify their respective associated characteristics. While the characteristics and respective point values displayed in Table 10 are specific to a Medicaid population and many include data provided by a CCO, this type of system could also be used for any other type of population that is to be targeted with an intervention and any characteristics that could

potentially be associated with odds to no-show. Prioritizing patients to contact ahead of their scheduled appointments is key to maximizing the effectiveness of interventions like CHW programs, and ultimately to improving the efficiency of the clinic and the health outcomes of patients.

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