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Healthcare utilization for asthma exacerbation among children of migrant and seasonal farmworkers

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ABSTRACT

Latino children of Migrant and Seasonal Farmworkers (MSFWs) with asthma are at risk for poor health outcomes due to medical access barriers. We compared differences in acute care utilization for asthma exacerbations among migrant and non-migrant Latino and non-Hispanic white (NHW) children at U.S. community health centers.

A retrospective observational study utilizing electronic health record data from the ADVANCE Clinical Research Network of United States community health centers included 13,423 children ages 3–17 with a primary care visit between 2005 and 2017 from eight states. Emergency department (ED) and hospitalization data came from Oregon Medicaid claims. Outcomes included acute clinic visits, ED visits, and hospitalizations for asthma exacerbation. Regression analyses adjusted for patient-level covariates.

Latino children had higher odds of acute clinic visits for asthma exacerbation compared to NHW children (MSFW odds ratio [OR] = 1.17, 95 % CI = 1.03–1.33; without migrant status OR = 1.13, 95 % CI = 1.03–1.23). MSFW children using Oregon Medicaid had fewer ED visits (rate ratio [RR] = 0.72, 95 % CI = 0.52–0.99) and hospitalizations (RR = 0.47, 95 % CI = 0.26–0.86) compared to NHW children.

Increased community health center visits may help mitigate disparities in acute asthma care for MSFW children.

1. Introduction

Asthma is a common pediatric disease with high rates of avoidable acute exacerbations (CDC, 2018; Engelkes et al., 2015). Among children with asthma in the US, 1 in 12 children will visit the Emergency Department (ED) and 1 in 20 will be hospitalized for asthma every year (CDC, 2018). Compared to non-Hispanic white (NHW) children, Latino children are more likely to have low quality care (Flores et al., 2002), lower medication adherence (McQuaid et al., 2012; Arcoleo et al., 2015), and more ED visits for asthma (Wright, 2009; McRoy et al., 2017). Latino children are also more likely to live in environments with known asthma triggers, including greater exposure to traffic pollution (Weaver and Gauderman, 2018; Meng et al., 2006), indoor molds (Sinclair et al., 2018), hazardous waste, pesticides, and mercury (Flores et al., 2002).

Children of migrant and seasonal farmworkers (MSFWs), in families that include an estimated 2.4 million adult (Hamer, 2017) and 500,000 child farmworkers (Hess, 2007) in the US, are particularly at risk for poor asthma outcomes (Kearney et al., 2014). MSFWs and their children have medical-access barriers because many are uninsured, low income, have low English language proficiency, and frequent relocation making Medicaid coverage difficult to obtain (Bechtel et al., 1995; Rosenbaum and Shin, 2005). Studies have documented children of MSFWs have fewer annual exams and routine health care visits (Seid et al., 2003;

Abbreviations: CI, confidence interval; ED, emergency department; GEE, generalized estimating equation; MSFW, Migrant and Seasonal Farmworker; NHW, non-Hispanic white; OR, odds ratio; RR, rate ratio.

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Weathers et al., 2004). Poor housing conditions for MSFWs, including the use of pesticides, rat poison, mold in sleeping rooms, and water damage in bathrooms, have all been linked with poor respiratory health among these workers (Kearney et al., 2014). Children living in these conditions are also at risk for developing respiratory health issues, such as asthma (Flores et al., 2002; Sinclair et al., 2018; Peat et al., 1998).

There are significant gaps in the literature on asthmatic Latino children of MSFWs. It is unknown whether these children experience high rates of ED visits or acute care visits for asthma exacerbations. While not specific to MSFWs, there are studies to support that asthmatic Latino children born of foreign-born parents have more hospitalizations (Leung et al., 2017; Bardin et al., 2019) and more ED visits (Koinis-Mitchell et al., 2011). Existing research on acute care utilization of Latino children with asthma has primarily used cross-sectional methods, and is therefore limited in its ability to generate findings on the course of primary and acute care over time (Wright, 2009; McRoy et al., 2017; Koinis-Mitchell et al., 2011; Canino et al., 2012). In order to fill this gap, we performed a study utilizing electronic health record data linked to Medicaid claims data to compare acute care utilization between MSFW Latino, non-MSFW Latino and non-Hispanic white (NHW) children with asthma. We hypothesize that both Latino children of MSFWs and non-MSFW Latino children will have more acute clinic visits, ED visits, and hospitalizations for asthma compared to NHW children.

2. Methods

2.1. Data sources and inclusion

We utilized data from the Accelerating Data Value Across a National Community Health Center Network (ADVANCE) Clinical Research Network (CRN). The ADVANCE CRN contains electronic health record data from the OCHIN (not an acronym) network of community health centers in most US states. Our analysis of acute clinic visits uses data from eight states, only including clinics where at least one migrant status was documented. Additionally, we had access to Medicaid claims data for Oregon only allowing us to analyze ED and hospitalization data exclusively in that state. This was a retrospective observational study with our study population including Latino children with a recorded migrant status and NHW children aged 3 to 17 years with asthma and at least one ambulatory visit between January 1, 2005 and December 31, 2017, within an OCHIN clinic. Patients were excluded if they had a diagnosis of cystic fibrosis. Latinos whose migrant status was not documented (missing) were excluded (N = 64).

Eight children with a date of death during the study period were also not included in this study.

2.2. Data collection

All data was collected during the routine provision of care, from the electronic health record and linked to Medicaid claims for ED visits and hospitalizations. For acute clinic-based visits, asthma exacerbation was identified in the electronic health record by either ICD-10: J45.901 or ICD-9-CM: 493.92 or by an encounter with any asthma diagnosis and a nebulized albuterol prescription or oral prednisone prescription. Using Oregon Medicaid claims, we considered ED and hospitalizations to be for asthma exacerbation if the primary diagnosis of the visit was asthma (ICD-9 493.xx or 10 codes J45.xx) or there was an asthma diagnosis (not the primary diagnosis) with ICD-9 or ICD-10 codes for a respiratory infection.

2.3. Dependent variables

We considered three sites where patients with asthma exacerbations could receive care: in the clinic, in the ED, or in-patient hospitalization. For each of these sites we considered two sets of outcomes: whether patients had ever received care for an asthma exacerbation at each site and the rates of visits at that site per year in the study period. Our first outcome was a binary indicator denoting whether asthma exacerbation was documented for each site. Our second outcome was a rate denoting the number of visits for each site per year in the study period meeting our asthma exacerbation criteria described above.

2.4. Independent variable

Our primary independent variable was a mutually exclusive combination of ethnicity and migrant seasonal farmworker status as three groups: Latino patients with migrant status, Latino patients without migrant status and NHW patients. MSFW was self-reported and was collected in the community health center in compliance with the Health Resources and Services Administration's Health Center Program data reporting requirements (System, 2021). This demographic information in community health centers is often collected by clinic staff during intake or during the assessment of eligibility for financial programs. We indicated a patient Latino when they self-reported their ethnicity as Hispanic or they reported Spanish as their preferred language. While we use Latino because it is often preferred in our study population, the actual ethnicity information collected by clinics is Hispanic and non-Hispanic white.

2.5. Covariates

Patient age was derived from the date of first study encounter. Also included were sex, number of residential changes over the study period, maximum asthma severity level over the study period, having ever had an albuterol prescription, having ever had an corticosteroid inhaler prescription, and having ever been prescribed an oral steroid prescription. Insurance status and family income as measured by percent of federal poverty level (with < 138 % denoting Medicaid eligibility) were derived over the study period as they were measured at each clinic visit. Insurance categories include "never insured" (insured at 0 clinic visits), "some public" insurance (insured by public insurance at at least one visit, but may also have been uninsured at other visits) and "some private and public" (mixture of insurance types over their visits which included private insurance and public insurance, and possibly no insurance at some visits). Family income included "always below 138 % of the federal poverty level" or "not always below 138 % of the federal poverty level," to allow for multiple measures per person over time. Residential change was defined as an address change to a different census tract. In addition, we estimated the rate of ambulatory visits (for any reason) per year up to and including the first asthma diagnosis and included it as a covariate. Language was not used as a covariate because it was co-associated with our main independent variable.

2.6. Statistical analysis

We described patient characteristics in our total sample and between our three ethnicity/migrant status groups. We performed two sets of analyses, one in our total sample in multiple states and one in a smaller subsample of Oregon clinics to which we could link Medicaid claims. In the multistate analysis, we examined acute OCHIN clinic visits across eight states. In the Oregon-only sample, we measured hospitalizations and ED visits, as hospitalization and ED data are not found routinely in the OCHIN electronic health record.

For the binary outcome of whether asthma exacerbation care was ever received at one of the three sites (i.e. in the clinic, in the ED, or in-patient hospitalization), we used generalized estimating equation (GEE) logistic regression models to estimate odds ratios comparing ethnicity/migrant groups adjusted for covariates. We fitted GEE logistic models with an exchangeable correlation structure and empirical sandwich variance estimator to account for clustering of patients within clinics. For the set of analyses evaluating annual rates of acute clinic visits, ED visits, and hospitalizations for asthma exacerbation, we first provide

unadjusted annual visit rate ratio estimates for each site by ethnicity/migrant status group. A negative binomial GEE regression model was used to evaluate the relative difference in rate of visits in each of the three sites between the ethnicity/migrant status groups over the study period. These models also used an exchangeable correlation structure and empirical sandwich variance estimator to account for clustering of patients by clinic. All statistical tests were performed with a 2-sided type I error of 5 %. Analyses were conducted in RStudio version 4.0 and SAS version 9.4. This study was approved by the Oregon Health & Science University's Institutional Review Board.

3. Results

Table 1 includes descriptive statistics for the multistate study population across eight states by ethnicity and MSFW. The Oregon sample is described in Appendix Table 1. Notably in both the multistate and Oregon samples, a greater proportion of Latino children regardless of migrant status were between ages 3–6 at first asthma diagnosis, had public insurance, had > 3 primary care visits per year, and were ever prescribed a corticosteroid inhaler and oral steroid compared to NHW children. Overall, characteristics of the Oregon sample are similar to the multistate sample.

Latino children regardless of migrant status had higher odds of ever having had an acute clinic visit for asthma exacerbation compared to non-Hispanic White children (Fig. 1, MSFW: Covariate-adjusted odds ratio [OR] = 1.17, 95 % Confidence Interval [CI] 1.03–1.33, p = 0.016; non-MSFW: OR = 1.13, 95 % CI 1.03–1.23, p = 0.006). There was no significant difference in odds of ever having an ED visit or hospitalization for asthma exacerbation for Latino children regardless of migrant status compared to NHW children. Unadjusted and adjusted numeric values corresponding to Fig. 1 are provided in Appendix Table 2.

Among the Oregon Medicaid sample, Latino children with migrant status had a lower rate of ED visits and hospitalizations compared to NHW children (Fig. 2, ED visit: covariate-adjusted rate ratio [RR] = 0.72, 95 % CI 0.52–0.99, hospitalizations: RR = 0.47, 95 % CI 0.26–0.86). There was no significant difference in rates of acute clinic visits for Latino children regardless of migrant status compared to NHW children. Unadjusted and adjusted numeric values corresponding to Fig. 2 are provided in Appendix Table 3.

To determine whether the significant acute clinic visit findings hold true for Oregon only, Appendix Table 4 shows adjusted and unadjusted odds of clinic visits subset to Oregon patients only. They are similar to the multistate sample.

4. Discussion

This study of acute clinic care, emergency department utilization, and hospitalization for asthma exacerbations in Latino and NHW children with asthma is novel in its use of longitudinal electronic health record data, sample size, community health center setting, and its focus on children of migrant and seasonal farmworkers (MSFW).. We found that Latino children in Oregon who had MSFW designation in their clinic compared to NHW children had lower annual rates of visiting the ED or being hospitalized for asthma exacerbations. Additionally, Latino children regardless of migrant status had higher odds of ever having an acute clinic visit for asthma exacerbations compared to NHW children which is inconsistent with our hypothesis. These findings are counter to cross-sectional studies which found that Latino children are more likely to have ED visits and hospitalizations for asthma exacerbations (CDC, 2018; Wright, 2009; McRoy et al., 2017). This finding holds true for the Oregon subsample as well as the multi-state sample, and has been seen for all children (regardless of whether or not clincis treated children of migrant and seasonal farmworkers) in other research in this network (Kaufmann et al., 2022).

While Latino children, and especially migrant children, continue to have medical access barriers and are more likely to live in environments

Table 1
Patient Characteristics of the Multistate Sample by Ethnicity/Migrant Status, 2005–2017.

	Total N (%)	Non-Hispanic White N (col %)	Latino Migrant and Seasonal Farmworker Status N (col %)	Latino Non-Migrant and Seasonal Farmworker Status N (col %)
Patients, N (row %)	13,423	4,512	1,615	7,296
Age at first study encounter				
3–5	6,892 (51.3)	1,820 (40.3)	927 (57.4)	4,145 (56.8)
6–10	4,499 (33.5)	1,704 (37.8)	555 (34.4)	2,240 (30.7)
11–17	2,032 (15.2)	988 (21.9)	133 (8.2)	911 (12.5)
Sex				
Female	5,739 (42.8)	1,966 (43.6)	650 (40.2)	3,123 (42.8)
Male	7,684 (57.2)	2,546 (56.4)	965 (59.8)	4,173 (57.2)
Insurance				
Never Insured	229 (1.7)	105 (2.3)	43 (2.7)	81 (1.1)
Some Private and Some Public	2,146 (16.0)	1,172 (26.0)	146 (9.0)	828 (11.3)
Some Public	11,048 (82.3)	3,235 (71.7)	1,426 (88.3)	6,387 (87.5)
Federal Poverty Level				
Always Below 138 %	8,396 (62.5)	2,440 (54.1)	1,117 (69.2)	4,839 (66.3)
Not always below 138 %	5,027 (37.5)	2,072 (45.9)	498 (30.8)	2,457 (33.7)
Number of Residential Changes				
0	5,702 (42.5)	1,958 (43.4)	642 (39.8)	3,102 (42.5)
1	3,546 (26.4)	1,168 (25.9)	444 (27.5)	1,934 (26.5)
2	1,765 (13.1)	568 (12.6)	246 (15.2)	951 (13.0)
3	1,635 (12.2)	503 (11.1)	226 (14.0)	906 (12.4)
Not Documented	775 (5.8)	315 (7.0)	57 (3.5)	403 (5.5)
Visits per year				
<2	6,717 (50.2)	2,627 (58.2)	630 (39.0)	3,460 (47.4)
2–4	3,482 (25.9)	1,084 (24.0)	559 (34.6)	2,137 (29.3)
5+	3,223 (23.9)	801 (17.8)	426 (26.4)	1,699 (23.3)
Asthma Ever Documented on Problem List				
Yes	9,767 (72.8)	3,220 (71.4)	1,170 (72.4)	5,377 (73.7)
No	3,656 (27.2)	1,292 (28.6)	445 (27.6)	1,919 (26.3)
Maximum Asthma Severity Level				
Mild Persistent/ Intermittent	5,558 (41.4)	1,633 (36.2)	738 (45.7)	3,187 (43.7)
Moderate/Severe Persistent	1,186 (8.8)	363 (8.0)	115 (7.1)	708 (9.7)
Not Documented	6,679 (49.8)	2,516 (55.8)	762 (47.2)	3,401 (46.6)
Albuterol Prescription Ever				
Yes	12,103 (90.2)	3,929 (87.1)	1,492 (92.4)	6,682 (91.6)

(continued on next page)

Table 1 (*continued*)

	Total N (%)	Non-Hispanic White N (col %)	Latino Migrant and Seasonal Farmworker Status N (col %)	Latino Non-Migrant and Seasonal Farmworker Status N (col %)
No	1,320 (9.8)	583 (12.9)	123 (7.6)	614 (8.4)
Corticosteroid Inhaler Prescription Ever				
Yes	5,812 (43.3)	1,758 (39.0)	810 (50.2)	3,244 (44.5)
No	7,611 (56.7)	2,754 (61.0)	805 (49.8)	4,052 (55.5)
Oral Steroid Prescription Ever				
Yes	4,158 (31.0)	1,097 (24.3)	520 (32.3)	2,541 (34.8)
No	9,265 (69.0)	3,415 (75.7)	1,095 (67.8)	4,755 (65.2)

Note: All patient characteristics were derived at first asthma diagnosis at age 3 years or older unless otherwise specified. All patients had an asthma diagnosis. The sample included 83 clinics across 8 states (CA, IN, MA, MT, NC, OH, OR, and WA), only including clinics where at least one migrant status was documented. Residential change was defined as an address change to a different census tract. Visits per year is any ambulatory visit (for any reason).
Federal Poverty Level and insurance status, collected at each visit, describe aggregate values for all visits in the study period. In the United States, income < 138 % of the federal poverty level qualifies one for public insurance (Medicaid).

with asthma triggers (Flores et al., 2002; Weaver and Gauderman, 2018; Meng et al., 2006; Sinclair et al., 2018; Kearney et al., 2014), it is possible that many children turn to community health centers as their primary source of care with asthma exacerbations, thereby increasing the number of acute clinic visits and decreasing the utilization of the ED and hospital. These clinics may help mitigate previously reported disparities in ED utilization and hospitalization for asthma exacerbation for these patients. Community health centers serve as safety nets for marginalized patient populations, as they provide care regardless of insurance status or ability to pay. The majority of patients at community health centers are uninsured, underinsured, publicly insured, racial and ethnic minorities, and low-income (Health, 2020). Our study population reflects these characteristics with a greater proportion of Latino children regardless of migrant status having public insurance and being under 138 % of the federal poverty level compared to NHW children.

Furthermore, it is also possible that care received at community health centers prevents the most severe asthma exacerbations that require ED or hospital care. Studies have found insurance status, lack of asthma medication, racial or ethnic minority status, and inability to access outpatient provider to be associated with greater ED utilization (Lawson et al., 2014; Hasegawa et al., 2016; Nath and Hsia, 2015). Previous work in our network has shown that once diagnosed with asthma, both Spanish- and English-speaking Latino children receive equitable asthma care indicators including documentation of asthma severity and prescription rates of common asthma medications (Heintzman et al., 2020). Interestingly, Spanish-speaking Latino children had higher rates of guideline appropriate albuterol prescriptions and inhaled corticosteroids (Heintzman et al., 2020). Therefore these children may be less likely to have severe exacerbations when symptoms requiring acute care occur.

In addition to financial access to care, community health centers also provide important cultural and linguistic services that may further contribute to reduced hospitalizations and ED visits for Latino and

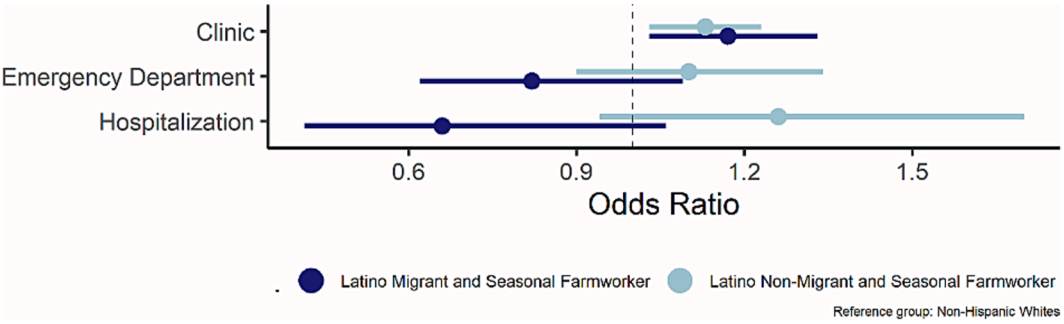

Fig. 1. Covariate-adjusted odds ratios of ever having an acute clinic visit, emergency department visit, or hospitalization for asthma exacerbation, by ethnicity/migrant status. Each was a logistic GEE model clustered at the clinic level and adjusted for sex, age, insurance status, income as a percent of the Federal Poverty Level, number of residential changes in the time period, and number of visits per year.

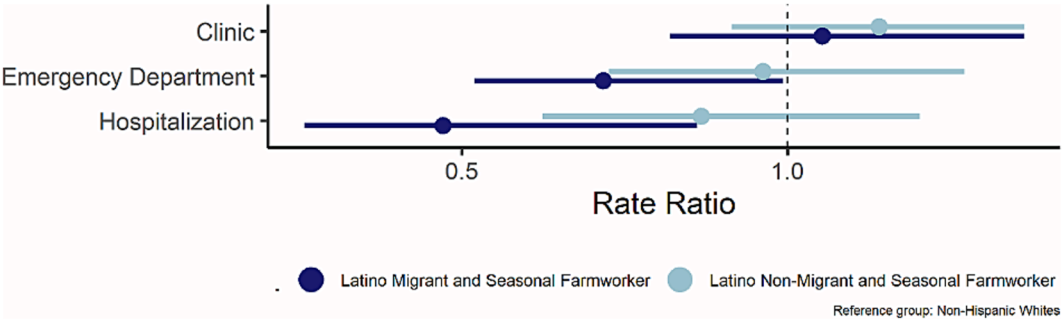

Fig. 2. Adjusted rate ratios of acute clinic visits, emergency department visits or hospitalizations for asthma exacerbation, by ethnicity/migrant status. Each was a negative binomial GEE model clustered at the clinic level and adjusted for sex, age, insurance status, income as a percent of the Federal Poverty Level, number of residential changes in the time period, and number of visits per year.

Latino children of MSFWs. By law, community health centers must provide language concordant care (U.S., 2021). Studies have shown that provider-patient language concordance improves outcomes in several areas of care (Diamond et al., 2019). These clinics additionally often provide culturally congruent care with use of promotoras, also known as community health workers. Studies have found that utilizing promotoras in interventions for children with asthma improve several outcomes including decreasing urgent health care utilization (Rashid et al., 2015; Campbell et al., 2015; Martin et al., 2021). Further research is needed to determine whether these reduced disparities are unique to culturally-sensitive community health centers compared to other clinic settings.

While community health centers serve diverse patient populations, there is variability in patient demographics.. In order to capture data for the MSFW children population, we only included community health centers that had patients with designated MSFW status in the electronic health record. It is possible that this subset of clinics may have more specific resources for migrant patients such as community health workers, language services, and mobile clinics to meet patients closer to their work sites and homes.

5. Limitations

The major limitation of our study is that we did not include clinics that did not have any patients with documented migrant status, as we could not ascertain whether a lack of migrant status represented true non-migrant status or simply the absence of collection of this data in the specific clinic. There may be variability in clinic resources and knowledge of barriers unique to the MSFW population based on the presence or absence of this designation in the electronic health record. Our analysis may be biased towards clinics accustomed to caring for MSFWs. We find better outcomes for children of MSFWs in our study because of our inclusion of only community health centers with MSFW documentation. In order to determine if these findings are unique to community health centers, clinics should expand the collection of this data, and future studies should explore approaches to facilitating this expansion and/or assess MSFW status even if not documented in the electronic health record. Our findings may also not be generalizable to all migrants because our database consisted exclusively of community health centers. However migrant patients are often seen in community health centers given linguistic, financial, and culturally specific resources they provide to this population among other minority populations (Health, 2020). It is also possible that patients have left the clinics to seek care out of this network, however research has shown that most patients in ADVANCE/OCHIN clinics stay in the network (Huguet et al., 2020). The potential for selection bias (i.e., patients who may not have been alive to enter the study) highlights the need for future studies evaluating this issue.

We did not have ED and hospital data on our multistate sample, so its uncertain if these trends would manifest in a multistate sample. However, our ambulatory findings for the Oregon (Appendix Table 1) and our multi-state sample were similar. Our criteria for determining exacerbations, including specific ICD-10 and ICD-9 codes and asthma medications could have missed children with exacerbations. Asthma exacerbation was indicated in the electronic health record by a visit with specific ICD-10 and ICD-9 codes or any asthma diagnosis with nebulized albuterol inhaler or any asthma diagnosis with oral prednisone prescription. Oral prednisone is prescribed for asthma exacerbations, though this medication may be used to treat other non-respiratory conditions. While we could not determine severity of exacerbations, a prescription of oral prednisone in combination with an asthma diagnosis may indicate patient with high risk for exacerbation or poor asthma control.

6. Conclusion

Latino children of MSFWs had lower rates of ED visits and hospitalizations in Oregon compared to NHW children. In the multistate network of community health centerss, Latino children regardless of migrant status had higher acute clinic visits for asthma exacerbation compared to NHW children. These findings suggest that community health centers may mitigate previously reported disparities in ED utilization and hospitalization for asthma in the Latino population. These clinics may also may prevent severe enough exacerbations requiring more urgent care. Further research is needed to determine whether these reduced disparities are unique to culturally-sensitive community health centers compared to other clinic settings.

CRediT authorship contribution statement

Cassandra Kasten-Arias: Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Tahlia Hodes:** Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Miguel Marino:** Conceptualization, Methodology, Writing – review & editing. **Jorge Kaufmann:** Writing – review & editing. **Jennifer A. Lucas:** Project administration, Writing – review & editing. **Cirila Estela Vasquez Guzman:** Writing – review & editing. **Sophia Giebultowicz:** Writing – review & editing, Data curation. **Brian Chan:** Writing – review & editing. **John Heintzman:** Conceptualization, Methodology, Writing – review & editing, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

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Appendix A. Supplementary data

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