DEPARTMENT OF HEALTH & HUMAN SERVICES
Centers for Medicare & Medicaid Services
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State Demonstrations Group

November 5, 2024

Jay Ludlam
Deputy Secretary, NC Medicaid
NC Medicaid Division of Health Benefits
State of North Carolina, Department of Health and Human Services
2501 Mail Service Center
Raleigh, NC 27699-2501

Dear Deputy Secretary Ludlam:

The Centers for Medicare & Medicaid Services (CMS) completed its review of the Healthy Opportunities Pilots (HOP) Interim Evaluation Report, which is required by the Special Terms and Conditions (STCs), specifically STC 36 "Interim Evaluation Report" of North Carolina's section 1115 demonstration, "North Carolina Medicaid Reform Demonstration" (Project No: 11-W-00313/4). Because of delays in HOP implementation, this report covers the demonstration period from March 15, 2022 to November 30, 2023. CMS determined that the evaluation report, submitted on April 16, 2024 and revised on July 10, 2024, is in alignment with the approved Evaluation Design and the requirements set forth in the STCs, and therefore, approves the state's HOP Interim Evaluation Report.

In accordance with STC 39 "Public Access," the approved evaluation report may now be posted to the state's Medicaid website within thirty days. CMS will also post the evaluation report on Medicaid.gov.

Evaluation findings for HOP were preliminary but promising. Between March 2022 and November 2023, HOP participants reported fewer health-related social needs after receipt of HOP services and had significantly lower emergency department utilization than comparable beneficiaries in non-HOP regions. Additionally, the evaluation found that costs per HOP beneficiary per month were 85 dollars lower than would have been expected in the absence of the HOP program. Due to time and data constraints, findings related to impacts on beneficiary health outcomes were limited. CMS looks forward to receiving the state's Summative Evaluation Report in order to better understand the demonstration's effectiveness.

We look forward to our continued partnership on the North Carolina Medicaid Reform Demonstration. If you have any questions, please contact your CMS demonstration team.

Sincerely,

Danielle Daly -S

Digitally signed by Danielle Daly -S
Date: 2024.11.05 11:15:24 -05'00'

Danielle Daly
Director
Division of Demonstration Monitoring and Evaluation

cc: Morlan Lannaman, State Monitoring Lead, CMS Medicaid and CHIP Operations Group

Interim Evaluation Report

NC Healthy Opportunities Pilots

July 16, 2024

Prepared by: Cecil G. Sheps Center for Health Services Research
Commissioned for: North Carolina Department of Health and Human Services – Division of Health Benefits

Contents

Executive Summary 6
General Background Information 15
HOP Program Overview: Buying Health with Regional Collaboration 16
HOP Implementation Timeline & Services Domains 20
Populations Served: Health Needs & Social Risk Factors 21
Member Participation: Screening & Care Management 25
Evaluation Questions and Hypotheses 27
Methodology 29
Evaluation Design 29
Target and Comparison Populations 30
Evaluation Period 31
Evaluation Measures 32
Data Sources 33
Analytic Methods 34
Methodological Limitations 42
Results 46
Evaluation Question 1 46
HOP Participants 46
Evaluation Question 2 63
Evaluation Question 3 66
Total Needs 67
Specific Needs 69
Food Needs 70
Housing Needs 72
Transportation Needs 73
Toxic Stress and IPV Needs 75
Evaluation Question 4 77
Low Birth Weight 77
Evaluation Question 5 78
Healthcare Utilization Measures 80
Evaluation Question 6 91
Total Cost of Care 93

Conclusions 97
Plans in Subsequent Evaluation Periods 102
Evaluation Question 1 102
Evaluation Question 2 102
Evaluation Question 3 102
Evaluation Question 4 102
Evaluation Question 5 103
Evaluation Question 6 103
Interpretations, Policy Implications, and Interactions with Other State Initiatives 104
Interpretations 104
Policy Implications 105
Interactions with Other State Initiatives 106
Lessons Learned and Recommendations 107
References 109
Attachments 112
CMS Approved Evaluation Design 112
Healthy Opportunities Pilots Fee Schedule 113
Appendices 114

List of Figures

Figure 1: Pilot Regions (Source: NCDHHS) 17
Figure 2: Schematic of Pilot Organization (Source: NCDHHS) 18
Figure 3: Roles of Entities in the Pilots (Source: NCDHHS) 19
Figure 4: HOP Timeline 20
Figure 5: Example Pilot Services (Source: NCDHHS) 21
Figure 6: Entry into the Pilots (Source: NCDHHS) 25
Figure 7: Driver Diagram 26
Figure 8: HOP Beneficiaries 47
Figure 9: Percentage of Enrollees Receiving Pilot Services in Each Time Period Since Enrollment 58
Figure 10: Interrupted Time Series Analysis of Total Needs 68
Figure 11: Estimated Probability of Specific Needs with and without HOP 69
Figure 12: CITS Analysis of Emergency Department Visits 82
Figure 13: CITS Analysis of Inpatient Admissions 86
Figure 14: CITS Analysis of Outpatient Visits 89
Figure 15: CITS Analysis of Monthly Cost of Care 96
Figure A1: New Enrollees per Month by Region 115
Figure A2: New Enrollees per Month by Eligibility Category 116
Figure A3: New Enrollees per Month by Prepaid Health Plan 117
Figure A4: Needs Identified per Month 118

List of Tables

Table 1: Physical/Behavioral Health Needs-Based Criteria at time of HOP Approval 22
Table 2: Social Risk Factors at time of HOP Approval 23
Table 3: Measures Used in Interim Evaluation Report 32
Table 4: Enrollment by Region 48
Table 5: Enrollment by Prepaid Health Plan (PHP) 48
Table 6: Enrollment by Pilot Eligibility Category 49
Table 7: Pilot Enrollment Rate by Region 50
Table 8: Age by Region* 50
Table 9: Demographics for HOP Participants and Medicaid Beneficiaries in Non-HOP Regions Who Report a Social Risk 51
Table 10: Assessments Provided by Region 53
Table 11: Assessments Provided by Eligibility Categories 53
Table 12: Assessments Provided by PHP 53
Table 13: Assessments and Participants with Identified Needs 54
Table 14: Needs per Assessment 54
Table 15: Days from Enrollment to First Assessment by Region 55
Table 16: Days from Enrollment to First Assessment by PHP 55
Table 17: Connection to Services by Service Type 56
Table 18: Connection to Services by Region 56
Table 19: Connection to Services by Eligibility Category 57
Table 20: Connection to Services by PHP 57
Table 21: Services delivered by HSOs 57
Table 22: Time from Eligibility to Service Dates, in Days 58
Table 23: Services Provided by Service Type 59
Table 24: Services Provided by Region 59
Table 25: Services Provided by Eligibility Category 60
Table 26: Services Provided by PHP 60
Table 27: Invoices Submitted and Paid by PHP 61
Table 28: Time from Invoice Submission to Payment, in Days 61
Table 29: Enrollment Ended by Region 62
Table 30: Enrollment Ended by Eligibility Categories 62
Table 31: Enrollment Ended by PHP 62

Table 32. Comparison of Screening Rates in HOP Region vs. Non-HOP Region Screening for All Beneficiaries in Medicaid 64
Table 33. Comparison of Screening Rates in HOP Region vs. Non-HOP Region Screening for Beneficiaries in a Standard Plan 64
Table 34: Screening Rates by HOP Region 64
Table 35: Needs per Assessment 65
Table 36: Changes in Level and Trend of Total Needs 68
Table 37: Changes in Level and Trend in Probability of Reporting a Food Need 70
Table 38: Changes in Level and Trend in Probability of Reporting a Housing Need 72
Table 39: Changes in Level and Trend in Probability of Reporting a Transportation Need 73
Table 40: Changes in Level and Trend in Probability of Reporting a Toxic Stress and/or IPV Need 75
Table 41: HOP Impact on Monthly ED Visits Examining 12 Months Before and 12 Months After HOP Enrollment Using Interrupted Time Series Analysis 81
Table 42: HOP Impact on Monthly ED Visits Examining 12 Months Before and 12 Months After HOP Enrollment Using Comparative Interrupted Time Series 81
Table 43: HOP Impact on Monthly Inpatient Admissions Examining 12 Months Before and 12 Months After HOP Enrollment Using Interrupted Time Series Analysis 85
Table 44: HOP Impact on Monthly Inpatient Admissions Examining 12 Months Before and 12 Months After HOP Enrollment Using Comparative Interrupted Time Series 85
Table 45: HOP Impact on Monthly Outpatient Visits Examining 12 Months Before and 12 Months After HOP Enrollment Using Interrupted Time Series Analysis 88
Table 46: HOP Impact on Monthly Outpatient Visits Examining 12 Months Before and 12 Months After HOP Enrollment Using Comparative Interrupted Time Series 88
Table 47: HOP Impact on Monthly Cost of Care Examining 12 Months Before and 12 Months After HOP Enrollment Using Interrupted Time Series Analysis 94
Table 48: HOP Impact on Monthly Cost of Care Examining 12 Months Before and 12 Months After HOP Enrollment Using Comparative Interrupted Time Series 95
Table A1: New Enrollment by Month & Region 114

Executive Summary

Health is affected by many factors beyond the medical care provided within the walls of a hospital or clinic. As such, the North Carolina Healthy Opportunities Pilots are testing evidence-based, non-medical interventions for their direct impact on North Carolina's Medicaid beneficiaries' health outcomes and healthcare costs.

North Carolina's Section 1115 Medicaid Demonstration Waiver entitled "North Carolina Medicaid Reform" was approved to cover the period November 1, 2019 through October 31, 2024. One aspect of that Demonstration Waiver is the State of North Carolina's Enhanced Case Management and Other Services Pilot (ECM), more commonly referred to as the Healthy Opportunities Pilots (abbreviated as the 'Pilots' or 'HOP'). Owing to the national context of the COVID-19 pandemic and local context, such as the delay in transition to Medicaid-managed care, the Pilots did not begin providing services until March 15, 2022. Thus, the Pilots have been actively delivering services for less time than intended.

The purpose of this Interim Evaluation Report is to assess the impact of the Pilots to date and to provide information to guide continued service delivery and programmatic adjustments for the Pilots. This assessment includes data regarding the delivery of pilot services from March 15, 2022 to November 30, 2023. This report is specific to the Pilots and does not cover other elements of the 1115 Waiver, which have been submitted as a separate Interim Evaluation Report. It also only includes 'standard' Pilot services and does not include the separate, direct-to-consumer 'expedited enrollment' program launched on March 21, 2023. Data from the 'expedited enrollment' program are not included in this report both given its relatively short time of operation in this evaluation period and limitations in data available to evaluate the program, which does not use the same data systems as the 'standard' Pilots. Analyses of the direct-to-consumer program will be included in the summative evaluation. Finally, this evaluation report is not meant to be as comprehensive as the subsequent summative evaluation.

The Pilots aim to test evidence-based, non-medical interventions for their direct impact on North Carolina's Medicaid and Children's Health Insurance Program (CHIP[a]) beneficiaries' health outcomes and healthcare costs, with the purpose of incorporating findings into the Medicaid program. As part of NCDHHS' commitment to promoting health equity by building a well-coordinated system that "buys health," as well as healthcare, in the period evaluated, the Pilots required Prepaid Health Plans (PHPs) to cover federally approved, evidence-based interventions that address social needs in four

[a] All references to Medicaid beneficiaries in this report are also inclusive of CHIP beneficiaries

domains—food insecurity, housing instability, transportation insecurity, and interpersonal violence/toxic stress—for qualifying Medicaid beneficiaries. PHPs and their care managers are responsible for determining who is eligible for the services by using physical health, behavioral health, and social risk criteria, and which services they will receive.

HOP services are delivered through innovative regional networks of community-based organizations and social services agencies (collectively called 'human service organizations' [HSOs]) to address needs across all domains. Each regional network is established, managed, and overseen by a Healthy Opportunities Network Lead (NL) (previously referred to as Lead Pilot Entities or LPEs). These organizations are the essential connection between PHPs, HSOs, and the state of North Carolina, along with clinical care teams when appropriate. NLs are local organizations embedded in the communities they serve. On May 27, 2021, following a competitive procurement process, NCDHHS announced the selection of three NLs to contract with the PHPs to develop, manage, and oversee a network of HSOs providing pilot services to their eligible enrollees. This created three Pilot regions in North Carolina, each with its own NL: Access East, Inc., Community Care of the Lower Cape Fear (CCLCF), and Impact Health. Access East and CCLCF were already established organizations within their communities, while Dogwood Health Trust created Impact Health to lead HOP implementation in its region of western North Carolina. The Pilot regions include rural communities and communities in which members experience health inequities at high rates.

Pilot services began with a phased launch—first offering food services on March 15, 2022, followed by housing and transportation services on May 1, 2022, and toxic stress and cross-domain services on June 15, 2022. Finally, interpersonal violence (IPV)-related services became available on April 5, 2023. The CMS-approved evaluation design for the Pilots included six Evaluation Questions covering different aspects of the Pilots. We summarize these six Evaluation Questions as: Evaluation Question 1 ("Effective Delivery of Pilot Services"), Evaluation Question 2 ("Increased Rates of Social Risk Factor Screening and Connection to Appropriate Services"), Evaluation Question 3 ("Improved Social Risk Factors"), Evaluation Question 4 ("Clinical Outcomes"), Evaluation Question 5 ("Healthcare Utilization"), Evaluation Question 6 ("Cost of Care"). This report covers aspects of all six questions.

Regarding Evaluation Question 1 ("Effective Delivery of Pilot Services") analyses, the results of the interim evaluation suggest that North Carolina's goal of establishing a multi-sector collaboration between the State, PHPs, healthcare systems, and HSOs has been achieved. Operational data demonstrate that despite challenges, Pilot infrastructure has successfully enabled the delivery of Pilot

services. As of November 30, 2023, the Pilots have enrolled 13,271 unique individuals and delivered 198,291 pilot services across many different intervention types by 147 HSO entities that submitted invoices. Initial social needs assessments occur quickly, with 90% of participants assessed for needs on the day of Pilot enrollment.

As the Pilots assessments identify needs, services to address them typically began soon after enrollment—over 75% of services had a service start date within 2 weeks of enrollment in the Pilots. At the time of this report, 11,809 (89%) enrollees received at least 1 Pilot service, with food services constituting the majority (86%) of services delivered. When examining services for specific needs, the rate of service receipt varied across need type: 10,055 individuals (93%) reporting a food need received a food service during this period, 5,803 individuals (68%) reporting a housing need received a housing service, 995 individuals (24%) reporting a transportation need received a transportation service, and 74 individuals (21%) reporting a toxic stress and/or IPV need received a toxic stress and/or IPV service. This difference may reflect both the phased rollout of services, with food services preceding all other services and IPV services coming much later, and differences in the complexity of delivering different services. Ongoing surveying work and qualitative interviews with Pilots participants, which will be reported in the summative evaluation, will help better understand this variation.

Invoices for services were paid in a timely fashion, with about 50% of invoices paid within 30 days, 75% paid within 46 days, and 97.9% within 90 days. This is important as a major goal of the Pilots was to ensure that HSOs, many of which historically depended on grant funding received prior to delivery of services, could operate successfully with a financing model that includes payments made soon after services were delivered.

Regarding Evaluation Question 2 (“Increased Rates of Social Risk Factor Screening and Connection to Appropriate Services”), we found that screening for social needs was significantly greater in Pilot regions, compared with other parts of North Carolina where the Pilots were not operating. The health-related social need screening rate was about 13.8% higher ($p< 0.001$) in Pilot regions compared with non-Pilot regions (9.1% of Medicaid beneficiaries screened in Pilot regions vs. 8.0% in non-Pilot regions), even though PHPs were required to attempt to screen all Medicaid beneficiaries in all regions upon enrollment in managed care. We were unable to evaluate whether more individuals with positive screens were connected to services in Pilot regions, compared with non-Pilot regions, owing to a lack of data regarding service connections in non-Pilot regions.

Evaluation Question 3 ("Improved Social Risk Factors") analyses evaluated whether Pilot services seem to be addressing the social risks (also referred to as health-related social needs or social needs) that Pilot participants report. The underlying logic of the Pilots is that addressing those risks is a key pathway whereby Pilot services can lead to changes in health, healthcare utilization, and healthcare cost. Thus, optimizing services delivered to address those risks is important to the overall success of the Pilots.

As Pilot services began to be delivered, we found strong evidence using interrupted time series analyses that Pilot services reduced the total number of social needs (defined as the total count of food, housing, transportation, and IPV and/or toxic stress needs). The possible total number of social risks ranges from 0 to 4. As Pilot services began, the mean number of risks was 1.7 overall, 1.8 for non-pregnant adults, 1.8 for pregnant individuals, 1.7 for children aged 0-20, and 1.7 for children aged 0-3. Over the entire follow-up period, we estimated that Pilot participation reduced the total number of risks by 0.01 needs per day of follow-up, on average (95% CI -0.01 to -0.01). Within the follow-up period, however, longer times since Pilot participation began were associated with greater reduction in needs. To help quantify this, at 6 months, we estimated Pilot participation was associated with 0.4 fewer needs than would have been expected had an individual not participated in HOP (95% CI -0.5 to -0.2, $p < .0001$). At 12 months, we estimated that, on average, Pilot participation was associated with 1.2 fewer needs than would have been expected had an individual not participated in HOP (95% CI -1.6 to -0.8, $p < .0001$). Thus, we estimate a larger impact of Pilot participation on needs at 12 months than at 6 months (difference in outcomes at 12 vs. 6 months: -0.8, 95%CI -1.1 to -0.5, $p <.0001$).

Moreover, Pilot services reduced the probability of reporting the specific risks of food needs (change in probability averaged over the entire follow-up period: -0.002 per day, 95% CI -0.003 to -0.001), housing needs (change in probability: -0.01 per day, 95%CI -0.01 to -0.004), and transportation needs (change in probability: -0.002 per day, 95%CI -0.003 to -0.001), relative to estimates of what would have occurred had participants not enrolled in the Pilots. These patterns held true for most eligibility subgroups, although there were a few instances for the 'pregnant individuals' and 'children aged 0 to 3' subgroups in which the results were not statistically significant. Because the magnitude of the risk reduction estimates in these instances was similar to that of Pilot participants overall, the lack of statistical significance may have resulted from low sample size in this interim report. The main case in which eligibility subgroup estimates seemed meaningfully different from the overall estimate was with transportation needs for children aged 0 to 20 and children aged 0 to 3. In these cases, the magnitude of

the estimate was small and not statistically significant. This may be explained by non-emergency medical transportation being a covered benefit for all Medicaid members, and relatively few HOP transportation services being provided for these age groups. This finding merits further investigation in the summative evaluation.

As IPV specific services have only been provided since April 2023, corresponding to only the last third of the evaluation period, and relatively few toxic stress services have been provided, the results of analyses examining the impact of the Pilots on IPV and/or toxic stress are more uncertain. We did find evidence that IPV and/or toxic stress needs decreased with Pilot participation for the subgroup of pregnant individuals, but we did not find significant differences for other subgroups or Pilot participants overall. These analyses did have limited power, however, as the reported prevalence of IPV and/or toxic stress needs was very low relative to other needs.

Comparative effectiveness analyses did not reveal significant differences in effectiveness of addressing social needs by intervention type. For example, we did not observe differences when comparing 1) a fruit and vegetable prescription, 2) a food box (large or small, for delivery or pick up), and 3) prepared meals (either a 'healthy' meal [for pick up or delivered] or a 'medically tailored' meal [delivered]) on the probability of reporting a food need; when comparing 1) housing navigation, support, and sustaining services, 2) essential utility set up, 3) move-in support, and 4) home remediation, safety and quality inspection, or accessibility and safety modifications on the probability of reporting a housing need; or when comparing 1) health-related private transportation and 2) health-related public transportation on the probability of reporting a transportation need. These findings support continuation of a variety of services, and allowing care managers and participants to select services they feel will best address the participant's particular health-related social need.

We do not yet have good estimates of whether Pilot participation affects clinical outcomes, as we were unable to investigate Evaluation Question 4 ("Clinical Outcomes") comprehensively in this report, owing to lack of data regarding most clinical outcomes we aim to evaluate. The one outcome we were able to evaluate, low birth weight, did reveal a point estimate in favor of Pilot services (0.021 decrease in probability of low birth weight, 95%CI 0.077 decrease to 0.035 increase, $p = 0.45$), but it was not statistically significant, with wide confidence intervals owing to relatively few events. Subsequent evaluation reporting will shed more light on the impact of Pilot participation on clinical outcomes.

Regarding Evaluation Question 5 ("Healthcare Utilization") analyses, we found that Pilot enrollment tends to occur during a period of rising risk for adverse healthcare utilization. We also found

strong evidence that Pilot participation was associated with decreased emergency department utilization over a 12-month period after Pilot enrollment, relative to what would have occurred in the absence of the Pilots (reduction of 6 emergency department visits per 1000 beneficiary-months, $p < .0001$). This was apparent both overall and for all Pilot eligibility categories. Further, we estimated that the impact of Pilot participation on emergency department visits was greater at 12 months than at 6 months (difference in outcomes at 12 vs. 6 months: -0.022, 95%CI -0.032 to -0.013, $p <.0001$). In other words, Pilot participation reduced emergency department visits by 22 more visits per 1000 beneficiary-months at 12 months than it did at 6 months. We did not find differences by Pilot region.

The pattern regarding the impact of Pilot services on inpatient admissions was more heterogenous. Overall, over the 12-month period following Pilot enrollment, we estimated that Pilot participation was associated with a non-statistically significant reduction in inpatient admissions (0.8 fewer admissions per 1000 beneficiary-months, $p = 0.07$). However, estimates varied meaningfully across Pilot eligibility categories. We estimated a larger and statistically significant reduction in inpatient admissions for non-pregnant adults (2 fewer admissions per 1000 beneficiary-months, $p < 0.001$), while estimates for pregnant individuals and children aged 0 to 20 were similar to the overall estimates and not statistically significant. We also estimated an increase in inpatient admissions for children aged 0 to 3 (4 more admissions per 1000 beneficiary-months, $p = 0.04$). This heterogeneity will be investigated further in subsequent reports. We did not find differences by Pilot region.

We did not observe a change in outpatient utilization attributable to Pilot participation. Similarly, we did not observe a change for specific outpatient utilization regarding prenatal and postpartum care.

For Evaluation Question 6 (“Cost of Care”) analyses, examining 12 months before and 12 months following Pilot enrollment, we observed significantly lower healthcare expenditures attributable to Pilot participation in both interrupted time series and comparative interrupted time series analyses, relative to what would have occurred in the absence of the Pilots. The decrease was approximately $85 per beneficiary per month (95% CI: $-122 to $-48). As these are individual-level estimates, they include the cost of direct Pilot services (which are included in Medicaid encounters), but do not include HOP spending that did not generate an encounter invoice (e.g., spending that was not for a specific service or individual, such as capacity building spending). Further, we estimated that the impact of Pilot participation on per beneficiary cost of care was greater at 12 months than at 6 months (difference in

outcomes at 12 vs. 6 months: -$566, 95%CI -$1016 to -$115, p = .01). We did not find differences by Pilot region.

For the outcomes of social risk, emergency department visits, and healthcare spending, we found negative trends over time in the period of Pilot participation. This implies greater benefits for Pilot participation at longer times from enrollment (e.g., 12 months rather than 6 months). These trends should not necessarily be extrapolated beyond the time period studied (12 months following Pilot enrollment for this interim evaluation report). Nevertheless, it does support allowing participants who meet eligibility criteria and feel they are benefiting from Pilot services to continue to receive them for periods longer than 6 months.

Overall, the findings of this report support the underlying rationale of the Pilots, which is that addressing social risk factors can lead to improvements in healthcare utilization and cost. Although there are analyses yet to conduct and evidence is limited in some areas, the results to date are largely positive. Of course, there are important limitations to keep in mind when interpreting these analyses. The most important limitation is that receipt of services was not randomly assigned. Aspects of a participant's clinical or social situation could have influenced both what type of service they received for their need and the likelihood that such a need would resolve or utilization would improve. However, the analyses in this report used several approaches to mitigate these potential biases—particularly regression adjustment (to help account for measured confounding), the use of data both before and after Pilot participation (to help account for time-fixed unmeasured confounding), and the use of a contemporaneous comparison group for many outcomes (to help account for time-varying confounding related to factors that affect Medicaid beneficiaries separately from Pilot participation, such as other changes in the Medicaid program or changing macroeconomic conditions). A second limitation relates to data availability. Data lag or data entry errors could lead to erroneous estimates, but we have little reason to expect this to be differential across the groups being compared. Moreover, this interim report does not include data on some Pilot spending (specifically, spending not associated with direct service provision), which will be included in the summative evaluation. Finally, this report does not evaluate the separate direct-to-consumer 'expedited enrollment' fruit and vegetable prescription offered alongside the 'standard' Pilot services, owing to data limitations.

In summary, we believe it is reasonable to conclude in this interim analysis that the Pilots are having an important impact on participants, and we will characterize this impact further in subsequent evaluation reporting.

The results of this interim evaluation lead to the following 4 recommendations:

1. Maintain Efforts to Screen, Enroll, and Deliver Healthy Opportunities Pilots Services to Medicaid Beneficiaries. Compared with the prior evaluation report, Rapid Cycle Assessment 1, screening and enrollment is substantially greater, and delivery of services to those enrolled is higher as well. Thus, efforts taken to improve these numbers appear to have been successful. Maintaining these efforts is likely beneficial for both Medicaid beneficiaries and for purposes of evaluation. If Medicaid beneficiaries who could benefit from Pilot services are not enrolled, it could leave them in need. In addition, as Pilot enrollment is linked to decreasing healthcare costs, greater enrollment could lead to increasing Medicaid costs savings. Moreover, greater enrollment would also help increase the power of evaluation activities, and permit evaluation of a broader set of questions. This is particularly important for detecting differences in response to services across groups, and for more in-depth analysis of groups that are of interest to the state of North Carolina, but are less common among Pilot participants—such as pregnant individuals. Without adequate numbers of individuals from categories of interest, there will be substantial uncertainty in any conclusions drawn from evaluation activities. Given the overall rate of screening of Medicaid beneficiaries in Pilot regions, there may yet be substantial numbers of individuals who could enroll in the Pilots.
2. Do Not Limit Service Duration. For most areas where Pilot services appear to be improving outcomes (e.g., health-related social needs, adverse healthcare utilization, and healthcare spending), we found that longer periods of time after Pilot enrollment were expected to result in better outcomes. Within the inherent limitations of this evaluation and the duration of time studied, the evidence to date is consistent with allowing Pilot participants to continue to receive services if they feel they are benefiting from them. Consistent engagement with care management can repeatedly assess if there is a continued need for services. Of course, if participants feel they no longer need services, there is no reason to continue. However, routinely ending services at a particular cut-off (e.g., after 6 months) may decrease the overall impact of the Pilots. Analyses in subsequent reporting periods will also help to further elucidate the relationship between duration of Pilot participation and outcomes.

3. Understand the Relationship between Pilot Services and Social Needs. The key focus of the Healthy Opportunities Pilots is to address health-related social needs to improve health. How to operationalize 'addressing' health-related social needs is complex, however. Though resolution of a need (defined as no longer reporting a previously reported need) is likely to be beneficial, it is also important to recognize that needs could get worse in the absence of the Pilots, and thus services may be beneficial even if individuals do not report a need as fully resolved. Indeed, our interrupted time series estimates did suggest that much of the difference between the probability of needs experienced by Pilot participants and what we estimate would have happened in the absence of the Pilots was driven by worsening needs in the counterfactual condition. Thus, assessment of whether Pilot services are 'addressing' needs should attend to the nuance of the situation Pilot participants experience.
4. Expansion of Pilot Services to Other Regions of North Carolina is Reasonable. Although this is only an interim evaluation, there are clear signals that key features of the Healthy Opportunities Pilots are working as intended. Screening for social needs is greater in Pilot regions than non-Pilot regions. The HOP approach to service delivery has established an extensive network of human service organizations, delivering services at scale to over 10,000 individuals. We estimate that these services reduce social needs, improve adverse healthcare utilization relative to what would have been experienced in the absence of the program, and reduce healthcare spending. Therefore, offering Pilot services in additional parts of the state, assuming similar operating conditions can be established, is well-supported by the available data.

General Background Information

Health is affected by many factors beyond the medical care provided within the walls of a hospital or clinic. While access to high-quality medical care is critical, social and environmental factors and the behaviors that emerge as a result are also important determinants of health.[1,2] A substantial body of research has established that having an unmet resource need—including experiencing housing instability[3], food insecurity[4], unmet transportation needs[5], and interpersonal violence (IPV) or toxic stress[6,7]—can significantly and negatively impact health and well-being, as well as increase healthcare utilization and costs.[1,8–11] Addressing those needs can potentially improve health and healthcare utilization, which in turn can lower healthcare costs. For example, research indicates that providing housing assistance to adults who have physical and/or behavioral co-morbidities and are experiencing homelessness decreases unnecessary use of hospital care and associated healthcare costs.[12–14] Similarly, reducing the presence of asthma triggers (such as moldy carpets and broken air conditioners) in a child's home can reduce hospital visits and related costs,[15,16] and nutritional assistance interventions have been associated with lower healthcare costs for food insecure individuals.[17,18] Notably, however, much of the research conducted to date has evaluated discrete interventions for specific, high-need populations, leaving unanswered critical questions regarding whether— and how—to scale and sustainably fund the integration of non-medical services into the healthcare system on a population-wide basis.

As such, the North Carolina Healthy Opportunities Pilots are testing evidence-based, non-medical interventions for their direct impact on North Carolina Medicaid beneficiaries' health outcomes and healthcare costs.[b] North Carolina's Section 1115 Medicaid Demonstration Waiver entitled "North Carolina Medicaid Reform" was approved to cover the period November 1, 2019 through October 31, 2024. The Cecil G. Sheps Center for Health Services Research at the University of North Carolina at Chapel Hill ('the Sheps Center') was selected by the North Carolina Department of Health and Human Services (NCDHHS) Division of Health Benefits to evaluate one aspect of that Demonstration Waiver, the State of North Carolina's Enhanced Case Management and Other Services Pilot (ECM), now more commonly referred to as the Healthy Opportunities Pilots ('HOP' or the 'Pilots'), under External Evaluation Services Contract #30-2021-017-DHB. The evaluation design approved by the Centers for

[b] CHIP (Children's Health Insurance Program) beneficiaries are also eligible for Healthy Opportunities Pilots services and are included in the analyses of this report. We refer to 'Medicaid' beneficiaries for convenience, but this is also inclusive of CHIP beneficiaries.

Medicare & Medicaid Services (CMS) on August 15, 2019, is included as an Attachment. This report analyzes data about Pilot activities from the commencement of service delivery on March 15, 2022 through November 30, 2023. This report is specific to the Pilots and does not cover other elements of the 1115 Waiver, which have been examined in a separate interim evaluation report. It also does not evaluate the separate direct-to-consumer 'expedited enrollment' program, described in more detail below.

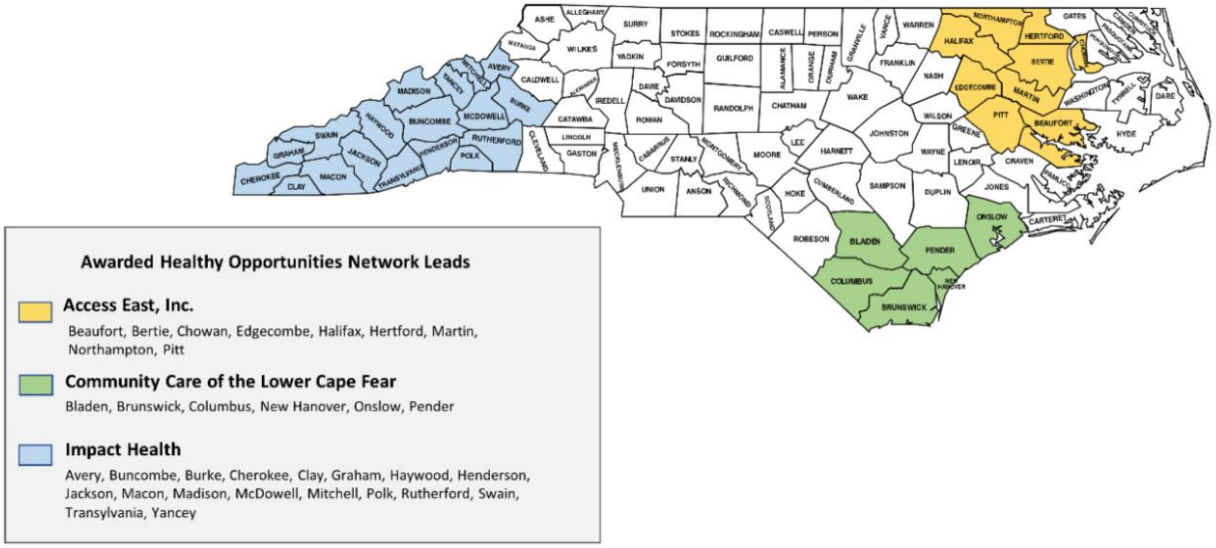
Planned implementation of the Pilots was affected by both the COVID-19 pandemic nationally and the delay of Medicaid managed care implementation in the state of North Carolina. This has meant that Pilot services have been delivered for less time than was originally planned.

HOP Program Overview: Buying Health with Regional Collaboration

North Carolina designed the Pilots to test evidence-based, non-medical interventions for their direct impact on North Carolina Medicaid beneficiaries' health outcomes and healthcare costs, with the purpose of incorporating findings into the Medicaid program. NC Medicaid's vision is to "to improve health through an equitable, innovative, whole-person centered, and well-coordinated system of care that addresses the medical and non-medical drivers of health." To help fulfill this vision, the Pilots require Prepaid Health Plans (PHPs) to cover evidence-based interventions that address four domains: housing instability, transportation insecurity, food insecurity, and IPV/toxic stress for a subset of Medicaid beneficiaries. PHPs and their care managers are responsible for determining who is eligible to receive the services and which services they will receive.

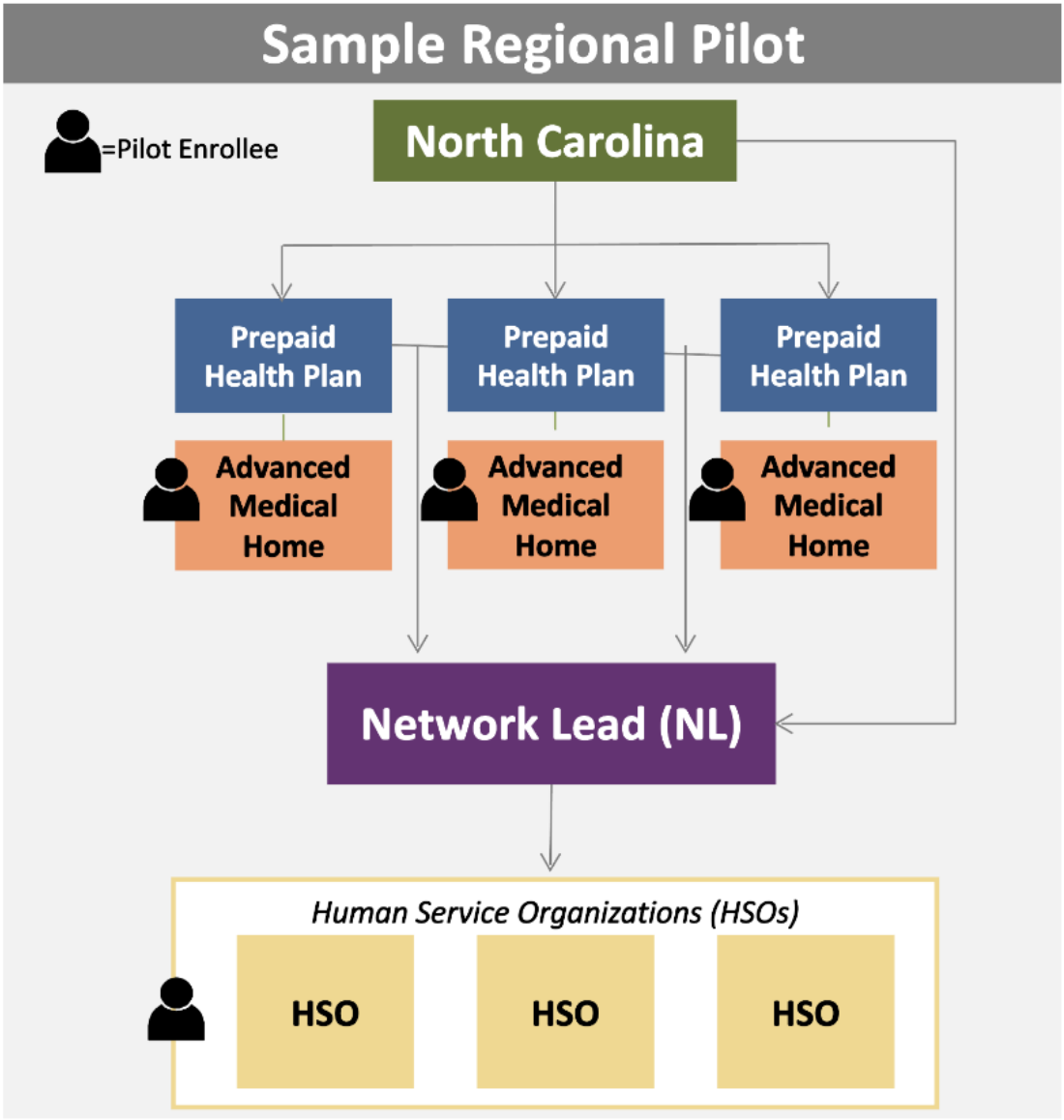
HOP services are delivered through innovative regional networks of community-based organizations and social services agencies (collectively called 'human service organizations' [HSOs]) to address needs across all domains. Each regional network is established, managed, and overseen by Network Leads (NLs) (previously referred to as Lead Pilot Entities or LPEs), organizations that serve as the essential connection between PHPs and HSOs, along with clinical care teams when appropriate. Network Leads are local organizations, embedded in the communities they serve. On May 27, 2021, following a competitive procurement process, NCDHHS announced the selection of three NLs to contract with the PHPs to develop, manage, and oversee a network of HSOs providing Pilot services to their eligible enrollees (see **Figure 1**).

Figure 1: Pilot Regions (Source: NCDHHS)



Coordination among these entities, and infrastructure necessary to support it, are intended to help address beneficiaries' non-medical needs in a way that conventional healthcare has not been able to do. Care managers providing Pilot services can be embedded within PHPs, or within local Tier 3 Advanced Medical Homes (AMH) (which provide primary care) or their affiliated Clinically Integrated Networks (CIN). Relationships between entities are depicted in **Figure 2.**

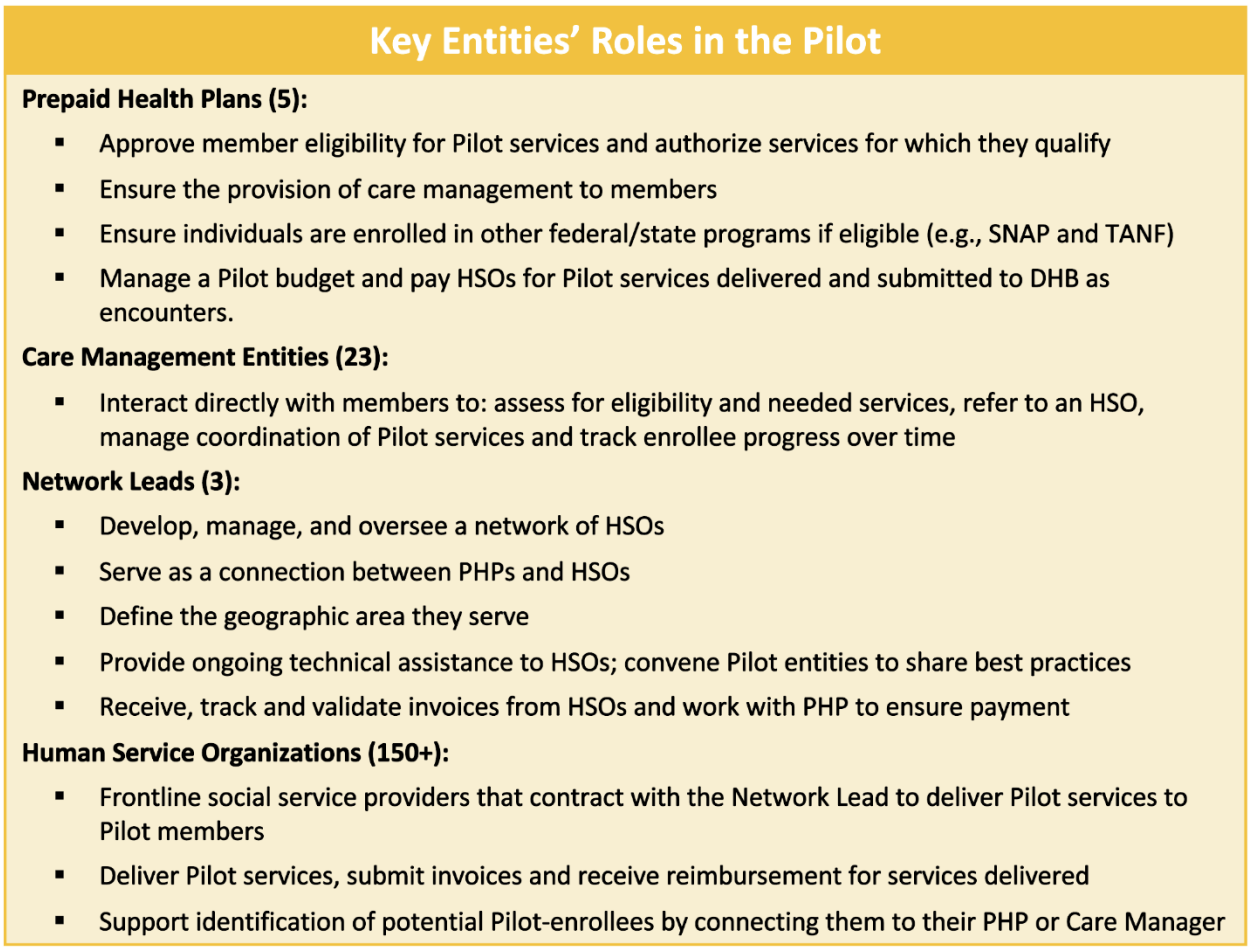
Figure 2: Schematic of Pilot Organization (Source: NCDHHS)



The primary responsibilities of the entities involved in delivering Pilot services across PHPs, Care Managers, NLs, and HSOs are depicted in **Figure 3**. Care Managers can be embedded within PHPs, or

within local Tier 3 Advanced Medical Homes (AMH) (which provide primary care) or their affiliated Clinically Integrated Networks (CIN).

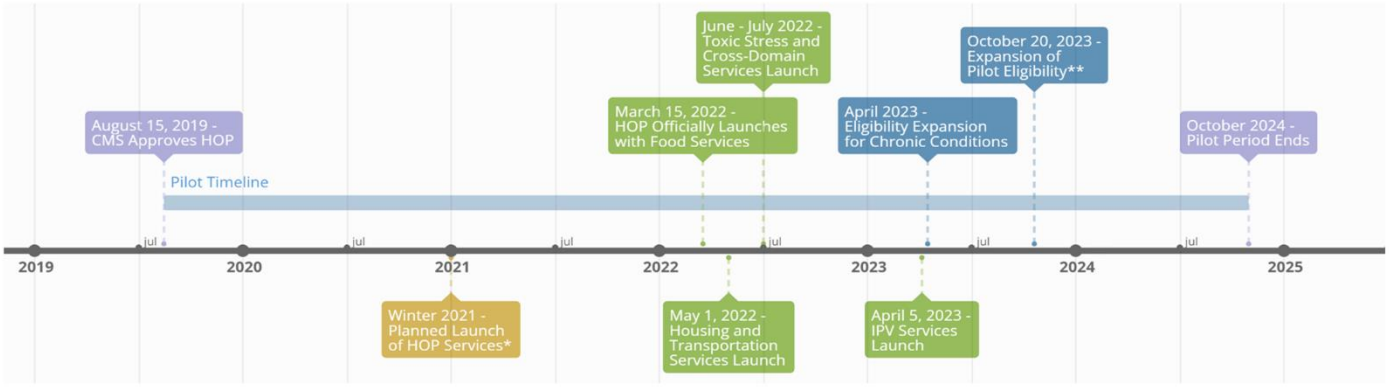
Figure 3: Roles of Entities in the Pilots (Source: NCDHHS)



Note: SNAP (Supplemental Nutrition Assistance Program) and TANF (Temporary Assistance for Needy Families)

HOP Implementation Timeline & Services Domains

Figure 4: HOP Timeline



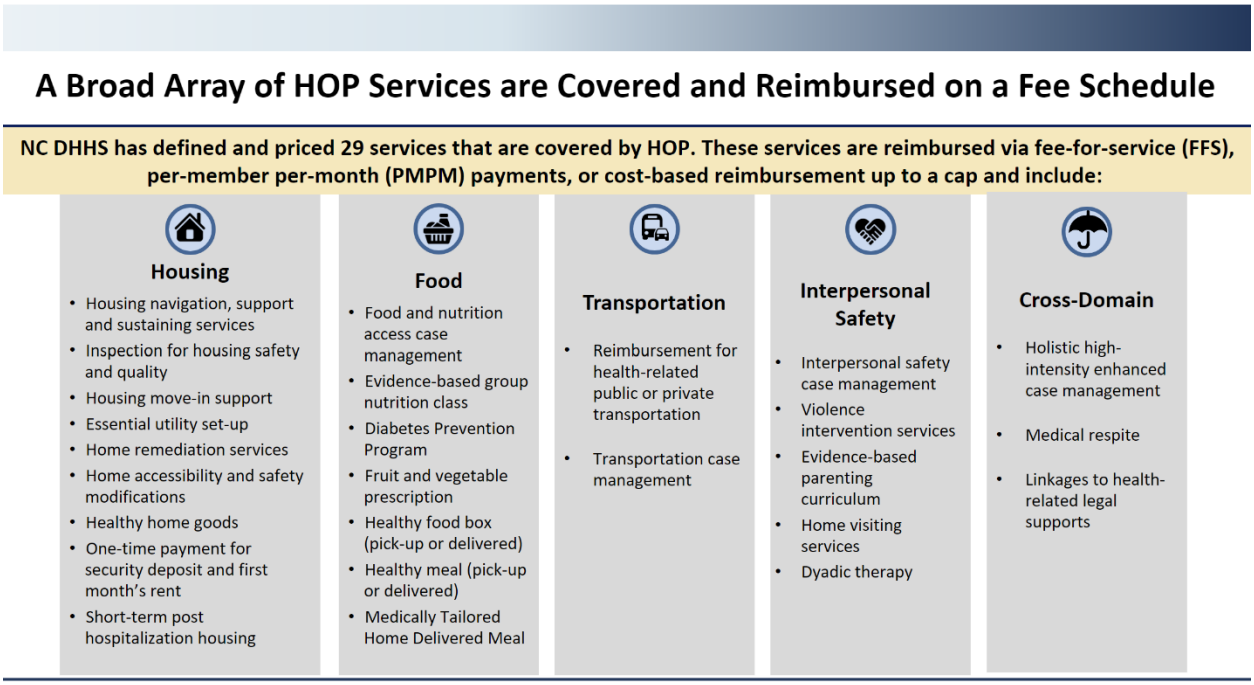
*COVID altered the planned start date

**October 2023 Eligibility expanded to include intellectual or developmental disability (I/DD), traumatic brain injury (TBI), and clinical eligibility criteria for Tailored Care Management as qualifying criteria for adults, pregnant women, and children 0-20.

On March 15, 2022, delivery of food services launched in all three Pilot regions, followed by housing and transportation on May 1, 2022. Cross-domain and toxic stress services became available on June 15, 2022. Delivery of IPV-related services began on April 5, 2023 (**Figure 4**). For this reason, the volume of IPV-related services is lower than other service types, and evaluation regarding these services is more limited.

Examples of Pilot services are presented in **Figure 5**. The Healthy Opportunities Pilots Fee Schedule, which provides a more complete description of the services, is provided as an attachment.

Figure 5: Example Pilot Services (Source: NCDHHS)



On March 21, 2023, North Carolina launched a separate pathway to receive one specific service to address food needs. This was a direct-to-consumer 'expedited enrollment' program that provided a fruit and vegetable prescription. This was not originally included as part of HOP, but developed as an innovation to reach more beneficiaries. Given that its structure is different from the 'standard' HOP program, data limitations (described in more detail below), and its relatively short duration within this evaluation period, this program could not be evaluated as part of the interim evaluation report. Analyses of the direct-to-consumer program will be included in summative evaluation.

Populations Served: Health Needs & Social Risk Factors

The Pilots provide services for certain high-risk, high-need individuals who live in a Pilot region and meet criteria for physical/behavioral health and social risk factors. The physical/behavioral health criteria as approved in the Evaluation Design are presented in **Table 1**, and the health-related social needs that serve as social risk factors as approved in the 1115 Waiver revision are presented in **Table 2**. There have been some changes to these criteria made as waiver revisions, implemented relatively late in the evaluation period. The first change was that, in April 2023, the Pilots were approved to expand the list of

chronic conditions that determine Pilot eligibility. This expansion added chronic mental illness, cancer, autoimmune disorders, and chronic liver disease as conditions that made individuals eligible for Pilot services. The second change included the approval to allow intellectual or developmental disability, traumatic brain injury, or clinical eligibility for Tailored Care Management (North Carolina's Health Home Benefit, SP 22-0024) as clinical eligibility criteria for adults, pregnant individuals, and children aged 0-20. Given how late in the evaluation period these changes were implemented, we believe they have not had a meaningful impact on the analyses in this evaluation report. Moreover, many Medicaid beneficiaries with serious mental illnesses or intellectual or developmental disability are still being served outside of PHPs.

Table 1: Physical/Behavioral Health Needs-Based Criteria at time of HOP Approval

Eligibility Category	**Age**	**Needs-Based Criteria (at least one, per eligibility category)**
Adults	≥21	• 2 or more chronic conditions. Chronic conditions that qualify an individual for pilot enrollment include: BMI over 25, blindness, chronic cardiovascular disease, chronic pulmonary disease, congenital anomalies, chronic disease of the alimentary system, substance use disorder, chronic endocrine and cognitive conditions, chronic musculoskeletal conditions, chronic neurological disease and chronic renal failure, in accordance with Social Security Act section 1945(h)(2). • Repeated incidents of emergency department use (defined as more than four visits per year) or hospital admissions (≥1 in past year).
Pregnant Individuals	Any	• Multifetal gestation • Chronic condition likely to complicate pregnancy, including hypertension and mental illness • Current or recent (month prior to learning of pregnancy) use of drugs or heavy alcohol • Adolescent ≤ 15 years of age • Advanced maternal age, ≥ 40 years of age • Less than one year since last delivery • History of poor birth outcome including: preterm birth, low birthweight, fetal death, neonatal death
	0-3	• Neonatal intensive care unit graduate • Neonatal Abstinence Syndrome • Prematurity, defined by births that occur at or before 36 completed weeks gestation • Low birth weight, defined as weighing less than 2500 grams or 5 pounds 8 ounces upon birth • Positive maternal depression screen at an infant well-visit

Eligibility Category	Age	Needs-Based Criteria (at least one, per eligibility category)
Children	0-20	• One or more significant uncontrolled chronic conditions or one or more controlled chronic conditions that have a high risk of becoming uncontrolled due to unmet social need, including: asthma, diabetes, underweight or overweight/obesity as defined by having a BMI of <5th or >85th percentile for age and gender, developmental delay, cognitive impairment, substance use disorder, behavioral/mental health diagnosis (including a diagnosis under DC: 0-5), attention-deficit/hyperactivity disorder, and learning disorders • Experiencing three or more categories of adverse childhood experiences (e.g. Psychological, Physical, or Sexual Abuse, or Household dysfunction related to substance abuse, mental illness, parental violence, criminal behavioral in household) • Enrolled in North Carolina's foster care or kinship placement system

Table 2: Social Risk Factors at time of HOP Approval

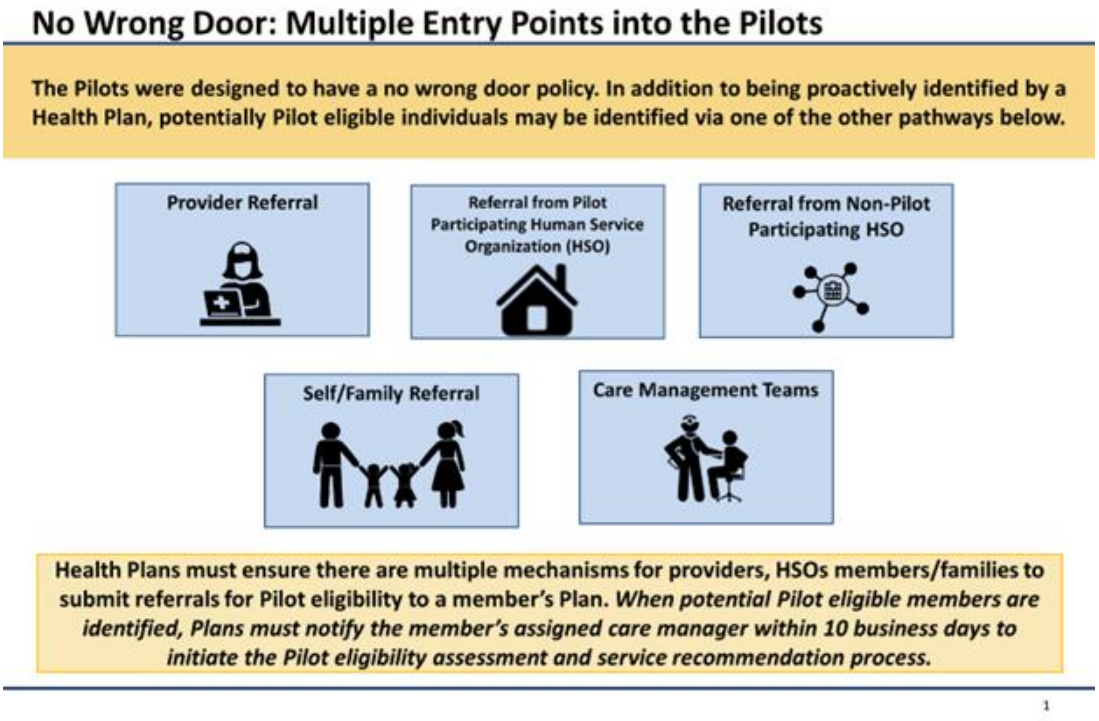
Risk Factor	Definition
Homelessness or housing insecurity	Homelessness, as defined in 42 C.F.R. § 254b(h)(5)(A), or housing insecurity, as defined based on the principles in the questions used to establish housing insecurity in the Accountable Health Communities Health Related Screening Tool or the North Carolina Social Determinants of Health (SDOH) screening tool.
Food Insecurity	As defined by the US Department of Agriculture commissioned report on Food Insecurity in America: • Low Food Security: reports of reduced quality, variety, or desirability of diet. Little or no indication of reduced food intake. • Very low food security: Reports of multiple indications of disrupted eating patterns and reduced food intake • Or food insecure as defined based on the principles in the questions used to establish food insecurity in the North Carolina Social Determinants of Health (SDOH) screening tool.
Transportation Insecurity	Defined based on the principles in the questions used to establish transportation insecurities in the Accountable Health Communities Health Related Screening Tool or the North Carolina SDOH screening tool.

Risk Factor	Definition
At risk of, witnessing, or experiencing interpersonal violence	Defined based on the principles in the questions used to establish interpersonal violence in the Accountable Health Communities Health Related Screening Tool or the North Carolina SDOH screening tool.

Member Participation: Screening & Care Management

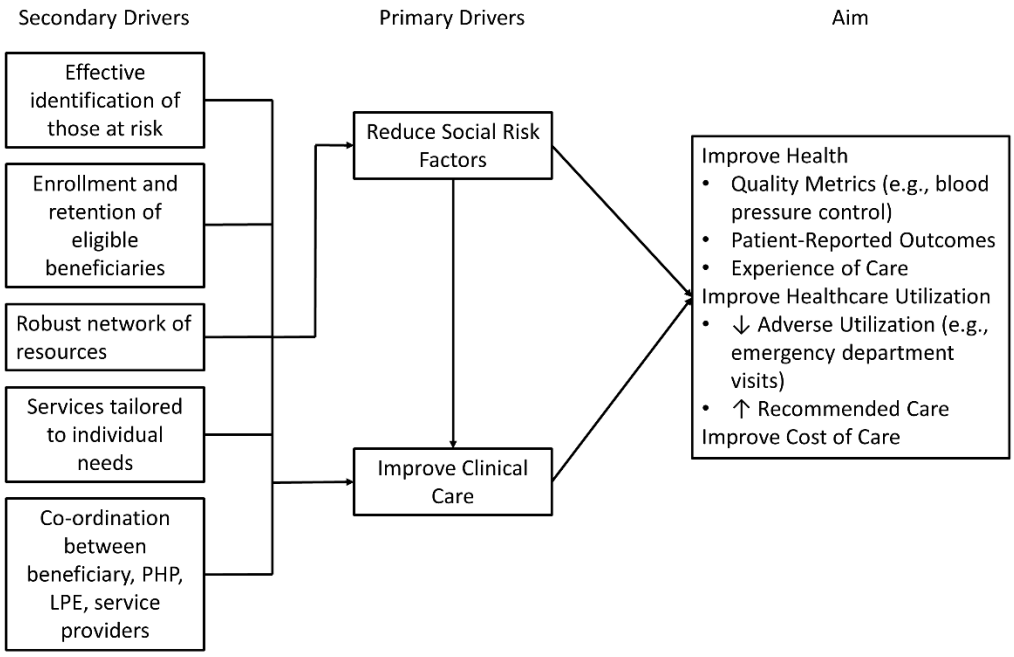
During this assessment period, outreach to Medicaid Managed Care members living in Pilot regions was led by PHPs, AMHs, and their care management teams, with support from NLs and HSOs. PHP Care Managers within HOP use the standardized Pilot Eligibility and Service Assessment (PESA) tool in NCCARE360, North Carolina's statewide resource and referral platform, to guide and document initial Pilot eligibility determination, service mix review every three months, and continuing eligibility determination every six months. DHHS leadership articulated a "no wrong door" approach (**Figure 6**) to support screening and connection to services using various referral pathways.

Figure 6: Entry into the Pilots (Source: NCDHHS)



The below Driver Diagram[c] (**Figure 7)** provides a conceptualization of how HOP services may improve health.

Figure 7: Driver Diagram



[c] LPE (Lead Pilot Entity) in the driver diagram is now more commonly referred to as a Network Lead (NL)

Evaluation Questions and Hypotheses

The state of North Carolina's overall goal is to improve North Carolina's Medicaid beneficiaries' health, healthcare utilization, and healthcare spending by building a well-coordinated system that "buys health," not just healthcare. Evaluating how well the Pilots achieve that goal involves evaluating specific questions related to program performance. One key component of successfully achieving the goals of the Pilots, as outlined in the above Driver Diagram, is identifying beneficiaries with social risks that affect health, enrolling them in the Pilots, and delivering services tailored to address those risks. Achieving these goals promotes the objectives of Titles XIX and XXI by helping to improve health for Medicaid and CHIP beneficiaries. This report describes analyses that break these pieces into the following Evaluation Questions and Hypotheses:

- Evaluation Question 1 ("Effective Delivery of Pilot Services") analyses relate to activities undertaken by NLs and HSOs to establish the necessary infrastructure, workforce, and data systems needed to effectively contract with and build the capacity of a network of HSOs, and to deliver Pilot services once established. Overall, Evaluation Question 1 analyses help test the hypothesis that NLs and HSOs will enable effective delivery of Pilot services.
- Evaluation Question 2 ("Increased Rates of Social Risk Factor Screening and Connection to Appropriate Services") analyses relate to how the coordinated activities of PHPs, NLs, and HSOs facilitate screening for social risk factors/needs and connect a higher proportion of those with social risk factors/needs to services tailored to address these risks in Pilot regions, compared with non-Pilot regions lacking these coordinated activities. Evaluation Question 2 analyses help test the hypothesis that the Pilots will increase rates of Medicaid beneficiaries screened for social risk factors and connected to services that address these risk factors.
- Evaluation Question 3 ("Improved Social Risk Factors") analyses relate to improving the social risk factors that Pilot members experience, across all eligibility categories: adults, pregnant individuals, children ages 0 to 20, and the subset of children ages 0 to 3. Evaluation Question 3 analyses help test the hypothesis that the Pilots will measurably improve the qualifying social risk factors in participants.

- Evaluation Question 4 ("Clinical Outcomes") analyses relate to improving clinical outcomes that may plausibly be affected by the social risk factors that Pilot members experience, across all eligibility categories: adults, pregnant individuals, children ages 0 to 20, and the subset of children ages 0 to 3. Evaluation Question 4 analyses help test the hypothesis that the Pilots will measurably improve clinical outcomes in participants. For reasons explained below, few analyses relating to Evaluation Question 4 are presented in this report. More extensive evaluation activities for this question will occur in subsequent periods.
- Evaluation Question 5 ("Healthcare Utilization") analyses relate to improving healthcare utilization by addressing the social risk factors that Pilot members experience, across all eligibility categories: adults, pregnant individuals, children ages 0 to 20, and the subset of children ages 0 to 3. Evaluation Question 5 analyses help test the hypothesis that the Pilots will measurably improve healthcare utilization in participants. It is important to note that improved utilization could consist of both decreased utilization (e.g., improved health which would lead to the need for fewer emergency department visits) and increased utilization (e.g., improved attendance at preventive visits).
- Evaluation Question 6 ("Cost of Care") analyses relate to improving cost of care by addressing the social risk factors that Pilot members experience, across all eligibility categories: adults, pregnant individuals, children ages 0 to 20, and the subset of children ages 0 to 3. Evaluation Question 6 analyses help test the hypothesis that the Pilots will measurably improve cost of care. It is important to note that improving cost of care could include decreased total spending, similar total spending simultaneous with improvements in health, and even increases in some spending categories (e.g., increased use of recommended medications or preventive services).

Methodology

Evaluation Design

For this reporting period, our methodology to address evaluation questions is as follows: Evaluation Question 1 ("Effective Delivery of Pilot Services") is descriptive and explanatory in nature, and so it does not involve comparisons or inferential statistics. Additional qualitative data collection for Evaluation Question 1 is ongoing and will be reported in the Summative Evaluation.

We used a cross-sectional comparative design for Evaluation Question 2 ("Increased Rates of Social Risk Factor Screening and Connection to Appropriate Services") analyses, comparing Medicaid beneficiaries in HOP regions to Medicaid beneficiaries outside of operating HOP regions.

Evaluation Question 3 ("Improved Social Risk Factors") activities used a within-participant comparison evaluating the prevalence and number of health-related social risks as a function of time and Pilot participation. We also used between-participant comparisons, evaluating the prevalence of health-related social needs as a function of time and receipt of specific Pilot services, comparing Pilot participants who used different services to address social risk factors (e.g., a fruit and vegetable prescription vs. a food box).

Evaluation Question 4 ("Clinical Outcomes") activities used a difference-in-differences style comparison to evaluate the outcome before and after Pilot participation, compared with individuals living outside of Pilot counties who report social risks (and thus likely would have been eligible for Pilot participation had they lived in Pilot counties). The purpose of the comparison group was to account for possible 'secular trends'—factors affecting Medicaid beneficiaries in North Carolina aside from Pilot services, such as COVID-related restrictions and increased use of telehealth services.

Evaluation Question 5 ("Healthcare Utilization") activities used two designs: The first design used a within-participant interrupted time series comparison to evaluate the outcomes as a function of time and Pilot participation. The second design used a comparative interrupted time series approach to produce difference-in-differences estimates of change in level and trend of healthcare utilization outcomes, examining Pilot participants and a comparison group of individuals living outside of Pilot counties who report social risks through state screening programs (and thus likely would have been eligible for Pilot participation had they lived in Pilot counties). The purpose of the comparison group was to account for possible 'secular trends'—factors affecting Medicaid beneficiaries in North Carolina aside from Pilot services.

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Target and Comparison Populations

For Evaluation Question 1 ("Effective Delivery of Pilot Services") analyses in this reporting period-- which related to establishment of the infrastructure necessary to deliver Pilot services and subsequent successful delivery of services—the target population for the secondary data analyses of Pilot operations data was Pilot participants.

For Evaluation Question 2 ("Increased Rates of Social Risk Factor Screening") analyses in this reporting period—which related to comparisons of social risks screening and delivery of services to those with social risks in the Pilot and non-Pilot regions—the target population was Medicaid beneficiaries in the Pilot regions and the comparison population was Medicaid beneficiaries in non-Pilot regions.

For Evaluation Question 3 ("Improved Social Risk Factors") analyses in this reporting period, which related to changes in social risks, the target population was Pilot participants. Because repeated assessment for social risk factors for individuals who are not involved in the Pilots are rare, we were unable to compare Pilot participants with non-Pilot participants as it relates to social risk factor outcomes.

For Evaluation Question 4 ("Clinical Outcomes"), analyses in this reporting period involved comparing the outcomes of HOP participants to what we estimated would have been observed in the absence of the Pilots, using data from those who reported social risks but resided in non-Pilot counties and thus did not receive HOP services to help produce these estimates. The purpose of the comparison group was to account for possible 'secular trends'—factors affecting Medicaid beneficiaries in North

Carolina aside from Pilot services. The target population for these analyses was Medicaid beneficiaries with social risks.

There were two types of Evaluation Question 5 ("Healthcare Utilization") analyses in this reporting period. The first type was within-participant (i.e., comparing how outcomes changed over time), for which the target population was HOP participants. The second type of analyses involved comparing the outcomes of HOP participants to what we estimated would have been observed in the absence of the Pilots, using data from those who reported social risks but resided in non-Pilot counties and thus did not receive HOP services to help produce these estimates. The purpose of the comparison group was to account for possible 'secular trends'—factors affecting Medicaid beneficiaries in North Carolina aside from Pilot services. The target population for these analyses was Medicaid beneficiaries with social risks.

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Evaluation Period

The two principal sources of data used for this report are NCCARE360 data and Medicaid Member and Claims data. NCCARE360 data were received by December 21, 2023. The last date of Pilot enrollment in the data received was November 30, 2023. Data for Medicaid members and claims were received on January 03, 2024. The period for evaluating HOP services in this report covers March 15, 2022 through November 30, 2023. Time periods closer to the end dates may be affected by data lag, but this data lag should not be differential when comparing Pilot and non-Pilot groups. For some analyses, particularly Evaluation Questions 3-6, which use individual-level longitudinal data, data prior to March 15, 2022 were used to provide 'pre-index' information. Further details regarding these situations are provided in the Results section for each of the sets of analyses.

Evaluation Measures

Measures used for this evaluation period are presented in the below table, **Table 3**. The Sheps Center was the steward for all measures.

Table 3: Measures Used in Interim Evaluation Report

Measure Name	Measure Description
Positive Screens for Unmet Social Needs	The percentage of beneficiaries who reported unmet social needs within NCCARE360 data within measurement period, reported by non-mutually exclusive categories of: • Food Insecurity • Housing Instability or Homelessness • Transportation Barrier • Experience Interpersonal Violence or Toxic Stress-related concern
Total Social Needs	Count of Unmet Social Needs (also referred to as risk factors or risks)
Positive Screens for Unmet Social Needs Connected to Services	The percentage of beneficiaries who reported unmet social needs within NCCARE360 data within measurement period, who received at least 1 invoiced service to address their needs
Rate of Screening for Unmet Social Needs	The percentage of Medicaid beneficiaries screened for unmet social needs from the health risk screening within measurement period
Number of Participants (Beneficiaries) Served	The total number of Pilots participants who received at least 1 invoiced Pilot service in the reporting period
Number Lost to Follow-up	The total number of participants lost to follow-up (could no longer be reached by care managers)
Number Withdrawn	The total number of participants who have withdrawn from the Pilots
Payment Completion	Percentage of completed payments made to HSOs
Payment Lag Time	Time from receipt of service to payment completion
Pilot Participants	Number of Medicaid members who enrolled in the Pilots
Dollars Paid	Dollar amount paid for Pilot services

Mean Payment Lag	Mean calendar days from HSO creating invoice to NL to PHP effectuating payment to HSO
Total Amount Invoiced	Total dollar amount invoiced for Pilot services
HSO Referrals	Number of referrals sent to human service organizations (HSO)
Services Invoiced	Number of services invoiced for during the assessment period
Mean Days from Pilot Eligibility Assessment to Service Delivery	Mean number of days between Pilot eligibility assessment and delivery of first invoiced Pilot service for those who enrolled in the Pilots
Low Birth Weight	The percentage of births with birthweight < 2500g
Emergency Department Visits	Count of Emergency Department (ED) visits.
Outpatient Visits	Count of Outpatient Visits
Inpatient Admissions	Count of inpatient admissions for all causes
Prenatal Care	Timeliness of Prenatal Care. The percentage of deliveries that received a prenatal care visit as a beneficiary of the organization in the first trimester, on the enrollment start date or within 42 days of enrollment in the organization.
Postpartum Care	Postpartum Care. The percentage of deliveries that had a postpartum visit on or between 21 and 56 days after delivery.
Total Cost of Care	Total PHP spending on services, per beneficiary per month. This includes both medical care costs and, for Pilot participants, invoices for Pilot services recorded in the Encounter Processing System (EPS).

Data Sources

In this reporting period, the evaluation relied on two key data sources: Pilot operations data from the NCCARE360 platform, and NC Medicaid administrative files—which includes both the member file that contained demographic information and encounters data (from the Encounter Processing System) that contained information for encounters that delivered specific medical care and Pilot related services. Encounters data is sometimes colloquially referred to as 'claims' data even after the transition to Medicaid managed care. Data cleaning and validation for NCCARE360 and NC Medicaid data was conducted by several organizations including Unite Us, NCDHHS, and the Sheps Center. Unite Us, in collaboration with United Way/211, and Expound, competitively procured by the Foundation for Health Leadership and Innovation, developed the statewide NCCARE360 referral platform. NCDHHS and Unite

Us modified the core functionalities of the platform to be used for Pilot enrollment, tracking, referrals, and invoicing. Additional data sources, such as vital records data, were also used for specific purposes (e.g., use of birth certificate data to help determine pregnancy status).

Analytic Methods

In this reporting period, the analytic methods for each evaluation question are as follows: Evaluation Question 1 ("Effective Delivery of Pilot Services") primarily consisted of descriptive statistics of program administration data.

Analytic methods for Evaluation Question 2 ("Increased Rates of Social Risk Factor Screening") primarily consisted of descriptive statistics of program administration data, with bivariate inference using chi-squared tests. Since the goal of these analyses was to assess screening prevalence as it occurred, adjusted estimates were not relevant.

The analytic methods for Evaluation Question 3 ("Improved Social Risk Factors") consisted of descriptive statistics and individual-level interrupted time series regression analyses. For individual-level interrupted time series regressions evaluating social risks associated with Pilot participation overall, regression models generally took the form:

$$\boldsymbol{Y_{ij} = \beta_0 + \beta_1 Participation_{ij} + \beta_2 Time_{ij} + \beta_3 TimeAfter_{ij} + \beta_4 Covariates_{ij} + \varepsilon}$$

Where 'i' indexes a unique individual observed on a particular day 'j'. 'Y' represents the outcome, participation is an indicator of whether an individual was participating in the Pilots on the date of observation, 'time' indicates the number of days relative to the participant's initial needs assessment, 'time after' indicates the number of days after the start of Pilot services, 'covariates' represent a vector of adjustment factors, and epsilon represents an error term. Unless otherwise specified, the covariates adjusted for were age, gender, race and ethnicity, disability status, index date (i.e., date of Pilot enrollment), quarter of observation (to account for seasonality), and rurality of residence. Models were fit using generalized estimating equations, with response distributions appropriate to the outcome type (e.g., Poisson distribution for the total number of risks or binomial distribution for the probability of a particular need). Standard errors were clustered at the level of the individual, which is the level of treatment for these analyses[19], and were robust to possible misspecification of the covariance matrix. After fitting the interrupted time series regression model, we created marginalized estimates of quantities of interest using the margins command in Stata. This approach is also termed marginalization, predictive margins, average marginal effects, recycled predictions for binary variables, or the parametric

g-computation formula. We targeted an average treatment effect on the treated (ATT) estimand for these analyses. Our interpretation of these analyses focused on the 'trend' in the total number of needs or probability of a specific need over time, as this indicates the ongoing impact of Pilot services, separate from any change in needs that occurred around the time of Pilot enrollment (and may in fact have prompted Pilot enrollment).

For individual-level difference-in-differences regressions evaluating social risks associated with receipt of specific Pilot services, regression models generally took the form:

$$\boldsymbol{Y_{ij} = \beta_0 + \beta_1 ServiceStart_{ij} + \beta_2 Time_{ij} + \beta_3 TimeAfter_{ij} + \beta_4 ServiceType_{ij}} \\ \boldsymbol{+ \beta_5 ServiceType_{ij} * ServiceStart_{ij} + \beta_6 ServiceType_{ij} * Time_{ij}} \\ \boldsymbol{+ \beta_7 ServiceType_{ij} * TimeAfter_{ij} + \beta_8 Covariates_{ij} + \varepsilon}$$

Where 'i' indexes a unique individual observed on a particular day 'j'. 'Y' represents the outcome, 'service start' is an indicator of whether the data point was observed before or after the start of the specific service examined, 'time' indicates the number of days relative to start of observation, 'time after' indicates the number of days after the start of the specific service, and 'service type' is an indicator of the specific service the individual received. The interaction terms allow for modeling of different intercepts and trends by service types. 'Covariates' represents a vector of adjustment factors, and epsilon represents an error term. Unless otherwise specified, the covariates adjusted for were age, gender, race and ethnicity, disability status, index date, quarter of observation (to account for seasonality), and rurality of residence. This approach is sometimes called a 'comparative interrupted time series' (CITS) approach (equivalent terms are 'interrupted time series with comparison group' or 'controlled interrupted time series'), and it models the trend in outcomes over time rather than giving a single estimate for an outcome in a specific post-intervention period. Models were fit using generalized estimating equations, with a Poisson response distribution and log link. Standard errors were clustered at the level of the individual, which is the level of treatment for these analyses and were robust to possible misspecification of the working covariance matrix.[19] After fitting the models, we created marginalized estimates of quantities of interest using the margins command in Stata. This approach is termed marginalization (equivalent terms are predictive margins, recycled predictions, or the parametric g-computation formula). We targeted an average treatment effect (ATE) estimand for these analyses, as their purpose was to indicate what effect on the outcomes may have been observed if all potentially eligible participants had received a specific service. Pilot participants could receive multiple service

types, but to avoid bias from cases where individuals are transitioned to one service because of an issue with a prior service, we compared individuals on the basis of the first service they received. This is analogous to an 'intention-to-treat' approach.

The services of interest and their comparisons vary for different social risks. Within a category of social risks, there are a variety of services that might meet an individual's need. Some of these services are not clear substitutes for each other (that is, they may be used in very different situations). However, others might plausibly substitute for each other, so questions of their comparative effectiveness in addressing social risks are relevant. For food services, we compared three types of services (combining some sub-categories for reasons of sample size): 1) a fruit and vegetable prescription, 2) a food box (large or small, for delivery or pick up), and 3) prepared meals (either a 'healthy' meal [for pick up or delivered] or a 'medically tailored' meal [delivered]). For housing services, we compared four types of services (combining some sub-categories): 1) housing navigation, support, and sustaining services, 2) essential utility set up, 3) move-in support (including assistance with security deposit and first and last month's rent), and 4) home remediation, safety and quality inspection, or accessibility and safety modifications. For transportation services, we compared two types of services 1) health-related private transportation and 2) health-related public transportation. Sample sizes did not permit comparisons of IPV services.

Analytic methods for Evaluation Question 4 ("Clinical Outcomes") consisted of descriptive statistics and individual-level difference-in-differences analyses. These compared Pilot participants, before and after enrollment, to Medicaid beneficiaries who screened positive for social risks but lived in non-Pilot counties. The difference-in-differences regression models took the form:

$$\boldsymbol{Y_{ij} = \beta_0 + \beta_1 HOP_{ij} + \beta_2 Time_{ij} + \beta_3 HOP_{ij} * Time_{ij} + \beta_4 Covariates_{ij} + \varepsilon}$$

Where 'i' indexes a unique individual observed on a particular day 'j'. 'Y' represents the outcome, 'HOP' is an indicator of whether an individual was a Pilot enrollee or not, 'time' is an indicator of whether the data point was observed before or after the index date (defined as the date of Pilot enrollment for Pilot participants and the date of a positive social risk screen for non-participants), 'covariates' represents a vector of adjustment factors, and epsilon represents an error term. The interaction term allows for the relationship between time and the outcome to vary across Pilot and non-Pilot participants, which allows for a difference-in-differences estimate. The covariates adjusted for were age, gender, race and ethnicity, disability status, index date, quarter of observation (to account for seasonality), and rurality of residence. Models were fit using generalized estimating equations to account for repeated measures

within individuals, with a binomial response distribution and logit link. The purpose of covariate adjustment was to help strengthen the plausibility of the parallel trends assumption. Standard errors were clustered at the level of the individual, which is the level of treatment for these analyses and were robust to possible misspecification of the working covariance matrix.[19] After fitting the models, we created marginalized estimates of quantities of interest using the margins command in Stata. This approach is equivalently termed standardization, recycled predictions, or the parametric g-computation formula. We targeted an average treatment effect (ATE) estimand for these analyses, as their purpose was to indicate what effect on the outcomes may have been observed if all Medicaid beneficiaries with social risks had enrolled in the Pilots (were the Pilots to be rolled out statewide such that county of residence were no longer an eligibility criterion).

Analytic methods for Evaluation Question 5 ("Healthcare Utilization") consisted of descriptive statistics, individual-level interrupted time series regression analyses (for comparisons within Pilot participants, before and after enrollment), and analyses that compared the outcomes of HOP participants to what we estimated would have been observed in the absence of the Pilots, using data from those who reported social risks but resided in non-Pilot counties and thus did not receive HOP services to help produce these estimates. These comparative interrupted time series analyses were used to produce difference-in-differences estimates of the change in level and trend in healthcare utilization outcomes attributable to the Pilots, as explained in more detail below. For individual-level interrupted time series regressions evaluating healthcare utilization associated with Pilot participation, regression models generally took the form:

$$\boldsymbol{Y_{ij} = \beta_0 + \beta_1 ParticipationStart_{ij} + \beta_2 Time_{ij} + \beta_3 TimeAfter_{ij} + \beta_4 Covariates_{ij} + \varepsilon}$$

Where 'i' indexes a unique individual observed on a particular month 'j'. 'Y' represents the outcome, 'participation start' is an indicator of whether the data point was observed before or after the index date (defined as the date of Pilot enrollment for Pilot participants), 'time' indicates the number of months relative to start of observation (up to 12 months prior to the index date), 'time after' indicates the number of months after the index date (up to 12 months after the index date), 'covariates' represents a vector of adjustment factors, and epsilon represents an error term. Unless otherwise specified, the covariates adjusted for were age, gender, race and ethnicity, disability status, index date, quarter of observation (to account for seasonality), and rurality of residence. Models were fit using generalized estimating equations, with a Poisson response distribution and log link. Standard errors were clustered at the level of the individual, which is the level of treatment for these analyses and were

robust to possible misspecification of the working covariance matrix (an autoregression 1 structure given that observations closer together in time may be more correlated than observations further apart in time).[19] After fitting the interrupted time series regression model, we created marginalized estimates of quantities of interest using the margins command in Stata. This approach is equivalently termed standardization, recycled predictions, or the parametric g-computation formula. We targeted an average treatment effect on the treated (ATT) estimand for these analyses.

To produce difference-in-differences estimates of changes in level and trend of healthcare utilization outcomes associated with Pilot participation, we used a comparative interrupted time series (CITS, also called controlled interrupted time series or interrupted time series with comparison group) approach. We implemented this CITS approach with regression models that generally took the form:

$$\boldsymbol{Y_{ij} = \beta_0 + \beta_1 ParticipationStart_{ij} + \beta_2 Time_{ij} + \beta_3 TimeAfter_{ij} + \beta_4 HOP_{ij} + \beta_5 HOP_{ij} * ParticipationStart_{ij} + \beta_6 HOP_{ij} * Time_{ij} + \beta_7 HOP_{ij} * TimeAfter_{ij} + \beta_8 Covariates_{ij} + \varepsilon}$$

Where ‘i' indexes a unique individual observed on a particular month ‘j’. ‘Y’ represents the outcome, ‘participation start’ is an indicator of whether the data point was observed before or after the index date (defined as the date of Pilot enrollment for Pilot participants and the date of a positive social risk screen for non-participants), ‘time’ indicates the number of months relative to start of observation (up to 12 months prior to the index date), ‘time after’ indicates the number of months after the index date (up to 12 months after the index date), and ‘HOP’ is an indicator of whether an individual was a Pilot enrollee or not. The interaction terms allow for modeling of different intercepts and trends by Pilot enrollment status. ‘Covariates’ represents a vector of adjustment factors, and epsilon represents an error term. Unless otherwise specified, the covariates adjusted for were age, gender, race and ethnicity, disability status, index date, quarter of observation (to account for seasonality), and rurality of residence.

The CITS approach produces difference-in-differences estimates of the change in level and trend of healthcare utilization outcomes in the sense that the change in level (and trend) for the comparison group (comparing the pre- and post-index period) can be subtracted from the change in level (and trend) for the intervention group (comparing the pre- and post-index period) to produce an estimate that ‘differences out’ both time-fixed characteristics of the intervention group and ‘secular trends’ that affect both groups. One advantage of this approach is that, unlike styles of difference-in-differences analyses that assume parallel trends in the pre-intervention period, the CITS approach directly models

the trends in the pre-intervention period.[20–24] Estimates from the CITS approach can still be unbiased in the presence of non-parallel pre-trends under the assumption that any deviations from the pre-intervention trends would occur equally for both groups in the absence of the intervention, which we view as a more plausible assumption than the version of the parallel trends assumption that other approaches to difference-in-differences analyses make. Covariate adjustment was used to help further support the plausibility of the assumptions needed for CITS analysis. Models were fit using generalized estimating equations, with a Poisson response distribution and log link. Standard errors were clustered at the level of the individual, which is the level of treatment for these analyses and were robust to possible misspecification of the working covariance matrix (an autoregression 1 structure given that observations closer together in time may be more correlated than observations further apart in time).[19] After fitting the models, we created marginalized estimates of quantities of interest using the margins command in Stata. This approach is equivalently termed standardization, recycled predictions, or the parametric g-computation formula. We targeted an average treatment effect (ATE) estimand for these analyses, as their purpose was to indicate what effect on the outcomes may have been observed if all potentially eligible participants had enrolled in the Pilots (were the Pilots to be rolled out statewide such that county of residence were no longer an eligibility criterion).

Our interpretation of both the interrupted time series and CITS analyses focused on the 'trend' in healthcare utilization, as this indicates the ongoing impact of Pilot services, separate from any change in healthcare utilization that occurred around the time of Pilot enrollment (and may in fact have prompted Pilot enrollment).

Analytic methods for Evaluation Question 6 ("Cost of Care") consisted of descriptive statistics, individual-level interrupted time series regression analyses (for comparisons within Pilot participants, before and after enrollment), and analyses that compared the outcomes of HOP participants to what we estimated would have been observed in the absence of the Pilots, using data from those who reported social risks but resided in non-Pilot counties and thus did not receive HOP services to help produce these estimates. These comparative interrupted time series analyses were used to produce difference-in-differences estimates of the change in level and trend in cost of care outcomes attributable to the Pilots, as explained in more detail below. For individual-level interrupted time series regressions evaluating cost of care associated with Pilot participation, regression models generally took the form:

$$\boldsymbol{Y_{ij} = \beta_0 + \beta_1 ParticipationStart_{ij} + \beta_2 Time_{ij} + \beta_3 TimeAfter_{ij} + \beta_4 Covariates_{ij} + \varepsilon}$$

Where ‘i' indexes a unique individual observed on a particular month ‘j’. ‘Y’ represents the outcome, ‘participation start’ is an indicator of whether the data point was observed before or after the index date (defined as the date of Pilot enrollment for Pilot participants and the date of a positive social risk screen for non-participants), ‘time’ indicates the number of months relative to start of observation (up to 12 months prior to the index date), ‘time after’ indicates the number of months after the index date (up to 12 months after the index date), ‘covariates’ represents a vector of adjustment factors, and epsilon represents an error term. Unless otherwise specified, the covariates adjusted for were age, gender, race and ethnicity, disability status, index date, quarter of observation (to account for seasonality), and rurality of residence. Models were fit using generalized estimating equations, with a Gamma response distribution and log link. Standard errors were clustered at the level of the individual, which is the level of treatment for these analyses and were robust to possible misspecification of the working covariance matrix (an autoregression 1 structure given that observations closer together in time may be more correlated than observations further apart in time).[19] After fitting the interrupted time series regression model, we created marginalized estimates of quantities of interest using the margins command in Stata. This approach is termed marginalization, predictive margins, recycled predictions, or the parametric g-computation formula. We targeted an average treatment effect on the treated (ATT) estimand for these analyses.

To produce difference-in-differences estimates of changes in level and trend of cost of care outcomes associated with Pilot participation, we used a comparative interrupted time series (CITS, also called controlled interrupted time series or interrupted time series with comparison group) approach. We implemented this CITS approach with regression models that generally took the form:

$$\boldsymbol{Y_{ij} = \beta_0 + \beta_1 ParticipationStart_{ij} + \beta_2 Time_{ij} + \beta_3 TimeAfter_{ij} + \beta_4 HOP_{ij} + \beta_5 HOP_{ij} * ParticipationStart_{ij} + \beta_6 HOP_{ij} * Time_{ij} + \beta_7 HOP_{ij} * TimeAfter_{ij} + \beta_8 Covariates_{ij} + \varepsilon}$$

Where ‘i' indexes a unique individual observed on a particular month ‘j’. ‘Y’ represents the outcome, ‘participation start’ is an indicator of whether the data point was observed before or after the index date (defined as the date of Pilot enrollment for Pilot participants and the date of a positive social risk screen for non-participants), ‘time’ indicates the number of months relative to start of observation (up to 12 months prior to the index date), ‘time after’ indicates the number of months after the index date (up to 12 months after the index date), and HOP is an indicator of whether an individual was a Pilot enrollee or not. The interaction terms allow for modeling of different intercepts and trends by Pilot

enrollment status. 'Covariates' represents a vector of adjustment factors, and epsilon represents an error term. Unless otherwise specified, the covariates adjusted for were age, gender, race and ethnicity, disability status, index date, quarter of observation (to account for seasonality), and rurality of residence.

The CITS approach produces difference-in-differences estimates of the change in level and trend of cost of care outcomes in the sense that the change in level (and trend) for the comparison group (comparing the pre- and post-index period) can be subtracted from the change in level (and trend) for the intervention group (comparing the pre- and post-index period) to produce an estimate that 'differences out' both time-fixed characteristics of the intervention group and 'secular trends' that affect both groups. One advantage of this approach is that, unlike styles of difference-in-differences analyses that assume parallel trends in the pre-intervention period, the CITS approach directly models the trends in the pre-intervention period.[20–24] Estimates from the CITS approach can still be unbiased in the presence of non-parallel pre-trends under the assumption that any deviations from the pre-intervention trends would occur equally for both groups in the absence of the intervention, which we view as a more plausible assumption than the version of the parallel trends assumption that other approaches to difference-in-differences analyses make. Covariate adjustment was used to help further support the plausibility of the assumptions needed for CITS analysis. Models were fit using generalized estimating equations, with a Gamma response distribution and log link. Standard errors were clustered at the level of the individual, which is the level of treatment for these analyses and were robust to possible misspecification of the working covariance matrix (an autoregression 1 structure given that observations closer together in time may be more correlated than observations further apart in time).[19] After fitting the models, we created marginalized estimates of quantities of interest using the margins command in Stata. This approach is equivalently termed standardization, recycled predictions, or the parametric g-computation formula. We targeted an average treatment effect (ATE) estimand for these analyses, as their purpose was to indicate what effect on the outcomes may have been observed if all potentially eligible participants had enrolled in the Pilots (were the Pilots to be rolled out statewide such that county of residence were no longer an eligibility criterion).

Our interpretation of both the interrupted time series and CITS analyses focused on the 'trend' in cost, as this indicates the ongoing impact of Pilot services, separate from any change in cost that occurred around the time of Pilot enrollment (and may in fact have been tied up with the events that prompted Pilot enrollment).

Methodological Limitations

We divide this section into limitations related to the methods used overall, and limitations related to the specific data available (or not available) for this assessment period.

Regarding methodological limitations overall, for Evaluation Question 1 ("Effective Delivery of Pilot Services"), the main limitations relate to the possibility of erroneous data entry within NCCARE360.

For Evaluation Question 2 ("Increased Rates of Social Risk Factor Screening and Connection to Appropriate Services") activities, the main methodological limitations relate to the possibility that screening data were not recorded, which could bias comparisons.

For Evaluation Question 3 ("Improved Social Risk Factors") activities, the main methodological limitation is that some analyses use within-participant comparisons, without an external comparison group. This means that regression to the mean is an important threat to validity for these analyses. As justified in the Evaluation Design, this was a known limitation, one that was viewed as acceptable in order to facilitate delivery of Pilot services and provide feedback to NL and HSO organizations in order to make course corrections. The results of these analyses are not definitive, but instead are meant to inform Pilot operations. A second limitation is that if there is differential loss to follow-up (i.e., whether an individual completes a repeated assessment is correlated with whether their needs are or are not improving), that can bias results. To help mitigate this, we recommend efforts to encourage follow-up data collection.

For Evaluation Question 4 ("Clinical Outcomes"), the main methodological limitation relates to lack of random assignment to Pilot services. We attempted to mitigate this concern by using difference-in-differences analyses, comparing Pilot participants to Medicaid beneficiaries living in other counties who screen positive for the same social risks that would make them eligible for the Pilots if they lived in Pilot counties, which helps account for secular trends (i.e., changes that affect North Carolina Medicaid beneficiaries more broadly than the HOP program, such as macroeconomic conditions, changes in Medicaid eligibility criteria, and healthcare delivery changes related to other aspects of the 1115 waiver or evolution of trends in healthcare delivery). Together, these approaches provide protection against many forms of bias, but could still be susceptible to unmeasured time-varying confounding that occurred contemporaneously with HOP and differentially affected HOP participants. For example, the conditions under which social risk screening occurred may have been different in HOP and non-HOP regions.

For Evaluation Question 5 ("Healthcare Utilization"), the main methodological limitation relates to lack of random assignment to HOP services. We took several steps to mitigate this concern, including both the use of individual-level interrupted time series analyses (repeated measures within individuals) which helps account for time-invariant characteristics of the individual, and CITS analyses, comparing HOP participants to Medicaid beneficiaries living in other counties who screen positive for the same social risks that would make them eligible for HOP if they lived in HOP counties, which helps account for secular trends (i.e., changes that affect North Carolina Medicaid beneficiaries more broadly than the HOP program, such as macroeconomic conditions, changes in Medicaid eligibility criteria, and healthcare delivery changes related to other aspects of the 1115 waiver or evolution of trends in healthcare delivery). As stated above, these approaches provide protection against many forms of bias, but could still be susceptible to unmeasured time-varying confounding that occurred contemporaneously with HOP and differentially affected HOP participants. For example, the conditions under which social risk screening occurred may have been different in HOP and non-HOP regions.

For Evaluation Question 6 ("Cost of Care"), the main methodological limitation relates to lack of random assignment to HOP services. We took several steps to mitigate this concern, including both the use of individual-level interrupted time series analyses (repeated measures within individuals) which helps account for time-invariant characteristics of the individual) and CITS analyses, comparing HOP participants to Medicaid beneficiaries living in other counties who screen positive for the same social risks that would make them eligible for HOP if they lived in HOP counties, which helps account for secular trends (i.e., changes that affect North Carolina Medicaid beneficiaries more broadly than the HOP program, such as macroeconomic conditions, changes in Medicaid eligibility criteria, and healthcare delivery changes related to other aspects of the 1115 waiver or evolution of trends in healthcare delivery). Together, these approaches provide protection against many forms of bias, but could still be susceptible to unmeasured time-varying confounding that occurred contemporaneously with HOP and differentially affected HOP participants.

An important data limitation was that data needed to evaluate the impact of the direct-to-consumer 'expedited enrollment' were not available for this report. The analyses in this report relate only to 'standard' HOP services. The direct-to-consumer program will be evaluated as part of the summative evaluation.

Another important data limitation is that some data were collected during the COVID-19 Public Health Emergency (PHE). The COVID-19 PHE is known to have had complicated impacts on health and

healthcare utilization, and thus data collected during this time may not be generalizable to the post-PHE period. However, we do not expect these impacts to be differential when comparing HOP participants to those in non-HOP regions who likely would have been HOP eligible had Pilot services been offered in their area. In our view, this reinforces the importance of analyses using comparison groups of Medicaid beneficiaries in non-HOP regions.

There were several other important data limitations that prevented some analyses for particular Evaluation Questions. We describe these by Evaluation Question. If an Evaluation Question is not listed, we completed analyses of the outcomes listed under that Evaluation Question in Table 4 of the Evaluation Design document.

- Evaluation Question 1 ("Effective Delivery of Pilot Services"). We were unable to complete analyses related to participant reason for ending Pilot enrollment. In the evaluation design, we planned to analyze the number of participants who completed Pilot participation, withdrew from participation, or were lost to follow-up. We do not receive individual-level data that specifies reasons for participants ending their Pilot participation. We do receive information at the referral level regarding why a specific referral was closed, but this is different from why an individual may end participation in the Pilots overall. We will work to identify the necessary data sources for these analyses and include them in subsequent evaluation reports, if possible. Additionally, we are in the process of finalizing instruments for our second round of primary data collection with organizations involved in service delivery (HSOs, NLs, and PHPs). Analyses of the primary data collection will be included in subsequent evaluation reports.
- Evaluation Question 2 ("Increased Rates of Social Risk Factor Screening and Connection to Appropriate Services"). We were unable to complete analyses that entailed comparing Medicaid beneficiaries in the Pilot regions and the non-Pilot regions on connection to services to address social risks. We were unable to complete these analyses owing to lack of data availability for responses to positive social risk factor screening in non-Pilot regions. Though screening responses were recorded, there is no central dataset recording connection to services, if any, made in response to positive screens. This precludes comparison of rates of connection to services between Pilot and non-Pilot regions. As data for this outcome become available, these comparisons will be made in subsequent evaluation reports.

- Evaluation Question 4 (“Clinical Outcomes”). This set of analyses was most substantially impacted by lack of data in this period. Analyses of outcomes involving blood pressure, asthma medications, and hemoglobin A1c were not conducted owing to lack of clinical outcome data. The state of North Carolina is in the process of establishing more robust health information exchanges that will permit ascertainment of these data, and so we anticipate completing these analyses in a subsequent reporting period. Similarly, we did not have data for the life skills progression outcome in children. Analyses involving patient reported outcomes such as health-related quality of life or global assessments of health were not completed owing to incomplete data collection. These outcomes require primary data collection through surveys. Longitudinal surveying is ongoing, with over 250 beneficiaries surveyed at the time of writing this report, but it is incomplete. Analyses of these outcomes will occur in a subsequent reporting period.
- Evaluation Question 5 (“Healthcare Utilization”). Most outcomes for this evaluation question were analyzed, however some outcomes applicable to specific subgroups were not. In particular, outcomes related to attendance of wellness visits in various childhood age ranges were not analyzed. This was because the proposed outcomes were based on HEDIS (Healthcare Effectiveness Data and Information Set) measures that subsequently underwent alteration during the course of Pilot service delivery, leading to discordant definitions over time. At present, it is not clear how best to aggregate these different metrics recorded over different times. We will work with the state of North Carolina to harmonize the metrics and present analyses in the spirit of the initially proposed outcomes in the summative evaluation report.
- Evaluation Question 6 (“Cost of Care”). Most outcomes for this evaluation question were analyzed, however we did not analyze costs by care setting owing to concerns about having sufficient power to produce meaningful results in the interim evaluation. Such analyses are planned in the summative evaluation.

Results

Evaluation Question 1

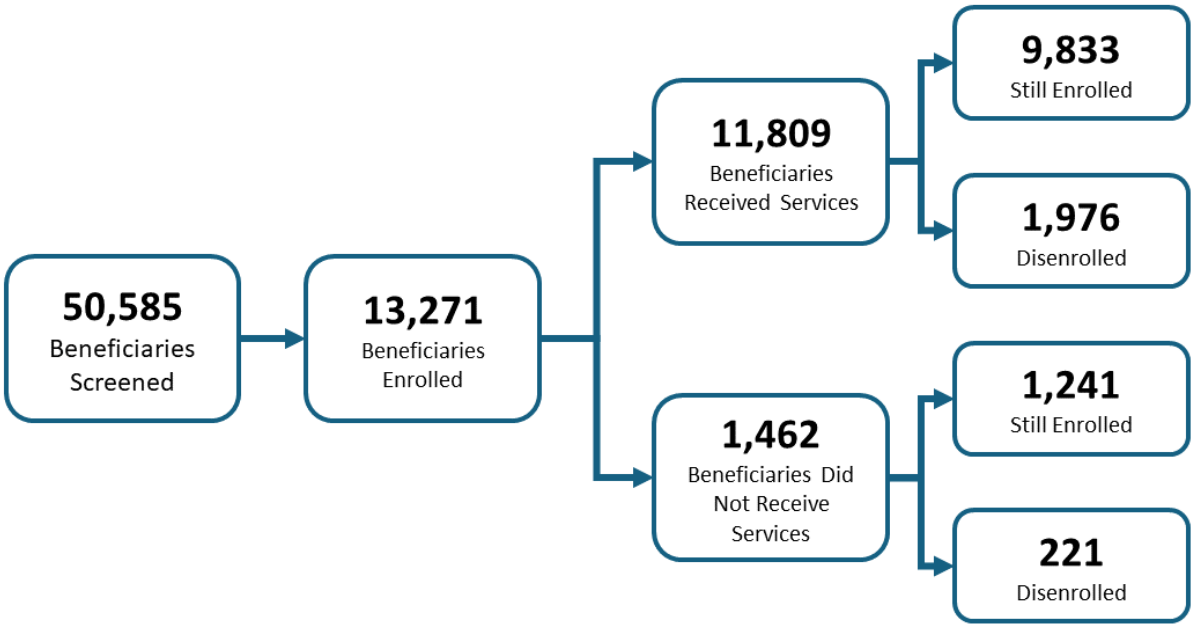
HOP Participants

In compliance with CMS guidelines,[d] cells have been suppressed when counts were fewer than 10 or calculated values were determined using fewer than 10 values. Data used in this assessment covered the period March 15, 2022 to November 30, 2023. Some statistics relating to Pilot activities may be affected by data lag—particularly for activities that occurred in October or November 2023.

[d] https://www.hhs.gov/guidance/document/cms-cell-suppression-policy

Figure 8 details the number of beneficiaries within HOP regions who received social risk screening and their progression through HOP.

Figure 8: HOP Beneficiaries



Enrollment Measures

A total of 13,271 participants enrolled in the Pilots between March 15, 2022 and November 30, 2023, as reflected in NCCARE360 data. Of these, 11,074 were actively enrolled at the end of the reporting period, meaning their eligibility to receive Pilot services had not ended. Overall, there were 77,772 'member-months' of Pilot enrollment during this evaluation period.

This section of the report provides data regarding aspects of Pilot service delivery. Additional information is provided in the Appendix (**Table A1, Figures A1-A4**).

Enrollment by region is presented in **Table 4**. Region was calculated using the residential county identified in the Medicaid Member file.

Table 4: Enrollment by Region

Region	Number	Percentage
Access East	3,582	26.99%
CCLCF	5,135	38.69%
Impact Health	4,394	33.11%
Missing*	160	1.21%
Total	**13,271**	**100.00%**

*160 HOP Enrollees could not be confirmed as located in HOP counties at enrollment

Enrollment by Prepaid Health Plan (PHP) is presented in **Table 5**. Enrollment into a PHP was determined using the PHP indicated in the Medicaid Member file during a participant's earliest enrollment.

Table 1: Enrollment by Prepaid Health Plan (PHP)

PHP	Number	Percentage
AmeriHealth Caritas North Carolina	2,225	16.77%
Blue Cross and Blue Shield of North Carolina	3,429	25.84%
Carolina Complete Health*	1,142	8.61%
UnitedHealthcare of North Carolina	2,525	19.03%
WellCare of North Carolina	3,899	29.38%
Missing	51	0.38%
Total	**13,271**	**100%**

*Carolina Complete Health is a regional health plan, and only covers Medicaid beneficiaries in one Pilot region

Enrollment by Pilot eligibility category is presented in **Table 6**. Based on eligibility criteria for the Pilots, there are four Pilot eligibility categories: adults 21+, pregnant individuals, children 0-20, and children 0-3. The data received from NCCARE360 do not permit deterministic assignment of Pilot participants to a Pilot eligibility category. For example, Pilot eligibility categories reported within NCCARE360 frequently indicated different eligibility categories for the same individual. Enrollees were eligible, but the specific category they should be assigned to is often unclear. Therefore, for purposes of analysis, we assign the categories in the following way. Pregnant individuals were identified using three methods: North Carolina Medicaid claims data, North Carolina Department of Public Heath Vital Records birth certificate records, and finally NCCARE360 screenings data. If a Pilot participant was identified as pregnant during enrollment from any of these sources, they were placed in the pregnant individuals Pilot eligibility

category. Next, for non-pregnant individuals, Pilot eligibility was determined by age at time of Pilot enrollment for age-based categories. Individuals who did not fall into the pregnant individuals category and had no date of birth provided had eligibility category missing (n=1). The clearest impact resulting from the lack of consistent Pilot eligibility category assignment in NCCARE360 data is that young children may be misclassified. There are two possible eligibility categories for children under 4, and the available data are not sufficient to distinguish between the two categories in some cases. This likely has little substantive impact on the interpretation of the report's findings, but should be understood transparently.

Table 2: Enrollment by Pilot Eligibility Category

Eligibility Category	Number	Percentage
Children 0-3	1,279	9.64%
Children 0-20	4,625	34.85%
Adults 21+	6,649	50.10%
Pregnant Individuals	717	5.40%
Missing	1	0.01%
Total	**13,271**	**100.00%**

Demographic Comparisons of Pilot Participants and Medicaid Beneficiaries in Pilot Regions

We examined how the demographics of Pilot participants compared with the demographics of all Medicaid beneficiaries in Pilot regions. For this comparison, we note that we would not expect Pilot participants to have similar demographics of Medicaid beneficiaries in Pilot regions, owing to eligibility criteria for Pilot participation. That is to say, applying eligibility criteria inherently includes some individuals and excludes others, meaning there is no reason to think Pilot participants would be demographically similar to all Medicaid beneficiaries in Pilot regions. Pilot participants are a specific subset of Medicaid beneficiaries selected based on their likelihood of benefiting from Pilot services.

We analyzed the NC Medicaid Member file to better understand demographics for both Pilot participants and Pilot counties. The total number of Medicaid beneficiaries in the Pilot counties was 550,432 as of March 2022 (the start of Pilot service delivery). We were able to link 13,270 HOP participants to members within the Medicaid member file. Within all Pilot counties, 2.38% of all Medicaid beneficiaries (across all different types of Medicaid coverage) were enrolled in the Pilots.

Table 7 shows enrollment in the Pilots as a percentage of Medicaid beneficiaries in the Pilot regions. Region was determined at the time of Pilot enrollment.

Table 7: Pilot Enrollment Rate by Region

Region	HOP Enrollment Count	Percentage of All HOP Participants	Number of Medicaid Beneficiaries in Pilot Regions	Percentage of All Medicaid Beneficiaries Living in Pilot Regions	Proportion of All Beneficiaries in Respective Pilot Regions that are Enrolled in HOP
Access East	3,582	27.32%	145,032	26.35%	2.47%
CCLCF	5,135	39.17%	172,631	31.36%	2.97%
Impact Health	4,394	33.51%	232,769	42.29%	1.89%
All Pilot Regions	13,111	100.00%	550,432	100.00%	2.38%

**160 HOP enrollees had Medicaid member files that indicated they were not residing in HOP regions at time of enrollment*

Statistics relating to the age (in years), gender, and race and ethnicity of Pilot participants and Medicaid beneficiaries in Pilot regions are shown in **Tables 8-9**, below.

Table 8: Age by Region*

Sample	Region	N	Min**	Median**	Max**	IQR (Q1,Q3)**	Mean	Std Dev
Enrolled in HOP	Access East	3,582	0	32	72	(13, 48)	31	19
	CCLCF	5,135	0	24	82	(10, 42)	27	19
	Impact Health	4,394	0	18	81	(8, 42)	25	20
	Total HOP***	13,111	0	25	82	(10, 43)	28	20
All Medicaid Beneficiaries in Pilot Regions	Access East	145,032	0	21	99	(10, 44)	29	23
	CCLCF	172,631	0	21	99	(10, 41)	27	22
	Impact Health	232,769	0	21	99	(10, 44)	28	23
	All Pilot Regions	550,432	0	21	99	(10, 43)	28	23

** Individuals aged greater than 99 years are excluded*

***Values have been aggregated to reflect the average of 11 values around this measure to comply with cell suppression*

****160 HOP enrollees had Medicaid member files that indicated they were not residing in HOP regions at time of enrollment*

Evaluation Questions 4-6 use Medicaid beneficiaries in non-HOP regions who reported social risks as a comparison group for CITS analysis to produce difference-in-differences estimates, as these individuals likely experience similar 'secular trends' (conditions unrelated to HOP participation) as HOP participants. Table 9 presents a comparison of the demographic characteristics of HOP participants and Medicaid beneficiaries in non-HOP regions who reported social needs.

Table 9: Demographics for HOP Participants and Medicaid Beneficiaries in Non-HOP Regions Who Report a Social Risk

Variable	HOP	Medicaid Beneficiaries in Non-HOP Regions Who Report a Social Risk	Overall	P-Value
n	13,270	73,483	86,753	
Age, median [Q1-Q3]	25.0 [10.0-43.0]	18.0 [8.0-35.0]	18.0 [8.0-36.0]	<0.001
HOP Region, n (%)				<0.001
Access East	3,582 (27.0)	(0.0)	3,582 (27.0)	
CCLCF	5,135 (38.7)	(0.0)	5,135 (38.7)	
Impact Health	4,394 (33.1)	(0.0)	4,394 (33.1)	
Non-HOP Region	159 (1.2)	73,483 (100.00)	73,642 (84.89)	
Medicaid Region, n (%)				<0.001
1	4,163 (31.4)	814 (1.1)	4,977 (5.7)	
2	10 (0.1)	15,713 (21.4)	15,723 (18.1)	
3	25 (0.2)	20,662 (28.1)	20,687 (23.8)	
4	54 (0.4)	19,040 (25.9)	19,094 (22.0)	
5	3,678 (27.7)	11,472 (15.6)	15,150 (17.5)	
6	5,094 (38.4)	5,719 (7.8)	10,813 (12.5)	
Missing	246 (1.9)	63 (0.1)	309 (0.4)	
Race, n (%)*				
American Indian	114 (0.9)	1,570 (2.1)	1,684 (1.9)	<0.001
Asian	57 (0.4)	2,236 (3.0)	2,293 (2.6)	<0.001
Black	6,703 (50.5)	30,073 (40.9)	36,776 (42.4)	<0.001
Hawaiian/Pacific Islander	45 (0.3)	250 (0.3)	295 (0.3)	<0.001
White	7,005 (52.8)	42,834 (58.3)	49,839 (57.4)	<0.001
Race Unknown	19 (0.1)	426 (0.6)	445 (0.5)	<0.001
Ethnicity, n (%)				<0.001
Hispanic	972 (7.3)	13,151 (17.9)	14,123 (16.3)	
Non-Hispanic	12,158 (91.6)	59,256 (80.6)	71,414 (82.3)	

Variable	HOP	Medicaid Beneficiaries in Non-HOP Regions Who Report a Social Risk	Overall	P-Value
Missing Ethnicity	140 (1.1)	1,076 (1.5)	1,216 (1.4)	
Sex, n (%)				<0.001
Female	8,698 (65.5)	46,727 (63.6)	55,425 (63.9)	
Male	4,572 (34.5)	26,756 (36.4)	31,328 (36.1)	
Rural Urban Continuum, n (%)				<0.001
1: Counties in metro areas of 1 million population or more	23 (0.2)	28,044 (38.2)	28,067 (32.4)	
2: Counties in metro areas of 250,000 to 1 million population	5,197 (39.2)	24,762 (33.7)	29,959 (34.5)	
3: Counties in metro areas of fewer than 250,000 population	3,664 (27.6)	4,886 (6.6)	8,550 (9.9)	
4/5: Urban population of 20,000 or more	1,101 (8.3)	9,399 (12.8)	10,500 (12.1)	
6: Urban population of 2,500 to 19,999, adjacent to a metro area	1,304 (9.8)	4,119 (5.6)	5,423 (6.3)	
7: Urban population of 2,500 to 19,999, not adjacent to a metro area	306 (2.3)	(0.0)	306 (0.4)	
8: Completely rural or less than 2,500 urban population, adjacent to a metro area	730 (5.5)	1,585 (2.2)	2,315 (2.7)	
9: Completely rural or less than 2,500 urban population, not adjacent to a metro area	699 (5.3)	625 (0.9)	1,324 (1.5)	
99: Missing	246 (1.9)	63 (0.1)	309 (0.4)	
Urban/Rural, n (%)				<0.001
Rural	3,932 (29.6)	15,629 (21.3)	19,561 (22.5)	
Urban	9,338 (70.4)	57,854 (78.7)	67,192 (77.5)	

**A participant can report more than one racial group*

Social Needs Assessment and Needs Identified

There were a total of 31,088 social needs assessments for the 13,271 unique HOP enrollees recorded in the NCCARE360 data in this time period. Out of 13,271 individuals enrolled, 12,993 individuals had at least one assessment recorded. **Tables 10-13** below present information on assessments made.

Table 10: Assessments Provided by Region

Enrollment Region	Assessments Count	Assessments Percentage	Participant Count	Participant Percentage
Access East	8,208	26%	3,530	27%
CCLCF	12,978	42%	5,007	39%
Impact Health	9,503	31%	4,302	33%
Non-HOP	399	1%	154	1%
Total	**31,088**	**100%**	**12,993**	**100%**

Table 11: Assessments Provided by Eligibility Categories

Eligibility Category*	Assessments Count	Assessments Percentage	Participant Count	Participant Percentage
Children 0-3	2,597	8%	1,244	10%
Children 0-20	10,104	33%	4,533	35%
Adults 21+	16,707	54%	6,515	50%
Pregnant Individuals	1,679	5%	700	5%
Total*	**31,087**	**100%**	**12,992**	**100%**

**1 participant with 1 assessment did not have an eligibility category and was therefore excluded from this table*

Table 12: Assessments Provided by PHP

PHP	Assessments Count	Assessments Percentage	Participant Count	Participant Percentage
AmeriHealth Caritas North Carolina	5,342	17%	2,170	17%
Blue Cross and Blue Shield of North Carolina	7,512	24%	3,359	26%
Carolina Complete Health	2,798	9%	1,093	8%
UnitedHealthcare of North Carolina	5,049	16%	2,465	19%
WellCare of North Carolina	10,292	33%	3,858	30%
Missing	95	0.31%	48	0.37%
Total	**31,088**	**100%**	**12,993**	**100%**

The mean number of needs indicated on an assessment was 1.75. Food needs were the most common need indicated, followed by housing (**Table 13**).

Table 13: Assessments and Participants with Identified Needs

Identified Need	Assessments Count*	Assessments Percentage	Participant Count*	Participant Percentage
Food	25,184	81.01%	10,775	82.93%
Housing	19,255	61.94%	8,522	65.59%
IPV-related / Toxic Stress	786	2.53%	347	2.67%
Transportation	9,215	29.64%	4,155	31.98%

**Participant could indicate more than one need per screening*

Pilot participants reported more than 1 need on slightly more than half of assessments (55.6%) (**Table 14**).

Table 14: Needs per Assessment

Needs Indicated on a Screening	Count	Percentage
0	34	0.11%
1	13,763	44.27%
2	11,488	36.95%
3	5,511	17.73%
4	292	0.94%
Total	31,088	100.00%

Pilot participants had an initial needs assessment completed in a timely fashion, with 90% of individuals assessed on the day of Pilot enrollment. **Tables 15 and 16** provide further information on time to first assessment, in days.

Table 15: Days from Enrollment to First Assessment by Region

Region	N	Min*	Mean*	Max*	IQR (Q1, Q3)*	% Assessed on Day of Enrollment
Access East	3,509	0	0.36	56	(0, 0)	90%
CCLCF	4897	0	0.56	59	(0, 0)	90%
Impact Health	4251	0	0.33	55	(0, 0)	90%
Non-HOP	336	0	0.80	58	(0, 0)	90%
Overall	12,993	0	0.43	59	(0, 0)	90%

**Values have been aggregated to reflect the average of 11 values around this measure to comply with cell suppression*

Table 16: Days from Enrollment to First Assessment by PHP

PHP	N	Min*	Mean*	Max*	IQR (Q1, Q3)*	% Assessed on Day of Enrollment
AmeriHealth Caritas North Carolina	2,149	0	0.44	57	(0, 0)	90%
Blue Cross and Blue Shield of North Carolina	3,316	0	0.31	58	(0, 0)	95%
Carolina Complete Health	1,066	0	0.63	59	(0, 0)	95%
UnitedHealthcare of North Carolina	2,671	0	0.50	58	(0, 0)	90%
WellCare of North Carolina	3,791	0	0.43	58	(0, 0)	90%
Overall**	12,993	0	0.43	59	(0, 0)	90%

**Values have been aggregated to reflect the average of 11 values around this measure to comply with cell suppression*

Participants Served and Services Invoiced

We categorized as 'delivered' services that had an invoice status of: accepted by payer, paid, submitted by network lead, submitted contracted service note, submitted to network lead, transmitted to payer, or under dispute. Invoices with invoice status of rejected by administrator, rejected by NL, or rejected by payer were not categorized as delivered services.

A total of 11,809 participants had services delivered through November 30, 2023. Out of 13,271 individuals enrolled in the Pilots, this means that 89% received at least 1 invoiced service. Further, additional individuals may have received services that had not yet been invoiced.

There was variation in the percentage of individuals who received services across types of services **(Table 17)**. The following table shows the number of individuals who screened positive for different need types, and of those, the number who received a related service for their need.

Table 17: Connection to Services by Service Type

Service Type	Total Participants Screened Positive	Participants Reporting Need Who Received A Service For That Need	% Screened Positive & Received Service
Food	10,775	10,055	93%
Housing	8,522	5,803	68%
IPV-related / Toxic Stress*	347	74	21%
Transportation	4,155	995	24%

*IPV services were not available until April 5, 2023

Tables 18-20 below present information on Pilot participants who were connected to services for which they indicated a need by region, eligibility category, and PHP. Of the 11,809 participants who received services, 10,796 participants received services specific to their identified need (e.g., a food service for an identified food need).

Table 18: Connection to Services by Region

Enrollment Region	Count of HOP Participants Connected to Services	Total Count of Screened HOP Participants	Percentage of HOP Participants Connected to Services
Access East	2,851	3,530	**81%**
CCLCF	4,380	5,007	**87%**
Impact Health	3,440	4,302	**80%**
Missing	125	154	**81%**
Total	**10,796**	**12,993**	**83%**

Table 19: Connection to Services by Eligibility Category

Eligibility Category *	Count of HOP Participants Connected to Services	Total Count of Screened HOP Participants	Percentage of HOP Participants Connected to Services
Children 0-3	977	1,244	**79%**
Children 0-20	3,731	4,533	**82%**
Adults 21+	5,509	6,515	**85%**
Pregnant individuals	579	700	**83%**
Total	**10,796**	**12,992**	**83%**

*1 participant had eligibility category missing

Table 20: Connection to Services by PHP

PHP	Count of HOP Participants Connected to Services	Total Count of Screened HOP Participants	Percentage of HOP Participants Connected to Services
AmeriHealth Caritas North Carolina	1,762	2,170	**81%**
Blue Cross and Blue Shield of North Carolina	2,835	3,359	**84%**
Carolina Complete Health	911	1,093	**83%**
UnitedHealthcare of North Carolina	1,988	2,465	**81%**
WellCare of North Carolina	3,269	3,858	**85%**
Missing	32	48	**67%**
Total	**10,797**	**12,993**	**83%**

We calculated the cumulative number of unique HSOs that had provided at least 1 service with a paid invoice (**Table 21**), and the distribution of the number of services provided by these HSOs.

Table 21: Services delivered by HSOs

Measure	Number of HSOs	Min	Median	Max	IQR (Q1, Q3)	Mean	Std Dev
Services Provided by HSO	147	1	239	11,916	(44, 931)	1,182	2,239

Half of the services had a service start date within a week after eligibility was established, and over 75% began within 15 days **(Table 22).**

Table 22: Time from Eligibility to Service Dates, in Days

Measure	N	Min*	Median*	Max*	IQR (Q1,Q3)*	Mean	Std Dev
Eligibility to Service Date	11,809	0	7	88	(3,15)	18	40

**Value has been aggregated to reflect the average of 11 values around this measure to comply with cell suppression*

Figure 9 depicts the percentage of Pilots participants who had a service invoiced in a given time period after Pilot enrollment. For example, over 75% of Pilot enrollees received a service in the first 30 days after enrollment and over 25% of Pilots enrollees received a service more than 360 days after enrollment. Thus, while service receipt was highest in the 30 days following enrollment, a substantial number of Pilots participants continued to receive services even 12 months after enrollment.

Figure 9: Percentage of Enrollees Receiving Pilot Services in Each Time Period Since Enrollment

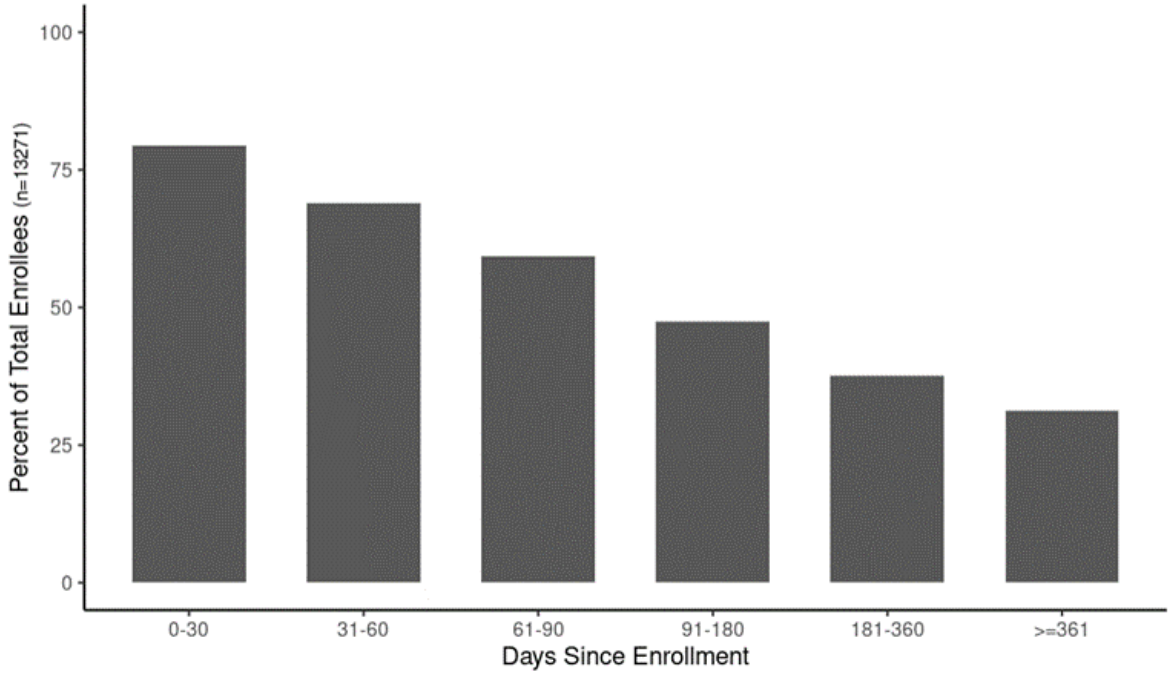


Figure 9 Legend: This figure depicts the percentage of Pilot enrollees who received at least one Pilot service in the specified time periods following Pilot enrollment. For instance, over 75% of Pilot enrollees received at least one Pilot service in the 30 days after Pilot enrollment, and over 25% of Pilot enrollees received a service more than 360 days from enrollment.

A total of 198,291 services were provided, for which the amount invoiced totaled $36,310,486.20.

We used invoiced amounts within NCCARE360 invoice data for spending calculations, as this allowed us to include services which have already been approved and delivered, although not yet paid. Not doing so would have undercounted spending by omitting encumbered funds.

Across 198,291 services, the mean invoiced amount was $183.12 per service and the median was $150.36 per service. The mean amount invoiced per enrollee was $3,571.23 and the median was $2,105.68 per enrollee. Of note, because more detailed cost reporting is available through dashboards and quarterly reports as part of ongoing Pilot monitoring separate from the IER, we do not recreate these analyses in this report.

Table 23 below provides more detail on number of services and spending on services by service type. Food services represent the bulk of delivered services and the majority of the invoiced amount, although housing services have higher invoiced amounts per service.

Table 23: Services Provided by Service Type

Service Type	Service Count	Service Percentage	Average Invoiced Amount Per Service	Invoiced Amount Total	Invoiced Amount Percentage
Cross-Domain*	1,577	0.80%	$329.78	$ 520,064.83	1.43%
Food	170,299	86%	$131.36	$ 23,180,778.40	64%
Housing	22,138	11%	$532.53	$ 11,789,144.80	32%
IPV-related / Toxic Stress	317	0.16%	$104.78	$ 33,215.68	0.09%
Transportation	3,960	2%	$198.81	$ 787,282.49	2%
Total	**198,291**	**100.00%**	**$183.12**	**$ 36,310,486.20**	**100%**

**One Cross-Domain service had an invoiced amount outside of range and was excluded from count and costs analysis*

Tables 24-26 include analysis on region, eligibility category, and PHP. Of the 11,809 beneficiaries who received services, we were unable to locate 62 (0.5% of beneficiaries) within either the enrollment roster or the Medicaid Member File. These 62 beneficiaries accounted for 968 services (0.5% of services). Due to incomplete data availability, these beneficiaries and services are excluded from these analyses.

Table 24: Services Provided by Region

Enrollment Region	Service Count	Percentage of Total Services	Invoiced Amount Total	Percentage of Total Invoices	Mean Amount Invoiced Per Service
Access East	43,622	22%	$ 7,732,050.59	21%	$177.25

CCLCF	86,477	44%	$ 16,339,753.20	45%	$188.95
Impact Health	64,999	33%	$ 11,618,468.30	32%	$178.74
Missing	2,225	1%	$ 439,068.10	1%	$197.33
Total	**197,323**	**100%**	**$36,129,340.19**	**100%**	**$183.12**

Table 25: Services Provided by Eligibility Category

Eligibility Category *	Service Count	Percentage of Total Services	Invoiced Amount Total	Percentage of Total Invoices	Mean Amount Invoiced Per Service
Children 0-3	15,299	8%	$2,783,781.04	8%	$181.96
Children 0-20	63,033	32%	$11,670,126.60	32%	$185.14
Adults 21+	110,641	56%	$19,994,579.90	55%	$180.72
Pregnant individuals	8,202	4%	$1,657,592.03	5%	$202.10
Missing	148	0.08%	$23,260.62	0.06%	$157.16
Total	**197,323**	**100.00%**	**$36,129,340.19**	**100.00%**	**$183.12**

Table 26: Services Provided by PHP

PHP	Service Count	Percentage of Total Services	Invoiced Amount Total	Percentage of Total Invoices	Mean Amount Invoiced Per Service
AmeriHealth Caritas North Carolina	31,345	16%	$5,648,697.75	16%	$180.21
Blue Cross and Blue Shield of North Carolina	48,800	25%	$9,223,090.60	26%	$189.00
Carolina Complete Health	14,333	7%	$2,561,684.18	7%	$178.73
UnitedHealthcare of North Carolina	35,014	18%	$6,542,483.63	18%	$186.85
WellCare of North Carolina	67,266	34%	$ 12,052,796.90	33%	$179.18
Missing	565	0.29%	$100,587.13	0.28%	$178.03
Total	**197,323**	**100%**	**$36,129,340.19**	**100%**	**$183.12**

Payments

The following analyses present information about timeliness of payments made for services.

Around 50% of invoices are paid within 30 days, and about 75% are paid within 45 days. (**Tables 27-28**).

Table 27: Invoices Submitted and Paid by PHP

PHP	Invoice Paid Count	Invoice Submitted Count	Percentage Paid
AmeriHealth Caritas North Carolina	22,943	31,345	**73%**
Blue Cross and Blue Shield of North Carolina	43,591	48,800	**89%**
Carolina Complete Health	12,179	14,333	**85%**
UnitedHealthcare of North Carolina	30,513	35,014	**87%**
WellCare of North Carolina	63,231	67,266	**94%**
Missing	504	565	**89%**
Total	**172,961**	**197,323**	**88%**

Table 28: Time from Invoice Submission to Payment, in Days

PHP	N	Min*	Median*	Max*	IQR (Q1, Q3)*	Mean	Stan. Dev.
AmeriHealth Caritas North Carolina	22,943	5	35	488	(27, 56)	48	41
Blue Cross and Blue Shield of North Carolina	43,591	4	20	375	(12, 40)	30	28
Carolina Complete Health	12,179	7	23	237	(14, 40)	31	25
UnitedHealthcare of North Carolina	30,513	2	30	415	(21, 47)	38	27
WellCare of North Carolina	63,231	8	32	138	(24, 45)	37	19
Missing	504	5	22	375	(13, 41)	31	28
Total/Overall	**172,961**	**2**	**27**	**515**	**(15, 44)**	**34**	**30**

**Values have been aggregated to reflect the average of 11 values around this measure to comply with cell suppression*

Retention and End of Enrollment

The majority of individuals who enrolled in the Pilots did not have an end date for their Pilot enrollment and were thus considered to be actively enrolled. 2,197 individuals (17% of all Pilot enrollees) had an end date for the Pilots and were thus considered to no longer be receiving Pilot services. **Tables 29-31** below present details of those whose Pilot enrollment had ended by the date of the report.

Table 29: Enrollment Ended by Region

Enrollment Region	Number of Pilot Participants with Enrollment Ended	Total Number of Pilot Participants	Percentage of Pilot Participants whose Enrollment Ended
Access East	504	3,582	14%
CCLCF	939	5,135	18%
Impact Health	413	4,394	9%
Missing	10	160	6%
Total	**1,866**	**13,221**	**14%**

Table 30: Enrollment Ended by Eligibility Categories

Eligibility Category	Number of Pilot Participants with Enrollment Ended	Total Number of Pilot Participants	Percentage of Pilot Participants whose Enrollment Ended
Children 0-3	147	1,279	11%
Children 0-20	599	4,625	13%
Adults 21+	1,028	6,649	15%
Pregnant individuals	92	717	13%
Missing	1	1	100%
Total	**1,866**	**13,221**	**14%**

Table 31: Enrollment Ended by PHP

PHP	Number of Pilot Participants with Enrollment Ended	Total Number of Pilot Participants	Percentage of Pilot Participants with Enrollment Ended
AmeriHealth Caritas North Carolina	379	2,225	17%
Blue Cross and Blue Shield of North Carolina	479	3,429	14%
Carolina Complete Health	211	1,142	18%
UnitedHealthcare of North Carolina	353	2,525	14%
WellCare of North Carolina	444	3,899	11%
Total	**1,866**	**13,220**	**14%**

**Pilot enrollees who could not be attributed to a plan were excluded from this table*

Evaluation Question 2

The principal goal for Evaluation Question 2 ("Increased Rates of Social Risk Factor Screening and Connection to Appropriate Services") during this reporting period was to determine whether there was a greater rate of screening for social risks in Pilot regions, as compared with non-Pilot regions. We counted all screens conducted from March 15, 2022 to November 30, 2023 in the 'numerator' of the screening outcomes (e.g., a person with a recorded screening at any time between March 15, 2022 and November 30, 2023 would be counted as having been screened).

We did find that a greater proportion of Medicaid beneficiaries were screened in Pilot regions (50,823 out of 557,318, or 9.1%) when compared with non-Pilot regions (181,948 out of 2,270,238, or 8.0%) (**Table 32**). This represents an approximately 13.8% increase in screening rates for Pilot regions compared with non-Pilot regions. A chi-squared test of this difference found that it was highly statistically significant ($p< 0.001$). In analyses more specific to beneficiaries in Medicaid Managed Care Standard Plans (which may better reflect the population of Medicaid beneficiaries HOP draws from), we again found that a greater proportion of Medicaid beneficiaries were screened in Pilot regions (44,725 out of 321,759, or 13.9%) when compared with non-Pilot regions (170,742 out of 1,434,672, or 11.9%) (**Table 33**). This represents an approximately 16.8% increase in screening rates for Pilot regions compared with non-Pilot regions ($p< 0.001$).

Despite these differences however, a substantial proportion of Medicaid beneficiaries in both HOP and non-HOP regions did not have screening results recorded.

As described above in the methodological limitations section, we were unable to determine the difference, if any, in connections to services for positive screening between the Pilot and non-Pilot regions, owing to lack of data regarding services received outside of the Pilots.

Table 32. Comparison of Screening Rates in HOP Region vs. Non-HOP Region Screening for All Beneficiaries in Medicaid

Region	Screened		Total	P-Value
	Yes	No		
HOP	50,823 (9.1%)	506,495 (90.9%)	**557,318**	<0.001
Non-HOP	181,948 (8.0%)	2,088,290 (92.0%)	**2,270,238**	
Total	**232,771**	**2,594,785**	**2,827,556**	

Note: Counts of Medicaid beneficiaries in HOP and non-HOP regions were based on March 2022 Medicaid beneficiaries plus any beneficiaries who completed screening but were not in the March 2022 file.
Percentages are row percentages
P-value compares screening rate in HOP and non-HOP regions

Table 33. Comparison of Screening Rates in HOP Region vs. Non-HOP Region Screening for Beneficiaries in a Standard Plan

Region	Screened		Total	P-Value
	Yes	No		
HOP	44,725 (13.9%)	277,034 (86.1%)	**321,759**	<0.001
Non-HOP	170,742 (11.9%)	1,263,930 (88.1%)	**1,434,672**	
Total	**215,467**	**1,540,964**	**1,756,431**	

Note: Counts of Medicaid beneficiaries in HOP and non-HOP regions were based on March 2022 Medicaid beneficiaries plus any beneficiaries who completed screening but were not in the March 2022 file.
Percentages are row percentages
P-value compares screening rate in HOP and non-HOP regions

Screening rates, using both all Medicaid beneficiaries and Medicaid beneficiaries in Standard Plans as the denominator population, were similar across HOP regions (**Table 34**).

Table 34: Screening Rates by HOP Region

Region	Percent with Screening out of All Beneficiaries in Medicaid in Region	Percent with Screening out of Beneficiaries in Medicaid Standard Plan in Region
Access East	8.4% (n=12341)	13.1% (n=11423)
CCLCF	9.6% (n=16763)	14.9% (n=15358)
Impact Health	9.2% (n=21719)	13.6% (n=17944)

Note: Counts of Medicaid beneficiaries in HOP and non-HOP regions were based on March 2022 Medicaid beneficiaries plus any beneficiaries who completed screening but were not in the March 2022 file.
Percentages are row percentages

Social needs assessments could be recorded in NCCARE360 (typically used for Pilot participants in HOP regions) or reported by the PHPs (contained in a report called 'BCM026'), which included data from both HOP and non-HOP participants in HOP regions, along with data from non-HOP regions. **Table 35** details the number of needs reported in each assessment, from each of the two sources of assessment information. Because the requirement of documentation of social needs assessments in NCCARE360 is specific to individuals enrolled in HOP (who have at least one social risk as an eligibility criterion), assessments recorded in NCCARE360 contain more needs, on average, than assessments documented outside of NCCARE360. In all, including multiple assessments per individual, 339,015 assessments of social needs were made during the evaluation period.

Table 35: Needs per Assessment

Needs Indicated on an Assessment	Source: NCCARE360		Source: BCM026 Report		Total	
	Count	Percentage	Count	Percentage	Count	Percentage
0	34	0.11%	167,348	54.35%	167,382	49.37%
1	13,763	44.27%	83,368	27.07%	97,131	28.65%
2	11,488	36.95%	36,786	11.95%	48,274	14.24%
3	5,511	17.73%	16,552	5.38%	22,063	6.51%
4	292	0.94%	3,873	1.26%	4,165	1.23%
Total	**31,088**	**100.00%**	**307,927**	**100.00%**	**339,015**	**100.00%**

Evaluation Question 3

The goal of Evaluation Question 3 ("Improved Social Risk Factors") analyses was to determine whether the overall burden of needs decreased with Pilot participation—among all participants and across different eligibility categories—along with determining whether the risk for specific needs decreased with Pilot enrollment.

Evaluation Question 3 ("Improved Social Risk Factors") analyses primarily used an individual-level interrupted time series approach that estimated a change in level (immediate change in needs as Pilot services began for an individual) and a trend (changes in needs over time as Pilot services were received by an individual). Data used for these analyses could have been recorded as early as February 13, 2022 (30 days prior to HOP enrollment for the earliest date of HOP enrollment of March 15, 2022) and as late as November 30, 2023.

Based on data regarding when Pilot services began to be received in relation to enrollment, we defined the 'pre-services' period as up to 21 days after enrollment and the 'post-services' period as 22 days or more after enrollment (in other words, at 22 days or more, the vast majority of Pilot participants will have begun to receive a service). With this structure, we anticipated that there would be small-to-no change in level (as services are not likely to immediately resolve a need), but that the total number of needs and the probability of a specific need would decrease over time (negative trend). The data for these analyses came from needs assessments reported by individuals both before and after they received Pilots services.

To account for repeated assessments within individuals, all Evaluation Question 3 analyses used generalized estimating equation regression models, with robust standard errors clustered at the level of the individual. We used a Poisson response distribution with a log link for analyses of total needs and a binomial distribution with a logistic link for estimating the probability of a specific need. Unless otherwise specified, analyses adjusted for age, race and ethnicity, gender, disability status, index date, quarter of observation (to account for seasonality), and an index of rurality of residence. Because we fit non-linear models, we used predictive margins for inference after fitting the models.[25]

Total Needs

As expected, we observed little immediate change in recorded needs as Pilot services began. Additionally, as expected, we observed a negative trend, suggesting a decrease in needs over time (**Figure 10**), relative to what would have occurred in the absence of HOP. In particular, we estimated that reported needs likely would have increased in the absence of HOP, and instead they decreased slightly. For context, it is helpful to keep in mind the baseline level of needs. As Pilot services began, the mean number of needs was 1.7 overall, 1.8 for non-pregnant adults, 1.8 for pregnant individuals, 1.7 for children aged 0-20, and 1.7 for children aged 0-3. The change in level and trend then represents a change from that baseline. We estimated the change in trend at -0.01 needs per day (95% CI -0.01 to -0.01), or approximately 10 fewer needs for 1000 person-days of follow-up than would have occurred in the absence of the Pilots (**Table 36**). Further, the negative trend implies that longer time periods are associated with greater reduction in needs (e.g., that needs would be expected to be lower 12 months after Pilot enrollment, compared with 6 months after). We used predictive margins to help quantify this difference. At 6 months, we estimated that, on average, Pilot participation was associated with 0.4 fewer needs than would have been expected had an individual not participated in HOP (95% CI -0.5 to -0.2, $p < .0001$). At 12 months, we estimated that, on average, Pilot participation was associated with 1.2 fewer needs than would have been expected had an individual not participated in HOP (95% CI -1.6 to -0.8, $p < .0001$). Thus, we estimate that Pilot participation had a larger impact on needs at 12 months than at 6 months (difference in outcomes at 12 vs. 6 months: -0.8, 95%CI -1.1 to -0.5, $p <.0001$). This estimate is specific for the time period studied, and should not be extrapolated indefinitely. Nevertheless, these findings support allowing longer duration of Pilot participation.

We found patterns to be broadly similar when examining Pilot eligibility subgroups, with statistically significant trends (decreases in needs over time, relative to a counterfactual in which individuals did not enroll in the Pilots) for all eligibility categories.

Figure 10: Interrupted Time Series Analysis of Total Needs

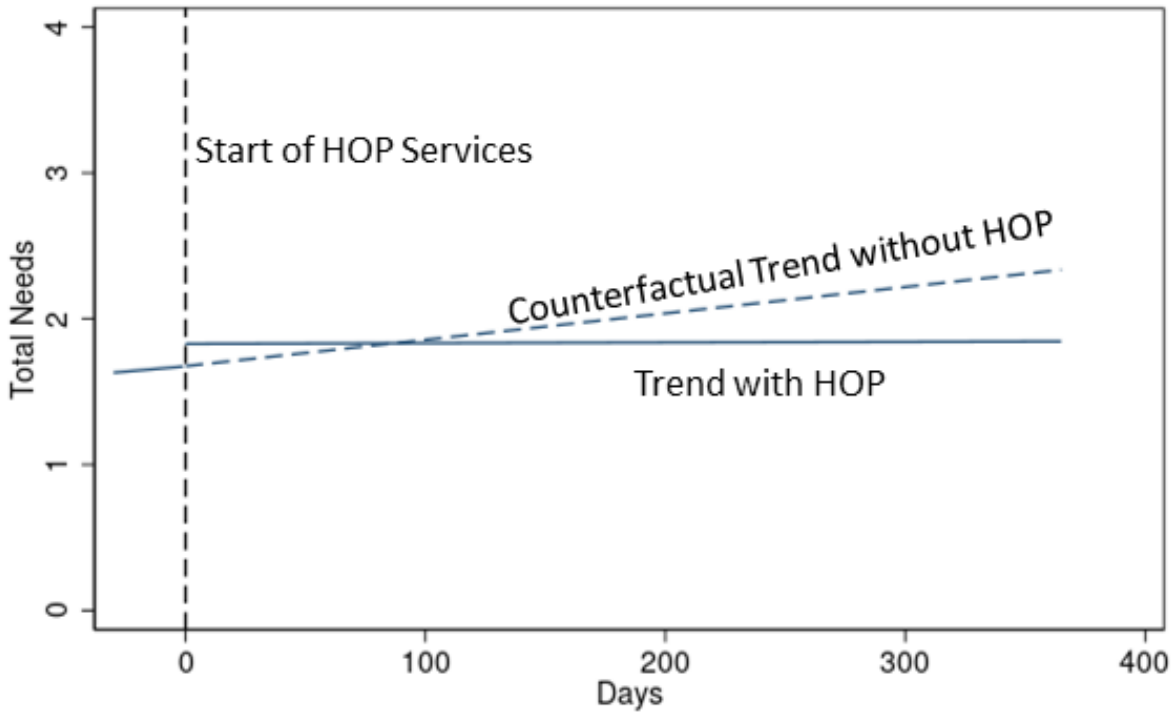


Figure 10 Legend: Estimates, overall, of reported needs among HOP participants from 30 days prior to and 365 days after receipt of HOP services. Dashed blue line indicates counterfactual trend projection if trends prior to the start of an individual's receipt of HOP services had continued. Dashed vertical line indicates the start of an individual's receipt of HOP services.

Table 36: Changes in Level and Trend of Total Needs

Eligibility Category	Change In Level (95% CI)	Trend (95% CI)
Overall	-0.03 (-0.07 to 0.01)	-0.01 (-0.01 to -0.01)
Non-Pregnant Adults	-0.01 (-0.07 to 0.04)	-0.01 (-0.01 to -0.01)
Pregnant Individuals	-0.12 (-0.28 to 0.04)	-0.02 (-0.03 to -0.01)
Children 0 to 20 years of age	-0.03 (-0.08 to 0.02)	-0.01 (-0.01 to -0.01)
Children 0 to 3 years of age	0.04 (-0.09 to 0.18)	-0.008 (-0.014 to -0.002)

Note: Change in level indicates the change in number of needs immediately associated with Pilot services. A positive number indicates more needs. Trend indicates the change in needs per day associated with Pilot services. A negative number indicates declining needs.

Specific Needs

In addition to analyzing the total number of needs, we analyzed the probability of reporting specific needs, relative to a counterfactual situation in which Pilot participants did not enroll in HOP. Overall, we estimated that Pilot participation was associated with a decreased probability of reporting each specific need, with the exception of Toxic Stress and/or IPV needs, where the point estimate was in favor of HOP, but the confidence intervals were too wide to draw firm conclusions **(Figure 11).** More details of these analyses, both overall and by subgroup, are presented by each specific need in the following sections of this report.

Figure 11: Estimated Probability of Specific Needs with and without HOP

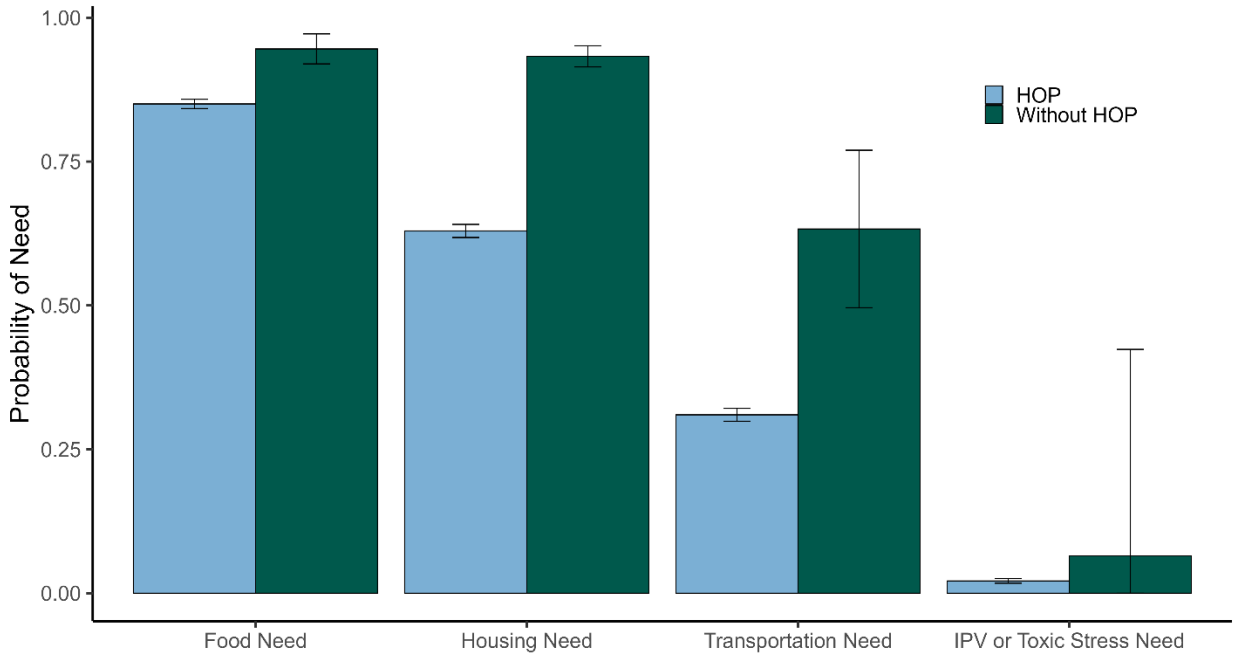


Figure 11 Legend: Estimates, averaged over the follow-up period, of the mean probability of reporting a specific need, comparing HOP participation to a counterfactual scenario in which participants did not enroll in HOP. Estimates were made using individual-level interrupted time series models. Details of the models are reported in their own sections below. Error bars represent 95% confidence intervals.

Food Needs

Regarding food needs, as expected, we observed little immediate change in the probability of a food need as Pilot services began. However, we did observe a negative trend, suggesting a decrease in the probability of a food need over time (**Table 37**), relative to a counterfactual scenario in which the individual did not enroll in HOP (change in probability: -0.002 per day, 95% CI -0.003 to -0.001). For context, as Pilot services began, the probability of experiencing a food need was 0.81 overall, 0.81 for non-pregnant adults, 0.71 for pregnant individuals, 0.81 for children aged 0-20, and 0.75 for children aged 0-3. The change in level and trend then represents a change from that baseline. Though the change in trend seems small, this is expressed per day, and the impact is cumulative. Further, the negative trend implies that longer Pilot participation is associated with greater reduction in the probability of a food need (e.g., that the difference in the probability of reporting a food need at 12 months, compared with having not participated in HOP, would be larger than the difference in the probability of reporting a food need at 6 months, compared with having not participated in HOP).

These patterns were broadly similar when examining Pilot eligibility subgroups, with statistically significant trends (decreases in needs over time, relative to a counterfactual scenario in which the individual did not enroll in HOP) for all eligibility categories except children aged 0 to 3 years. As the category of children aged 0 to 3 years has a relatively small number of individuals, and because the magnitude of the estimated trend was similar to the other subgroups, we suspect the small number of observations may be driving the lack of precision in the estimates for this subgroup.

Table 37: Changes in Level and Trend in Probability of Reporting a Food Need

Eligibility Category	Change In Level (95% CI)	Trend (95% CI)
Overall	0.003 (0.019 to 0.026)	-0.002 (-0.003 to -0.001)
Non-Pregnant Adults	0.006 (-0.026 to 0.039)	-0.001 (-0.003 to -0.0002)
Pregnant Individuals	-0.007 (-0.097 to 0.083)	-0.006 (-0.011 to -0.0001)
Children 0 to 20 years of age	-0.0001(-0.030 to 0.030)	-0.002 (-0.004 to -0.001)
Children 0 to 3 years of age	0.044 (-0.017 to 0.104)	-0.001 (-0.003 to 0.001)

Note: Change in level indicates the change in the probability of reporting a food need immediately associated with Pilot services. A positive number indicates greater probability. Trend indicates the change in probability of reporting a food need per day associated with Pilot services. A negative number indicates declining probability.

We did not observe any statistically significant differences, with regard to the probability of reporting a food need over time, when comparing 1) a fruit and vegetable prescription, 2) a food box

(large or small, for delivery or pick up), and 3) prepared meals (either a ‘healthy’ meal [for pick up or delivered] or a ‘medically tailored’ meal [delivered]).

Housing Needs

Regarding housing needs, we observed little immediate change in the probability of a housing need as Pilot services began, as expected. However, we observed a negative trend, suggesting a decrease in the probability of a housing need over time (**Table 38**), relative to a counterfactual scenario in which the individual did not enroll in HOP (change in probability: -0.01 per day, 95%CI -0.01 to -0.004). As Pilot services began, the probability of experiencing a housing need was 0.62 overall, 0.62 for non-pregnant adults, 0.73 for pregnant individuals, 0.60 for children aged 0-20, and 0.62 for children aged 0-3. The negative trend implies that longer Pilot participation is associated with greater reduction in the probability of a housing need (e.g., that the difference in the probability of reporting a housing need at 12 months, compared with having not participated in HOP, would be larger than the difference in the probability of reporting a housing need at 6 months, compared with having not participated in HOP).

These patterns were broadly similar when examining Pilot eligibility subgroups, with statistically significant trends (decreases in needs over time) for all eligibility categories.

Table 38: Changes in Level and Trend in Probability of Reporting a Housing Need

Eligibility Category	Change In Level (95% CI)	Trend (95% CI)
Overall	-0.03 (-0.05 to -0.01)	-0.01 (-0.01 to -0.004)
Non-Pregnant Adults	-0.01 (-0.03 to 0.02)	-0.004 (-0.006 to -0.003)
Pregnant Individuals	-0.06 (-0.12 to -0.01)	-0.01 (-0.01 to -0.005)
Children 0 to 20 years of age	-0.05 (-0.07 to -0.02)	-0.01 (-0.01 to -0.01)
Children 0 to 3 years of age	-0.06 (-0.13 to 0.01)	-0.01 (-0.01 to -0.003)

Note: Change in level indicates the change in the probability of reporting a housing need immediately associated with Pilot services. A positive number indicates greater probability. Trend indicates the change in probability of reporting a housing need per day associated with Pilot services. A negative number indicates declining probability.

We did not observe any statistically significant differences, with regard to the probability of reporting a housing need over time, when comparing 1) housing navigation, support, and sustaining services, 2) essential utility set up, 3) move-in support (including assistance with security deposit and first and last month's rent), and 4) home remediation, safety and quality inspection, or accessibility and safety modifications.

Transportation Needs

Regarding transportation needs, we observed little immediate change in the probability of a transportation need as Pilot services began, as expected. However, we observed a negative trend, suggesting a decrease in the probability of a transportation need over time (**Table 39**), relative to a counterfactual scenario in which the individual did not enroll in HOP (change in probability: -0.002 per day, 95%CI -0.003 to -0.001). As Pilot services began, the probability of experiencing a transportation need was 0.28 overall, 0.31 for non-pregnant adults, 0.31 for pregnant individuals, 0.23 for children aged 0-20, and 0.26 for children aged 0-3. The change in level and trend then represents a change from that baseline. Further, the negative trend implies that longer Pilot participation is associated with greater reduction in the probability of a transportation need (e.g., that the difference in the probability of reporting a transportation need at 12 months, compared with having not participated in HOP, would be larger than the difference in the probability of reporting a transportation need at 6 months, compared with having not participated in HOP).

These patterns varied somewhat when examining Pilot eligibility subgroups. The trend was similar in magnitude and statistically significant for non-pregnant adults and pregnant individuals. In contrast, the findings in both subgroups of children were small in magnitude and not statistically significant. This may be explained by non-emergency medical transportation being a covered benefit for all Medicaid members, and relatively few HOP transportation services being provided for these age groups. This finding will be investigated further in subsequent reports.

Table 39: Changes in Level and Trend in Probability of Reporting a Transportation Need

Eligibility Category	Change In Level (95% CI)	Trend (95% CI)
Overall	0.005 (-0.016 to 0.026)	-0.002 (-0.003 to -0.001)
Non-Pregnant Adults	-0.008 (-0.035 to 0.019)	-0.003 (-0.004 to -0.001)
Pregnant Individuals	-0.017 (-0.099 to 0.064)	-0.005 (-0.009 to -0.0003)
Children 0 to 20 years of age	0.030 (-0.006 to 0.067)	-0.001 (-0.003 to 0.0004)
Children 0 to 3 years of age	0.097 (-0.014 to 0.208)	0.001 (-0.004 to 0.005)

Notes: Change in level indicates the change in the probability of reporting a transportation need immediately associated with Pilot services. A positive number indicates greater probability. Trend indicates the change in probability of reporting a transportation need per day associated with Pilot services. A negative number indicates declining probability.
For the children aged 0-3 model, adjustment for racial category was omitted owing to model convergence errors.

We did not observe any statistically significant differences, with regard to the probability of reporting a transportation need over time, when comparing 1) health-related private transportation and 2) health-related public transportation.

Toxic Stress and IPV Needs

The findings for toxic stress and/or IPV-related needs analyses differed from those of the other needs. Again, we observed little immediate change in the probability of a toxic stress and/or IPV-related need as Pilot services began. However, we did not consistently observe a negative trend, with results suggesting no statistically significant change in toxic stress and/or IPV-related need over time (**Table 40**), relative to a counterfactual scenario in which the individual did not enroll in HOP. The exception to this pattern was for pregnant individuals, among whom we did estimate a decrease in the probability of a toxic stress and/or IPV need over time, relative to a counterfactual scenario in which the individual did not enroll in HOP (change in probability: -0.0015 per day, 95%CI -0.0028 to -0.0002).

There are two factors that may explain the lack of change observed. First, services to address IPV needs specifically did not begin until April 2023, meaning there was much less time to attempt to resolve these needs through specific services than for other needs. Second, IPV needs are known to be underreported by those experiencing interpersonal violence, and the baseline probability of reporting a toxic stress and/or IPV-related need was substantially lower than for any other need, meaning there were very few cases in the data. Before Pilot services began, the probability of experiencing a toxic stress and/or IPV need was 0.02 overall, 0.02 for non-pregnant adults, 0.04 for pregnant individuals, 0.02 for children aged 0-20, and could not be modeled for children aged 0-3. For these reasons, the impact of the Pilots on the probability of a toxic stress and/or IPV-related need will require special investigation in future reporting periods.

Table 40: Changes in Level and Trend in Probability of Reporting a Toxic Stress and/or IPV Need

Eligibility Category	Change In Level (95% CI)	Trend (95% CI)
Overall	-0.002 (-0.011 to 0.008)	-0.0001 (-0.0007 to 0.0004)
Non-Pregnant Adults	-0.001 (-0.013 to 0.011)	-0.0001 (-0.0008 to 0.0007)
Pregnant Individuals	-0.025 (-0.058 to 0.008)	-0.0015 (-0.0028 to -0.0002)
Children 0 to 20 years of age	-0.005 (-0.021 to 0.012)	-0.0003 (-0.0012 to 0.0005)
Children 0 to 3 years of age	--	--

Notes: Change in level indicates the change in the probability of reporting a toxic stress and/or IPV need immediately associated with Pilot services. A positive number indicates greater probability. Trend indicates the change in probability of reporting a toxic stress and/or IPV need per day associated with Pilot services. A negative number indicates declining probability.
For the non-pregnant adult model, adjustment for racial category was omitted owing to model convergence errors.
For the pregnant individual model, adjustment for racial category was omitted owing to model convergence errors.
For the children aged 0-20 model, adjustment for racial category, index date, and rurality was omitted owing to model convergence errors.
Models did not converge for the children aged 0-3 category owing to low number of observations with this need.

Small sample sizes did not permit comparisons of specific IPV services with regard to reducing the probability of experiencing an IPV need over time.

Evaluation Question 4

The goal of Evaluation Question 4 ("Clinical Outcomes") analyses was to determine how clinical outcomes changed with Pilot participation. As discussed in the methodological limitations section, the only clinical outcome evaluated in this report for Evaluation Question 4 is low birth weight, as data were not available for other clinical outcomes of interest. Additional clinical outcomes (such as those relating to diabetes, hypertension, and health-related quality of life) will be evaluated in the summative evaluation report as data become available.

Data used for these analyses could have been recorded as early as March 15, 2021 (1 year prior to HOP enrollment for the earliest date of HOP enrollment of March 15, 2022) and as late as November 30, 2023.

Low Birth Weight

For analyses of low birth weight, we conducted only difference-in-differences analyses as these outcomes do not lend themselves to interrupted time series analysis in this dataset. Out of the sample of individuals who had a live birth, we assessed whether or not the birth was complicated by low birth weight (weight < 2500g). We analyzed time periods 1 year prior and 1 year post index date (with index date defined as the date of enrollment for Pilot participants and the date of first positive social risk screening for comparison group members). We used generalized estimating equation logistic regression analyses, with standard errors clustered at the level of the individual. Analyses were adjusted for age, race and ethnicity, disability status, index date, and an index of rurality of residence. After fitting these models, we used predictive margins to estimate the probability of experiencing the outcome.

There were a relatively small number of live births in Pilot participants, only 210 after Pilot enrollment, which limits the precision of the estimates. In the entire sample, 10.6% of births were complicated by low birth weight.

Overall, the point estimate was in favor of Pilot participation, but the result was not statistically significant (difference-in-differences estimate: 0.021 decrease in probability of low birth weight, 95%CI 0.077 decrease to 0.035 increase, p = 0.45). As the wide confidence intervals may have been driven by the small number of outcomes, re-examining these outcomes in the summative evaluation, as we plan to do, may allow for more precise estimates.

Evaluation Question 5

The goal of Evaluation Question 5 ("Healthcare Utilization") analyses was to determine how healthcare utilization changed with Pilot participation, among all participants and across different eligibility categories. We evaluated the amount of three types of healthcare utilization to help answer Evaluation Question 5: emergency department visits, inpatient admissions (medical, surgical, or maternity related), and outpatient visits. We further evaluated two types of appropriate utilization specifically relevant for pregnant individuals: attending prenatal care visits and attending postpartum visits. Data used for these analyses could have been recorded as early as March 15, 2021 (1 year prior to HOP enrollment for the earliest date of HOP enrollment of March 15, 2022) and as late as November 30, 2023.

Evaluation Question 5 ("Healthcare Utilization") analyses used two main approaches for the emergency department visit, inpatient admission, and outpatient visit outcomes. The first was an individual-level interrupted time series approach, using the date of Pilot enrollment as an index date, and examining utilization on a monthly basis for up to 12 months before and up to 12 months after Pilot enrollment (subsequent analyses will assess longer time periods). The interrupted time series analysis estimates a change in level (an immediate change in utilization around the time of Pilot enrollment), and a change in trend (how the trend in utilization differs after Pilot enrollment, relative to before). Because Pilot services typically begin a few weeks after enrollment, we interpret a change in level, if any, as reflecting the circumstances that surrounded Pilot enrollment (e.g., a 'triggering event' such as an emergency department visit for uncontrolled diabetes), rather than an effect of the Pilots themselves. We interpret the change in trend as an estimate of how utilization changed for the participant, compared with a counterfactual scenario in which they did not enroll in the Pilots. In this sense, the change in trend can be interpreted as the impact of the Pilots on utilization. However, estimates from interrupted time series analyses can be subject to certain types of bias, such as regression to the mean or 'secular trends' (social conditions that affected Medicaid beneficiaries more broadly and were co-occurring with Pilot participation, but are not an effect of the Pilots themselves). To guard against this possibility, we also conducted CITS analyses, which compare changes in utilization trends before and after Pilot participation among Pilot participants to changes in utilization trends in a comparison group. The comparison group we used consisted of Medicaid beneficiaries who screened positive for social risks (an eligibility criterion for Pilot enrollment) but who lived in counties not covered by the Pilots and so did not participate in the Pilots. This approach directly models the pre-intervention period trends in outcomes. As with the interrupted time series analyses, we interpreted changes in level around the time

of the index date (HOP enrollment for HOP participants or first positive social risk screening for comparison group participants) as reflecting the circumstances that led to HOP enrollment or positive social risk screening. Changes in trend after the index date could reflect some combination of the impact of HOP (for HOP participants), the impact of actions taken to address needs outside of HOP, and the 'natural history' or 'regression to the mean' after the index date. By contrasting the change in trend in the HOP group with the change in trend in the comparison group, we hoped to 'difference out' the impact of actions taken to address needs outside of HOP along with 'natural history' and 'regression to the mean', and thus isolate the impact of HOP.

In a CITS comparison, the purpose of the comparison group is not to compare with HOP participants directly, but to help estimate the counterfactual situation HOP participants would have experienced in the absence of enrolling in HOP. Thus, individuals in the comparison group could be different from Pilots participants in some ways, but the important part is that they should experience 'secular trends' similar to Pilots participants (for example, changes in macroeconomic conditions, non-HOP related changes in the Medicaid program, or changes in practice patterns such as shifts towards telehealth).

The index date for the comparison group was the first date of reporting a social risk during a screening assessment. Therefore, differences in utilization trends for Pilot participants that incorporate data from non-Pilot participants make attributions of an effect of Pilot participation on utilization more credible.

To account for repeated assessments within individuals, all Evaluation Question 5 analyses used generalized estimating equation regression models, with robust standard errors clustered at the level of the individual. We used an autoregressive 1 working correlation structure, and Poisson response distribution with a log link. Analyses adjusted for age, race and ethnicity, gender, disability status, index date, quarter of observation (to account for seasonality), and an index of rurality of residence. Because we fit non-linear models, we used predictive margins for inference after fitting the models.[25]

We present estimates both overall (among all Pilots participants) and by eligibility category.

Healthcare Utilization Measures

Emergency Department Visits

The mean number of emergency department visits per beneficiary per month immediately after Pilot enrollment was 0.14. For non-pregnant adults it was 0.17, for pregnant individuals it was 0.22, for children aged 0 to 20 it was 0.09, and for children aged 0 to 3 it was 0.15.

In interrupted time series analyses examining emergency department visits, we found overall that at the time of Pilot enrollment, emergency department visits were greater than would be expected based on data from before Pilot enrollment: about 0.03 emergency department visits per beneficiary per month higher than would be expected prior to Pilot enrollment (**Table 41**)**.** We also found that emergency department visit use significantly decreased over the following 12 months after Pilot enrollment, at a rate of 0.009 emergency department visits per beneficiary per month (or 9 per 1000 beneficiary-months), relative to a counterfactual scenario in which the individual did not enroll in HOP.

In CITS analyses, which incorporated a comparison group (**Table 42** and **Figure 12**), we observed a negative trend in emergency department visits in the post-intervention period for both groups. However, this difference was significantly greater for HOP participants. From the CITS analysis, the difference-in-differences estimates of the change in trend suggested that HOP participation was associated with a decline in emergency department visits of -0.006 emergency department visits per beneficiary per month (or 6 per 1000 beneficiary-months) ($p < .0001$), even after accounting for the negative trend in comparison group participants. Of note, while we do not have data to test this hypothesis, one explanation for change in level and trend in emergency department visits in the comparison group is that it may be attributable to actions taken in response to the reported social need, such as services to address health-related social needs provided outside of HOP. We are investigating the possibility of obtaining the data needed to test this hypothesis, and will do so in the summative evaluation if feasible.

The negative trend in emergency department visits among HOP participants suggests that longer participation in the Pilots will be associated with a greater cumulative reduction in emergency department visits. To help quantify this difference, using predictive margins, we estimated that the impact of Pilot participation on emergency department visits was greater at 12 months than at 6 months (difference in outcomes at 12 vs. 6 months: -0.022, 95%CI -0.032 to -0.013, $p <.0001$). In other words, Pilot participation reduced emergency department visits by 22 more visits per 1000 beneficiary-months

at 12 months than it did at 6 months. This estimate is specific for the time period studied and should not be extrapolated indefinitely. Nevertheless, these findings support allowing longer duration of Pilot participation.

Results were consistent in Pilot eligibility subgroups, with Pilot participation being associated with reduced emergency department visits over time in both interrupted time series and CITS analyses for all subgroups. Using interaction terms, we assessed for heterogeneity of results across Pilot regions, but the estimates of any differences were small in magnitude and not statistically significant.

Table 41: HOP Impact on Monthly ED Visits Examining 12 Months Before and 12 Months After HOP Enrollment Using Interrupted Time Series Analysis

	Analyses among HOP Participants Alone	
Eligibility Category	**Change in Level (95% CI)**	**Change in Trend (95% CI)**
Overall	0.03 (0.02 to 0.04)	-0.009 (-0.010 to -0.007)
Non-Pregnant Adults	0.04 (0.03 to 0.06)	-0.009 (-0.011 to -0.006)
Pregnant Individuals	0.04 (-0.02 to 0.09)	-0.03 (-0.04 to -0.02)
Children 0 to 20 years of age	0.02 (0.008 to 0.03)	-0.08 (-0.10 to -0.006)
Children 0 to 3 years of age	0.03 (0.006 to 0.06)	-0.01 (-0.02 to -0.008)

Notes: This table reports results using an interrupted time series approach, which only uses data from HOP participants. Change in level indicates the change in the monthly number of ED visits at the time of Pilot enrollment. A positive number indicates more ED visits. Change in trend indicates the change per month in number of ED visits associated with Pilot enrollment. A negative number indicates fewer ED visits. To convert trends to units of 1000 beneficiary-months, multiply by 1000.

Table 42: HOP Impact on Monthly ED Visits Examining 12 Months Before and 12 Months After HOP Enrollment Using Comparative Interrupted Time Series Analysis

	HOP Participants		**Comparison Group**		**Difference-in-Differences Estimate**	
Eligibility Category	**Change in Level (95% CI)**	**Change in Trend (95% CI)**	**Change in Level (95% CI)**	**Change in Trend (95% CI)**	**Difference-in-Differences Level (95% CI)**	**Difference-in-Differences Trend (95% CI)**
Overall	0.030 (0.021 to 0.039)	-0.009 (-0.011 to -0.006)	-0.004 (-0.006 to -0.002)	-0.002 (-0.003 to -0.002)	0.034 (0.025 to 0.043)	-0.006 (-0.008 to -0.004)

Non-Pregnant Adults	0.041 (0.027 to 0.055)	-0.009 (-0.012 to -0.006)	-0.004 (-0.008 to 0.000)	-0.001 (-0.002 to -0.001)	0.045 (0.030 to 0.060)	-0.008 (-0.011 to -0.004)
Pregnant Individuals	0.044 (-0.010 to 0.098)	-0.036 (-0.054 to -0.019)	-0.013 (-0.022 to -0.005)	-0.013 (-0.015 to -0.011)	0.057 (0.003 to 0.112)	-0.024 (-0.041 to -0.006)
Children 0 to 20 years of age	0.018 (0.008 to 0.028)	-0.007 (-0.009 to -0.004)	-0.002 (-0.004 to -0.001)	-0.001 (-0.002 to -0.001)	0.020 (0.010 to 0.031)	-0.005 (-0.008 to -0.003)
Children 0 to 3 years of age	0.031 (0.005 to 0.056)	-0.013 (-0.020 to -0.006)	-0.002 (-0.007 to 0.003)	-0.001 (-0.002 to 0.000)	0.033 (0.007 to 0.058)	-0.012 (-0.019 to -0.005)

Note: This table presents results using a comparative interrupted time series approach. This produces estimates of the change in level and trends comparing the HOP group in the post-index period to the HOP group in the pre-index period, change in level and trends comparing the comparison group in the post-index period to the comparison group in the pre-index period, and difference-in-differences estimates of change in level and trend which compares the change in the HOP group with the change in the comparison group. Change in level indicates the change in the monthly number of ED visits at the time of Pilot enrollment. A positive number indicates more ED visits. Change in trend indicates the change per month in number of ED visits associated with Pilot enrollment. A negative number indicates fewer ED visits. To convert trends to units of 1000 beneficiary-months, multiply by 1000.

Figure 12: CITS Analysis of Emergency Department Visits

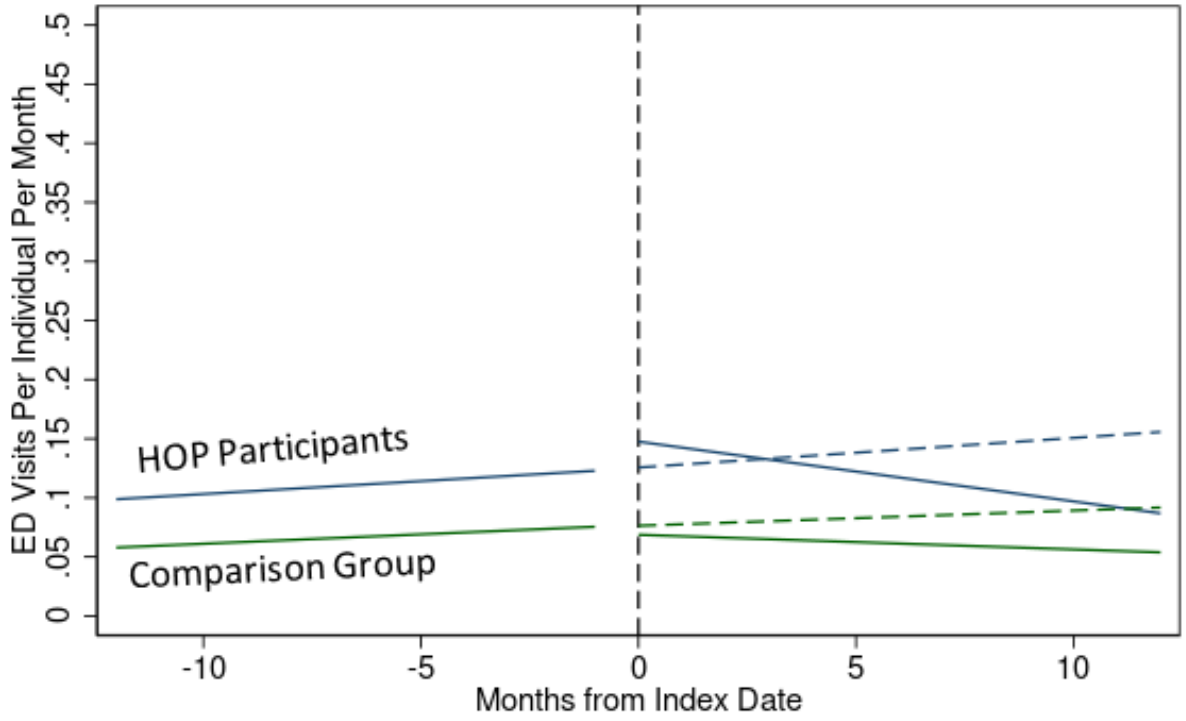


Figure 12 Legend: Estimates, overall, of monthly mean values of emergency department visits among HOP participants (blue) and comparison group members (green). Dashed colored lines indicate counterfactual trend projection if trends prior to the start of HOP had continued. Dashed vertical line indicates the index date (date of HOP enrollment for HOP participants and date

of positive social need screening for comparison group members). The larger difference between the slopes of the dashed and solid blue lines, compared with the difference between the slopes of the dashed and solid green lines, gives a visual representation of the difference-in-differences estimate.

Inpatient Admissions

The mean number of inpatient admissions per beneficiary per month immediately after Pilot enrollment was 0.03. For non-pregnant adults it was 0.03, for pregnant individuals it was 0.07, for children aged 0 to 20 it was 0.01, and for children aged 0 to 3 it was 0.03.

In the interrupted time series analyses examining inpatient admissions, we found overall that the time of Pilot enrollment showed greater than typical inpatient admission utilization—about 0.008 more inpatient admissions per beneficiary per month than would be expected prior to Pilot enrollment based on the preceding 12 months (**Table 43**). We also found, in interrupted time series analyses, that admissions significantly decreased over the 12 months after HOP enrollment, at a rate of 0.003 admissions per beneficiary per month (or 3 admissions per 1000 beneficiary-months), relative to a counterfactual scenario in which the individual did not enroll in HOP.

In CITS analyses, which incorporated a comparison group (**Table 44** and **Figure 13**), we observed a negative trend in inpatient admissions in the post-intervention period for both groups. However, the CITS analysis suggested that this may not be directly attributable to HOP. From the CITS analysis, the difference-in-differences estimates of the change in trend, accounting for the change in trend of the comparison group, suggested that HOP participation was associated with a decline in inpatient admissions of -0.0008 inpatient admissions per beneficiary per month (or 0.8 per 1000 beneficiary-months), but was not statistically significant ($p = 0.07$). Of note, while we do not have data to test this hypothesis, one explanation for change in level and trend in inpatient admissions in the comparison group is that it may be attributable to actions taken in response to the reported social need, such as services to address health-related social needs provided outside of HOP. We are investigating the possibility of obtaining the data needed to test this hypothesis, and will do so in the summative evaluation if feasible.

The results regarding the change in trend in inpatient admissions may have been influenced by heterogeneity across Pilot eligibility categories. Using CITS, the difference-in-differences estimate for change in trend in inpatient admissions for the non-pregnant adult subgroup was larger than for the overall analysis and statistically significant (0.002 fewer admissions per non-pregnant adult beneficiary per month, $p < .0001$), while results for pregnant individuals and children 0-20 were similar to the overall results. Results from children aged 0 to 3 showed slightly increased admissions (0.004 greater admissions per child 0 to 3 per month, $p = 0.04$). However, as there were fewer inpatient admissions than other utilization events, there may simply be more variability in these estimates owing to chance.

The summative evaluation will be able to examine more admissions in order to gain greater clarity on these findings.

Using interaction terms, we assessed for heterogeneity of results across Pilot regions, but the estimates of any differences were small in magnitude and not statistically significant.

Table 43: HOP Impact on Monthly Inpatient Admissions Examining 12 Months Before and 12 Months After HOP Enrollment Using Interrupted Time Series Analysis

	Analyses among HOP Participants Alone	
Eligibility Category	**Change in Level (95% CI)**	**Change in Trend (95% CI)**
Overall	0.008 (0.004 to 0.01)	-0.003 (-0.004 to -0.003)
Non-Pregnant Adults	0.006 (0.0006 to 0.01)	-0.003 (-0.004 to -0.002)
Pregnant Individuals	0.09 (0.05 to 0.12)	-0.02 (-0.02 to -0.01)
Children 0 to 20 years of age	0.005 (0.0004 to 0.01)	-0.002 (-0.003 to -0.002)
Children 0 to 3 years of age	-0.005 (-0.15 to 0.05)	-0.004 (-0.008 to 0.001)

Note: This table reports results using an interrupted time series approach, which only uses data from HOP participants. Change in level indicates the change in the monthly number of inpatient admissions at the time of Pilot enrollment. A positive number indicates more admissions. Change in trend indicates the change per month in number of admissions associated with Pilot enrollment. A negative number indicates fewer admissions. To convert trends to units of 1000 beneficiary-months, multiply by 1000.

Table 44: HOP Impact on Monthly Inpatient Admissions Examining 12 Months Before and 12 Months After HOP Enrollment Using Comparative Interrupted Time Series Analysis

	HOP Participants		Comparison Group		Difference-in-Differences Estimate	
Eligibility Category	**Change in Level (95% CI)**	**Change in Trend (95% CI)**	**Change in Level (95% CI)**	**Change in Trend (95% CI)**	**Difference-in-Differences Level (95% CI)**	**Difference-in-Differences Trend (95% CI)**
Overall	0.008 (0.004 to 0.012)	-0.003 (-0.004 to -0.002)	-0.003 (-0.004 to -0.002)	-0.003 (-0.003 to -0.002)	0.011 (0.007 to 0.015)	-0.0008 (-0.0017 to 0.0001)
Non-Pregnant Adults	0.006 (0.000 to 0.011)	-0.003 (-0.004 to -0.002)	-0.005 (-0.007 to -0.003)	-0.001 (-0.001 to 0.000)	0.011 (0.005 to 0.016)	-0.0024 (-0.0037 to -0.0012)
Pregnant Individuals	0.089 (0.052 to 0.125)	-0.028 (-0.036 to -0.020)	0.036 (0.030 to 0.041)	-0.026 (-0.028 to -0.025)	0.053 (0.016 to 0.090)	-0.0013 (-0.0094 to 0.0069)

Children 0 to 20 years of age	0.005 (0.000 to 0.010)	-0.003 (-0.004 to -0.001)	-0.009 (-0.010 to -0.008)	-0.002 (-0.002 to -0.001)	0.014 (0.009 to 0.019)	-0.0009 (-0.0022 to 0.0005)
Children 0 to 3 years of age	-0.004 (-0.014 to 0.005)	-0.002 (-0.006 to 0.002)	-0.017 (-0.021 to -0.014)	-0.006 (-0.008 to -0.005)	0.013 (0.003 to 0.023)	0.0045 (0.0001 to 0.0088)

Note: This table presents results using a comparative interrupted time series approach. This produces estimates of the change in level and trends comparing the HOP group in the post-index period to the HOP group in the pre-index period, change in level and trends comparing the comparison group in the post-index period to the comparison group in the pre-index period, and difference-in-differences estimates of change in level and trend which compares the change in the HOP group with the change in the comparison group. Change in level indicates the change in the monthly number of inpatient admissions at the time of Pilot enrollment. A positive number indicates more admissions. Change in trend indicates the change per month in number of admissions associated with Pilot enrollment. A negative number indicates fewer admissions. To convert trends to units of 1000 beneficiary-months, multiply by 1000.

Figure 13: CITS Analysis of Inpatient Admissions

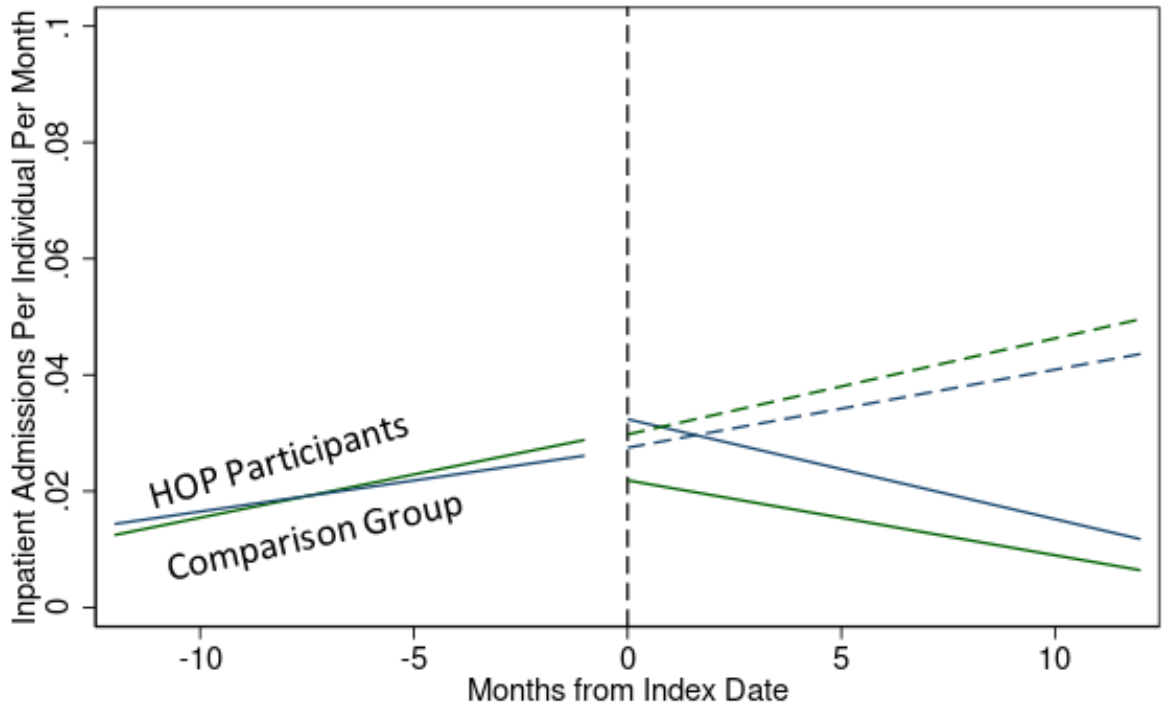


Figure 13 Legend: Estimates, overall, of monthly mean values of inpatient admissions among HOP participants (blue) and comparison group members (green). Dashed colored lines indicate counterfactual trend projection if trends prior to the start of HOP had continued. Dashed vertical line indicates the index date (date of HOP enrollment for HOP participants, date of positive social need screening for comparison group members).

Outpatient Visits

The mean number of outpatient visits per beneficiary per month immediately after Pilot enrollment was 1.1. For non-pregnant adults it was 1.3, for pregnant individuals it was 1.2, for children aged 0 to 20 it was 0.7, and for children aged 0 to 3 it was 1.0.

In the interrupted time series analyses examining outpatient visits, we found overall that outpatient utilization at the time of Pilot enrollment was about 0.15 outpatient visits per beneficiary per month greater than would be expected prior to Pilot enrollment based on the preceding 12 months (**Table 45** and **Figure 14**). Interrupted time series analyses estimated that outpatient visits significantly decreased over 12 months after Pilot enrollment, at a rate of 0.10 outpatients visits per beneficiary per month (or 100 per 1000 beneficiary-months).

In CITS analyses, which incorporated a comparison group (**Table 46** and **Figure 14**), we observed a negative trend in outpatient visits in the post-intervention period for both groups. However, the CITS analysis suggested that this may not be directly attributable to HOP. Instead, this decline may have been more attributable to broader social conditions than to Pilot participation. From CITS analysis, the difference-in-differences estimate of change in trend in HOP participants was 0.001 more outpatient visits per beneficiary per month (or 1 per 1000 beneficiary-months) and not statistically significant ($p = .77$). Therefore, we conclude that Pilot participation had no impact on outpatient visits, relative to a counterfactual scenario in which the individual did not enroll in HOP.

Results were mostly consistent across Pilot eligibility subgroups, with decreased visits observed among Pilot participants, relative to the period prior to participation, but with evidence that this may have been explained by secular trends (the difference-in-differences estimate was significant only for the subgroup of pregnant individuals). Given known national trends of lower outpatient utilization after the year 2020,[26,27] we believe that results estimating lower outpatient visits associated with Pilot participation are most consistent with national trends. Moreover, changes in outpatient utilization are difficult to interpret, as they could represent improved health (and thus less need for care) or foregone opportunities to receive needed care. Given the observed decreases in emergency department visits, which would be expected to increase if needed outpatient care is foregone, and the fact that there is no clear mechanism for Pilot participation to cause participants to forego needed outpatient care, we think this possibility is less likely. Nevertheless, it should be explored in the summative evaluation.

Using interaction terms, we assessed for heterogeneity of results across Pilot regions, but the estimates of any differences were small in magnitude and not statistically significant.

Table 45: HOP Impact on Monthly Outpatient Visits Examining 12 Months Before and 12 Months After HOP Enrollment Using Interrupted Time Series Analysis

	Analyses among HOP Participants Alone	
Eligibility Category	**Change in Level (95% CI)**	**Change in Trend (95% CI)**
Overall	0.15 (0.12 to 0.18)	-0.10 (-0.11 to -0.10)
Non-Pregnant Adults	0.21 (0.15 to 0.26)	-0.12 (-0.13 to -0.11)
Pregnant Individuals	0.17 (-0.02 to -0.35)	-0.27 (-0.31 to -0.23)
Children 0 to 20 years of age	0.10 (0.06 to 0.13)	-0.08 (-0.10 to -0.006)
Children 0 to 3 years of age	0.10 (0.02 to 0.18)	-0.09 (-0.11 to -0.07)

Notes: This table reports results using an interrupted time series approach, which only uses data from HOP participants. Change in level indicates the change in the monthly number of outpatient visits at the time of Pilot enrollment. A positive number indicates more outpatient visits. Change in trend indicates the change per month in number of outpatient visits associated with Pilot enrollment. A negative number indicates fewer outpatient visits. To convert trends to units of 1000 beneficiary-months, multiply by 1000.

Table 46: HOP Impact on Monthly Outpatient Visits Examining 12 Months Before and 12 Months After HOP Enrollment Using Comparative Interrupted Time Series Analysis

	HOP Participants		Comparison Group		Difference-in-Differences Estimate	
Eligibility Category	**Change in Level (95% CI)**	**Change in Trend (95% CI)**	**Change in Level (95% CI)**	**Change in Trend (95% CI)**	**Difference-in-Differences Level (95% CI)**	**Difference-in-Differences Trend (95% CI)**
Overall	0.081 (0.049 to 0.113)	-0.089 (-0.097 to -0.081)	0.163 (0.152 to 0.173)	-0.090 (-0.092 to -0.088)	-0.082 (-0.115 to -0.048)	0.001 (-0.007 to 0.009)
Non-Pregnant Adults	0.134 (0.083 to 0.186)	-0.107 (-0.119 to -0.095)	0.271 (0.249 to 0.293)	-0.119 (-0.123 to -0.114)	-0.137 (-0.193 to -0.081)	0.011 (-0.002 to 0.024)
Pregnant Individuals	0.079 (-0.107 to 0.265)	-0.266 (-0.321 to -0.211)	0.129 (0.091 to 0.167)	-0.148 (-0.156 to -0.139)	-0.050 (-0.240 to 0.140)	-0.118 (-0.174 to -0.063)
Children 0 to 20 years of age	0.036 (0.002 to 0.070)	-0.057 (-0.066 to -0.048)	0.092 (0.083 to 0.102)	-0.060 (-0.062 to -0.058)	-0.056 (-0.091 to -0.021)	0.003 (-0.005 to 0.012)
Children 0 to 3 years of age	0.033 (-0.045 to 0.110)	-0.072 (-0.095 to -0.049)	0.095 (0.073 to 0.116)	-0.077 (-0.082 to -0.072)	-0.062 (-0.143 to 0.019)	0.005 (-0.019 to 0.029)

Note: This table presents results using a comparative interrupted time series approach. This produces estimates of the change in level and trends comparing the HOP group in the post-index period to the HOP group in the pre-index period, change in level and trends comparing the comparison group in the post-index period to the comparison group in the pre-index period, and difference-in-differences estimates of change in level and trend which compares the change in the HOP

group with the change in the comparison group. Change in level indicates the change in the monthly number of outpatient visits at the time of Pilot enrollment. A positive number indicates more outpatient visits. Change in trend indicates the change per month in number of outpatient visits associated with Pilot enrollment. A negative number indicates fewer outpatient visits. To convert trends to units of 1000 beneficiary-months, multiply by 1000.

Figure 14: CITS Analysis of Outpatient Visits

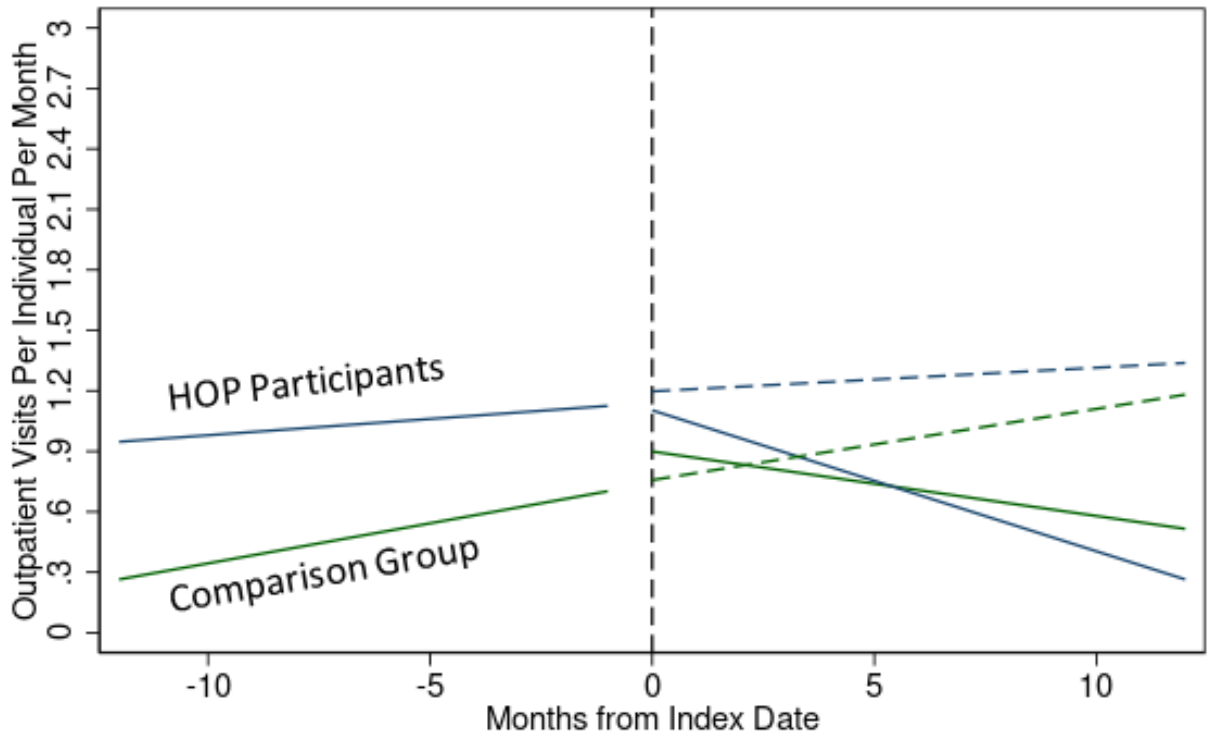


Figure 14 Legend: Estimates, overall, of monthly mean values of outpatient visits among HOP participants (blue) and comparison group members (green). Dashed colored lines indicate counterfactual trend projection if trends prior to the start of HOP had continued. Dashed vertical line indicates the index date (date of HOP enrollment for HOP participants, date of positive social need screening for comparison group members).

Prenatal and Postpartum Care

For analyses of prenatal and postpartum care, we conducted standard difference-in-differences analyses as these outcomes do not lend themselves to interrupted time series analysis in this dataset. Out of the population of pregnant individuals, we assessed whether they did or did not meet measure criteria for appropriate prenatal and postpartum care. We analyzed time periods 1 year prior and 1 year post index date (index date is defined again as the date of enrollment for Pilot participants and the date of first positive social risk screening for comparison group members). We used generalized estimating equation logistic regression models, with standard errors clustered at the level of the individual. Analyses adjusted for age, race and ethnicity, disability status, index date, and an index of rurality of residence. After fitting these models, we used predictive margins to estimate the probability of experiencing the outcome.

There were a relatively small number of pregnancies in Pilot participants, only 222 after Pilot enrollment, which limits the precision of the estimates. In the entire sample, 73.1% of pregnancies met the prenatal care metric, and 61.8% of pregnancies met the postpartum care metric.

Overall, while we estimated that Pilot participation was associated with an increase in appropriate prenatal care, this difference was not statistically significant (difference-in-differences estimate: 0.05 increase in probability of meeting the metric, 95%CI -0.02 to 0.11, p = 0.15).

We similarly found no significant difference in postpartum care associated with Pilot enrollment (difference-in-differences estimate: 0.032 decrease in probability of meeting the metric, 95% CI -0.11 to 0.05, p = 0.43).

Both of these estimates are imprecise, likely owing to the small number of pregnancy care episodes observed. Re-analysis in the summative evaluation may permit more precision.

Evaluation Question 6

The goal of Evaluation Question 6 ("Cost of Care") analyses was to determine how healthcare costs changed with Pilot participation, among all participants and across different eligibility categories. Costs considered included both medical care costs and for Pilot participants, costs recorded in invoices for Pilot services recorded in the Encounter Processing System (EPS). Costs not reflected in these data included payments made to Pilot organizations not associated with a specific encounter, or any payments to healthcare organizations not captured in the Encounter Processing System. These data will be added to subsequent analyses as they become available. Data used for these analyses could have been recorded as early as March 15, 2021 (1 year prior to HOP enrollment for the earliest date of HOP enrollment of March 15, 2022) and as late as November 30, 2023.

Evaluation Question 6 ("Cost of Care") analyses used two main approaches. The first approach was an individual-level interrupted time series approach, using the date of Pilot enrollment as an index date, and examining cost on a monthly basis for up to 12 months before and up to 12 months after Pilot enrollment (subsequent analyses will assess longer time periods). The interrupted time series analysis estimates a change in level (an immediate change in cost around the time of Pilot enrollment), and a change in trend (how the trend in cost differs after Pilot enrollment, relative to before). Because Pilot services typically begin a few weeks after enrollment, we interpret a change in level, if any, as reflecting the circumstances that surrounded Pilot enrollment (e.g., costs related to a 'triggering event', such as an emergency department visit for uncontrolled diabetes), rather than an effect of the Pilots themselves. We interpret the change in trend as an estimate of how utilization changed for the participant, compared with a counterfactual scenario in which they did not enroll in the Pilots. In this sense, the change in trend can be interpreted as the impact of the Pilots on costs. However, estimates from interrupted time series analyses can be subject to certain types of bias, such as regression to the mean or 'secular trends' (social conditions that affected Medicaid beneficiaries more broadly and were co-occurring with Pilot participation, but are not an effect of the Pilots themselves). To guard against this possibility, we also conducted CITS analyses, which compare changes in utilization trends before and after Pilot participation among Pilot participants to changes in utilization trends in a comparison group. The comparison group we used consisted of Medicaid beneficiaries who screened positive for social risks (an eligibility criterion for Pilot enrollment) but who lived in counties not covered by the Pilots and so did not participate in the Pilots. This approach directly models the pre-intervention period trends in outcomes. As with the interrupted time series analyses, we interpreted changes in level around the time

of the index date (HOP enrollment for HOP participants or first positive social risk screening for comparison group participants) as reflecting the circumstances that led to HOP enrollment or positive social risk screening. Changes in trend after the index date could reflect some combination of the impact of HOP (for HOP participants), the impact of actions taken to address needs outside of HOP, and the 'natural history' or 'regression to the mean' after the index date. By contrasting the change in trend in the HOP group with the change in trend in the comparison group, we hoped to 'difference out' the impact of actions taken to address needs outside of HOP along with 'natural history' and 'regression to the mean', and thus isolate the impact of HOP. In a CITS analysis, the purpose of the comparison group is not to compare with HOP participants directly, but to help estimate the counterfactual situation HOP participants would have experienced in the absence of enrolling in HOP. Thus, individuals in the comparison group could be different from Pilots participants in some ways, but the important part is that they should experience 'secular trends' similar to Pilots participants (for example, changes in macroeconomic conditions, non-HOP related changes in the Medicaid program, or changes in practice patterns such as shifts towards telehealth).

The index date for the comparison group was the first date of reporting a social risk during a screening assessment. Therefore, differences in costs for Pilot participants compared with non-Pilot participants make attributions of an effect of Pilot participation on cost more credible.

To account for repeated assessments within individuals, all Evaluation Question 6 analyses used generalized estimating equation regression models, with robust standard errors clustered at the level of the individual. We used an autoregressive 1 working correlation structure, and Gamma response distribution with a log link. Analyses adjusted for age, race and ethnicity, gender, disability status, index date, quarter of observation (to account for seasonality), and an index of rurality of residence. Because we fit non-linear models, we used predictive margins for inference after fitting the models.[25] We present estimates both overall (among all Pilots participants) and by eligibility category.

Total Cost of Care

The mean cost of care per beneficiary per month immediately after Pilot enrollment was $1739. For non-pregnant adults it was $2257, for pregnant individuals it was $1700, for children aged 0 to 20 it was $1004, and for children aged 0 to 3 it was $1667.

In the interrupted time series analyses examining the individual-level total cost of care, we found overall that healthcare costs were greater at the time of Pilot enrollment than would have been expected based on the preceding 12 months—about $587 more in costs per beneficiary per month than would be expected prior to Pilot enrollment (**Table 47**). In interrupted time series analyses, we found that costs significantly decreased over 12 months after Pilot enrollment, at a rate of $122 per beneficiary per month, relative to a counterfactual scenario in which the individual did not enroll in HOP.

In CITS analyses, which incorporated a comparison group (**Table 48** and **Figure 15**), we observed a negative trend in cost of care in the post-index period for both groups. However, this difference was significantly greater for HOP participants. From the CITS analysis, the difference-in-differences estimates of the change in trend suggested that HOP participation was associated with a decline in cost of care of $85 per beneficiary per month ($p < .0001$), which includes the cost of Pilot services reflected in the Encounter Processing System (EPS) data, and also accounts for the negative trend in comparison group participants. Of note, while we do not have data to test this hypothesis, one explanation for change in level in the comparison group is that health-related social needs are often detected around the time of a 'triggering event' such as an adverse change in circumstances that worsens health. One explanation for the negative trend in cost of care in the comparison group is that it may be attributable to actions taken in response to the reported social need, such as services to address health-related social needs provided outside of HOP. We are investigating the possibility of obtaining the data needed to test this hypothesis and will do so in the summative evaluation if feasible.

The negative trend suggests that longer participation in the Pilots may be associated with a greater cumulative reduction in healthcare costs. To help quantify this difference, using predictive margins, we estimated that the impact of Pilot participation on per beneficiary cost of care was greater at 12 months than at 6 months (difference in outcomes at 12 vs. 6 months: -$566, 95%CI -$1016 to -$115, $p = .01$). This estimate is specific for the time period studied and should not be extrapolated indefinitely. Nevertheless, these findings support allowing longer duration of Pilot participation.

Results were consistent in Pilot eligibility subgroups, with Pilot participation being associated with lower costs in both interrupted time series and CITS analyses for all subgroups, with the exception of the CITS estimate for children aged 0 to 3 which was favorable for Pilot participation but not statistically significant (p = 0.20). Using interaction terms, we assessed for heterogeneity of results across Pilot regions, but the estimates of any differences were small in magnitude and not statistically significant.

As described in the approved evaluation plan, these results focused on individual-level expenditures for specific beneficiaries in a specific month. These can be thought of as direct services—both for healthcare and, for HOP participants, specific services offered to address health-related social needs. The individual-level analyses conducted here do not include expenditures that are not attributable to specific individuals, such as HSOs' capacity building expenditures. Additional analyses around expenditures will be conducted in the summative evaluation.

At this time, it is not clear what factors are driving the change in cost of care. Differences in healthcare utilization may play a role, but may not explain the entire difference. In the summative evaluation, we will conduct additional analyses that seek to better understand the causes of these differences.

Table 47: HOP Impact on Monthly Cost of Care Examining 12 Months Before and 12 Months After HOP Enrollment Using Interrupted Time Series Analysis

	Analyses among HOP Participants Alone	
Eligibility Category	**Change in Level (95% CI)**	**Change in Trend (95% CI)**
Overall	$587 ($419 to $755)	$-122 ($-143 to $-101)
Non-Pregnant Adults	$546 ($389 to $703)	$-127 ($-150 to $-102)
Pregnant Individuals	$1245 ($886 to $1604)	$-224 ($-273 to $-175)
Children 0 to 20 years of age	$474 ($293 to $655)	$-67 ($-89 to $-44)
Children 0 to 3 years of age	$302 ($553 to $1157)	$-134 ($-241 to $-28)

Note: This table reports results using an interrupted time series approach, which only uses data from HOP participants. Change in level indicates the change in the monthly cost of care at the time of Pilot enrollment. A positive number indicates greater costs. Change in trend indicates the change per beneficiary per month in costs of care associated with Pilot enrollment. A negative number indicates lower costs.

Table 48: HOP Impact on Monthly Cost of Care Examining 12 Months Before and 12 Months After HOP Enrollment Using Comparative Interrupted Time Series Analysis

	HOP Participants		Comparison Group		Difference-in-Differences Estimate	
Eligibility Category	**Change in Level (95% CI)**	**Change in Trend (95% CI)**	**Change in Level (95% CI)**	**Change in Trend (95% CI)**	**Difference-in-Differences Level (95% CI)**	**Difference-in-Differences Trend (95% CI)**
Overall	$741 ($478 to $1003)	$-147 ($-184 to $-110)	$54 ($6 to $101)	$-62 ($-70 to $-54)	$687 ($420 to $954)	$-85 ($-122 to $-48)
Non-Pregnant Adults	$597 ($423 to $771)	$-134 ($-167 to $-100)	$16 ($-67 to $99)	$-37 ($-49 to $-25)	$581 ($389 to $774)	$-96 ($-132 to $-61)
Pregnant Individuals	$1355 ($983 to $1727)	$-327 ($-410 to $-243)	$559 ($484 to $634)	$-240 ($-258 to $-223)	$796 ($417 to $1174)	$-86 ($-172 to $-1)
Children 0 to 20 years of age	$509 ($267 to $752)	$-64 ($-96 to $-32)	$2 ($-32 to $35)	$-24 ($-30 to $-18)	$508 ($262 to $753)	$-40 ($-72 to $-8)
Children 0 to 3 years of age	$-111 ($-1789 to $1568)	$-122 ($-252 to $8)	$-62 ($-145 to $22)	$-36 ($-51 to $-21)	$-49 ($-1732 to $1634)	$-86 ($-216 to $44)

Note: This table presents results using a comparative interrupted time series approach. This produces estimates of the change in level and trends comparing the HOP group in the post-index period to the HOP group in the pre-index period, change in level and trends comparing the comparison group in the post-index period to the comparison group in the pre-index period, and difference-in-differences estimates of change in level and trend which compares the change in the HOP group with the change in the comparison group. Change in level indicates the change in the monthly cost of care at the time of Pilot enrollment. A positive number indicates greater costs. Change in trend indicates the change per beneficiary per month in costs of care associated with Pilot enrollment. A negative number indicates lower costs.

Figure 15: CITS Analysis of Monthly Cost of Care

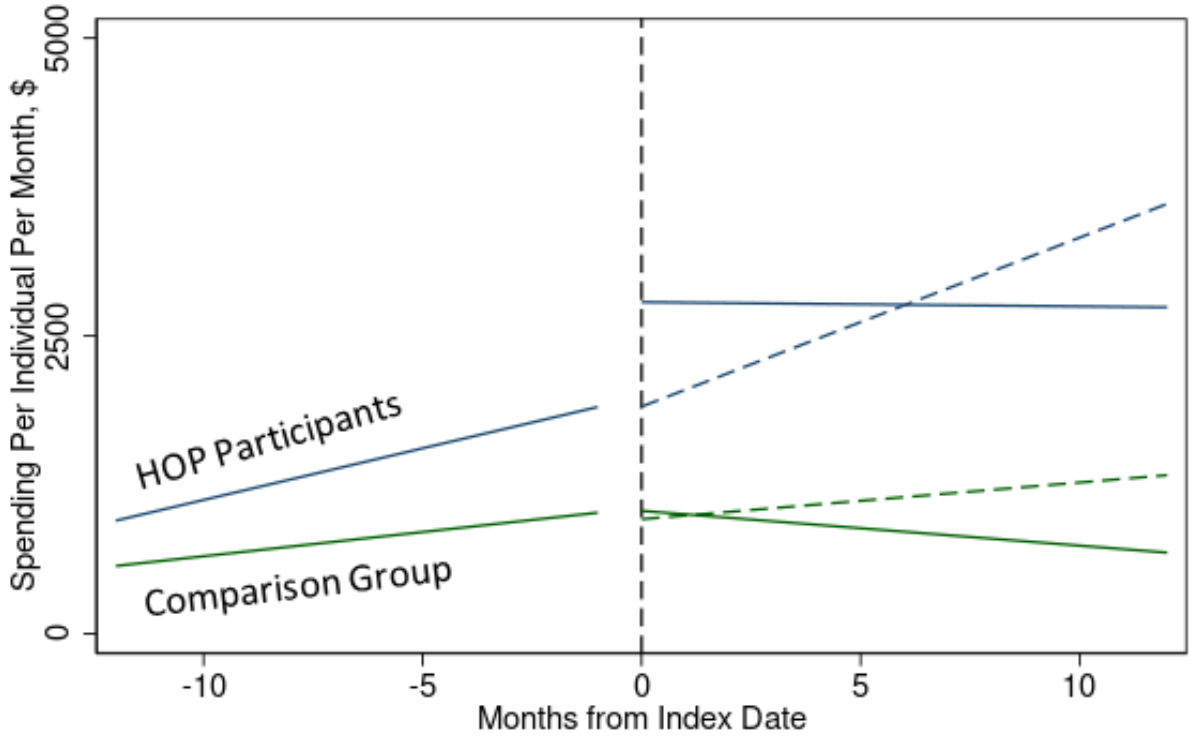


Figure 15 Legend: Estimates, overall, of monthly mean values of monthly cost of care among HOP participants (blue) and comparison group members (green). Dashed colored lines indicate counterfactual trend projection if trends prior to the start of HOP had continued. Dashed vertical line indicates the index date (date of HOP enrollment for HOP participants, date of positive social need screening for comparison group members). The larger difference between the slopes of the dashed and solid blue lines, compared with the difference between the slopes of the dashed and solid green lines, gives a visual representation of the difference-in-differences estimate.

Conclusions

Regarding Evaluation Question 1 ("Effective Delivery of Pilot Services") analyses, the results of the interim evaluation suggest that North Carolina's goal of establishing a multi-sector collaboration between the state of North Carolina, PHPs, healthcare systems, and HSOs has been achieved. Operational data demonstrate that despite challenges, Pilot infrastructure has successfully enabled the delivery of Pilot services. As of November 30, 2023, the Pilots have enrolled 13,271 unique individuals and delivered 198,291 Pilot services across many different intervention types by 147 HSOs that have submitted invoices. Initial social needs assessments occur quickly, with 90% of participants assessed for needs on the day of Pilot enrollment.

As the Pilot assessments identify needs, services to address them are delivered promptly. Services typically began soon after enrollment—over 75% of services had a service start date within 2 weeks of enrollment in the Pilots. At the time of this report, 11,809 (89%) enrollees received at least 1 Pilot service. Food services constituted the majority (86%) of services delivered. When examining services for specific needs, the rate of service receipt varied across need types: 10,055 individuals (93%) reporting a food need received a food service during this period, 5,803 individuals (68%) reporting a housing need received a housing service, 995 individuals (24%) reporting a transportation need received a transportation service, and 74 individuals (21%) reporting a toxic stress and/or IPV need received a toxic stress and/or IPV service. This difference may reflect both the phased rollout of services, with food services preceding all other services and IPV services coming much later, and differences in the complexity of delivering different services. Ongoing surveying work and qualitative interviews with Pilots participants, which will be reported in the summative evaluation, will help better understand this variation.

Invoices for services were paid in a timely fashion, with about 50% of invoices paid within 30 days, 75% paid within 46 days, and 97.9% within 90 days. This is important as a major goal of the Pilots was to ensure that HSOs, many of which historically depend on grant funding received prior to delivery of services, could operate successfully with a financing model that includes payments made soon after services were delivered.

Regarding Evaluation Question 2 ("Increased Rates of Social Risk Factor Screening and Connection to Appropriate Services"), we found that screening for social needs was significantly greater in Pilot regions, compared with the other parts of North Carolina where the Pilots were not operating.

The health-related social need screening rate was about 13.8% higher (p< 0.001) in Pilot regions compared with non-Pilot regions (9.1% of Medicaid beneficiaries screened in HOP regions vs. 8.0% in non-HOP regions), even though PHPs were required to attempt to screen all Medicaid beneficiaries in all regions upon enrollment in managed care. However, we were unable to evaluate whether more individuals with positive screens were connected to services in Pilot regions, compared with non-Pilot regions, owing to a lack of data regarding service connections in non-Pilot regions.

Evaluation Question 3 ("Improved Social Risk Factors") analyses evaluated whether Pilot services seem to be addressing the health-related social needs that Pilot participants report. Following the Driver Diagram that depicts the underlying logic of the Pilots, addressing those needs is a key pathway whereby Pilot services can lead to changes in health, healthcare utilization, and healthcare cost. Thus, optimizing services delivered to address those needs is important to the overall success of the Pilots.

As Pilot services began to be delivered, we found strong evidence using interrupted time series analyses that Pilot services reduced the total number of social needs (defined as the total count of food, housing, transportation, and IPV and/or toxic stress needs). The possible total number of social risks ranges from 0 to 4. As Pilot services began, the mean number of risks was 1.7 overall, 1.8 for non-pregnant adults, 1.8 for pregnant individuals, 1.7 for children aged 0-20, and 1.7 for children aged 0-3. Over the entire follow-up period, we estimated that Pilot participation reduced the total number of risks by 0.01 needs per day of follow-up, on average (95% CI -0.01 to -0.01). Within the follow-up period, however, longer times since Pilot participation began were associated with greater reduction in needs. To help quantify this, at 6 months, we estimated Pilot participation was associated with 0.4 fewer needs than would have been expected had an individual not participated in HOP (95% CI -0.5 to -0.2, p < .0001). At 12 months, we estimated that, on average, Pilot participation was associated with 1.2 fewer needs than would have been expected had an individual not participated in HOP (95% CI -1.6 to -0.8, p < .0001). Thus, we estimate a larger impact of Pilot participation on needs at 12 months than at 6 months (difference in outcomes at 12 vs. 6 months: -0.8, 95%CI -1.1 to -0.5, p <.0001).

Moreover, Pilot services reduced the probability of reporting the specific risks of food needs (change in probability averaged over the entire follow-up period: -0.002 per day, 95% CI -0.003 to -0.001), housing needs (change in probability: -0.01 per day, 95%CI -0.01 to -0.004), and transportation needs (change in probability: -0.002 per day, 95%CI -0.003 to -0.001), relative to estimates of what would have occurred had participants not enrolled in the Pilots. These patterns held true for most eligibility subgroups, although there were a few instances for the 'pregnant individuals' and 'children

aged 0 to 3' subgroups in which the results were not statistically significant. Because the magnitude of the risk reduction estimates in these instances was similar to that of Pilot participants overall, the lack of statistical significance may have resulted from low sample size in this interim report. The main case in which eligibility subgroup estimates seemed meaningfully different from the overall estimate was with transportation needs for children aged 0 to 20 and children aged 0 to 3. In these cases, the magnitude of the estimate was small and not statistically significant. This may be explained by non-emergency medical transportation being a covered benefit for all Medicaid members, and relatively few HOP transportation services being provided for these age groups. This finding merits further investigation in the summative evaluation.

As IPV specific services have only been provided since April 2023, corresponding to only the last third of the evaluation period, and relatively few toxic stress services have been provided, the results of analyses examining the impact of the Pilots on IPV and/or toxic stress are more uncertain. We did find evidence that IPV and/or toxic stress needs decreased with Pilot participation for the subgroup of pregnant individuals, but we did not find significant differences for other subgroups or Pilot participants overall. These analyses did have limited power, however, as the reported prevalence of IPV and/or toxic stress needs was very low relative to other needs.

Comparative effectiveness analyses did not reveal significant differences in addressing social needs by intervention type. We did not observe differences when comparing 1) a fruit and vegetable prescription, 2) a food box (large or small, for delivery or pick up), and 3) prepared meals (either a 'healthy' meal [for pick up or delivered] or a 'medically tailored' meal [delivered]) on the probability of reporting a food need; when comparing 1) housing navigation, support, and sustaining services, 2) essential utility set up, 3) move-in support (including assistance with security deposit and first and last month's rent), and 4) home remediation, safety and quality inspection, or accessibility and safety modifications on the probability of reporting a housing need; or when comparing 1) health-related private transportation, and 2) health-related public transportation on the probability of reporting a transportation need. These findings support continuation of a variety of services and support allowing care managers and participants to select services they feel will best address the participant's particular health-related social need.

We do not yet have good estimates of whether Pilot participation affects clinical outcomes, as we were unable to investigate Evaluation Question 4 ("Clinical Outcomes") comprehensively in this report, owing to lack of data regarding most clinical outcomes we aim to evaluate. The one outcome we

were able to evaluate, low birth weight, did reveal a point estimate in favor of Pilot services, but it was not statistically significant, with wide confidence intervals owing to relatively few events. Subsequent evaluation reporting will shed more light on the impact of Pilot participation on clinical outcomes.

Regarding Evaluation Question 5 ("Healthcare Utilization") analyses, we found that Pilot enrollment tends to occur during a period of rising risk for adverse healthcare utilization. We also found strong evidence that Pilot participation was associated with decreased emergency department utilization over a 12-month period after Pilot enrollment, relative to what would have occurred in the absence of the Pilots (reduction of 6 emergency department visits per 1000 beneficiary-months, $p < .0001$). This was apparent both overall and for all Pilot eligibility categories. Further, we estimated that the impact of Pilot participation on emergency department visits was greater at 12 months than at 6 months (difference in outcomes at 12 vs. 6 months: -0.022, 95%CI -0.032 to -0.013, $p <.0001$). In other words, Pilot participation reduced emergency department visits by 22 more visits per 1000 beneficiary-months at 12 months than it did at 6 months.

The pattern regarding the impact of Pilot services on inpatient admissions was more heterogenous. Overall, over the 12-month period following Pilot enrollment, we estimated that Pilot participation was associated with a non-statistically significant reduction in inpatient admissions (0.8 fewer admissions per 1000 beneficiary-months, $p = 0.07$). However, estimates varied meaningfully across Pilot eligibility categories. We estimated a larger and statistically significant reduction in inpatient admissions for non-pregnant adults (2 fewer admissions per 1000 beneficiary-months, $p < 0.001$), while estimates for pregnant individuals and children aged 0 to 20 were similar to the overall estimates and not statistically significant. We also estimated an increase in inpatient admissions for children aged 0 to 3 (4 more admissions per 1000 beneficiary-months, $p = 0.04$). This heterogeneity will be investigated further in subsequent reports.

We did not observe a change in outpatient utilization attributable to Pilot participation. Similarly, we did not observe a change for specific outpatient utilization regarding prenatal and postpartum care.

For Evaluation Question 6 ("Cost of Care") analyses, over the 12-month period following Pilot enrollment, we observed significantly lower healthcare expenditures attributable to Pilot participation in both interrupted time series and CITS analysis, relative to what would have occurred in the absence of the Pilots. The decrease was approximately $85 per beneficiary per month (95%CI: $-122 to $-48). As these are individual-level estimates, they include the cost of direct Pilot services (which are included in

Medicaid encounters), but do not include HOP spending that did not generate an encounter invoice (e.g., spending that was not for a specific service or individual, such as capacity building spending). Further, we estimated that the impact of Pilot participation on per beneficiary cost of care was greater at 12 months than at 6 months (difference in outcomes at 12 vs. 6 months: -$566, 95%CI -$1016 to -$115, p = .01).

For the outcomes of social risk, emergency department visits, and healthcare spending, we found negative trends over time in the period of Pilot participation. This implies greater benefits for Pilot participation at longer times from enrollment (e.g., 12 months rather than 6 months). These trends should not necessarily be extrapolated beyond the time period studied (12 months following Pilot enrollment for this interim evaluation report). Nevertheless, it does support allowing participants who meet eligibility criteria and feel they are benefiting from Pilot services to continue to receive them for periods longer than 6 months.

Overall, the findings of this report support the underlying rationale of the Pilots, which is that addressing social risk factors can lead to improvements in healthcare utilization and cost. Although there are analyses yet to be conducted and evidence is limited in some areas, the results to date are largely positive. Of course, there are important limitations to keep in mind when interpreting these analyses. The most important limitation is that receipt of services was not randomly assigned. Aspects of a participant's clinical or social situation could have influenced both what type of service they received for their need and the likelihood that such a need would resolve or that utilization would improve. However, the analyses in this report used several approaches to mitigate these potential biases—particularly regression adjustment (to help account for measured confounding), the use of data both before and after Pilot participation (to help account for time-fixed unmeasured confounding), and the use of a contemporaneous comparison group for many outcomes (to help account for time-varying confounding related to 'secular trends' or other factors that affect Medicaid beneficiaries separately from Pilot participation). A second limitation relates to data availability. Data lag or data entry errors could lead to erroneous estimates, but we have little reason to expect this to be differential across the groups being compared. Moreover, this interim report does not include data on some Pilot spending (specifically, spending not associated with direct service provision), which will be included in the summative evaluation. Finally, this report does not evaluate the separate direct-to-consumer 'expedited enrollment' fruit and vegetable prescription offered alongside the 'standard' Pilot services, owing to data limitations.

Plans in Subsequent Evaluation Periods

The below sections describe plans to help answer evaluation questions in subsequent evaluation periods.

For all evaluation questions, additional HOP services and any expansion of the populations to whom HOP services are offered will be included in the summative evaluation.

Evaluation Question 1

("Effective Delivery of Pilot Services")

We will continue to monitor enrollment, delivery of Pilot services, and spending on Pilot services. To do this, we will conduct network analyses examining the interrelationship between PHPs, NLs, and HSOs and we will conduct qualitative interviews with diverse HOP roles within PHPs, NLs, and HSOs.

Evaluation Question 2

("Increased Rates of Social Risk Factor Screening and Connection to Appropriate Services")

We will continue to compare rates of screening for health-related social needs between Medicaid beneficiaries in Pilot and non-Pilot regions. We will also work to identify sources of data that will let us compare differences, if any, in use of services to address health-related social needs between Medicaid beneficiaries in Pilot and non-Pilot regions.

Evaluation Question 3

("Improved Social Risk Factors")

We will conduct analyses examining the effect of Pilot participation on changes in health-related social needs over longer timeframes than were examined in this report. We will also conduct analyses comparing the effectiveness of different types of interventions (e.g., food subsidies versus meal delivery) for improving health-related social needs over longer time frames than were examined in this report. We will further attempt to incorporate the direct-to-consumer 'expedited enrollment' program into analyses.

Evaluation Question 4

("Clinical Outcomes")

Using longitudinal survey data, we will conduct analyses examining the effect of Pilot participation on changes in clinical outcomes (as detailed in the evaluation design). We will also conduct analyses

comparing the effectiveness of different types of interventions (e.g., food subsidies versus meal delivery) for improving clinical outcomes. We will further attempt to incorporate the direct-to-consumer 'expedited enrollment' program into analyses.

Evaluation Question 5

("Healthcare Utilization")

We will continue to conduct analyses examining the effect of Pilot participation on changes in healthcare utilization (as detailed in the evaluation design). We will also conduct analyses comparing the effectiveness of different types of interventions (e.g., food subsidies versus meal delivery) for improving healthcare utilization. We will further attempt to incorporate the direct-to-consumer 'expedited enrollment' program into analyses. We will also investigate whether data on services to address health-related social needs in the comparison group can be obtained and incorporate those data into our analyses if feasible.

Evaluation Question 6

("Cost of Care")

We will continue to conduct analyses examining the effect of Pilot participation on changes in healthcare costs (as detailed in the evaluation design). We will also conduct analyses comparing the effectiveness of different types of interventions (e.g., food subsidies versus meal delivery) for improving healthcare costs. We will further attempt to incorporate the direct-to-consumer 'expedited enrollment' program into analyses. We will also investigate whether data on services to address health-related social needs in the comparison group can be obtained and incorporate those data into our analyses if feasible. Finally, we anticipate analyzing different categories of cost (e.g., in different care settings), in addition to total cost.

Interpretations, Policy Implications, and Interactions with Other State Initiatives

Interpretations

We offer the following interpretations to integrate the findings of this interim evaluation report.

First, the successful operation of the Pilots is a major achievement. Network Lead procurement and initial implementation of the program occurred during the COVID-19 Public Health Emergency. The Healthy Opportunities Pilots are a complex program involving multi-sector collaboration between the state of North Carolina, healthcare providers, payors, care management entities, Network Lead organizations, and Human Services Organizations. To be successful, this approach required substantial infrastructure development, capacity building activities, and ongoing efforts to ensure a robust network of services are available for beneficiaries. Infrastructure that needed to be established included the development of shared information, data, and referral technology platforms (such as NCCARE360); the legal and regulatory agreements necessary for the state of North Carolina, PHPs, NLs, HSOs, and healthcare organizations to collaborate; integrating HSOs into the healthcare ecosystem; and the interpersonal work of making these complex, multi-sector relationships effective and efficient. Moreover, these efforts needed to be sustained over time. Such an undertaking is quite extensive, and it is a notable success that this has been accomplished.

Second, efforts to increase Pilot enrollment have borne fruit. In the first Rapid Cycle Assessment, the ability to address some questions of interest was hindered by the number of individuals enrolled in the Pilots. Although there are still some evaluation questions for which greater numbers of beneficiaries would permit more precise answers, there has overall been a noticeable uptick in both the cumulative number of those enrolled in the Pilots and the duration of their Pilots enrollment, which has facilitated evaluation efforts.

Third, screening for health-related social needs is greater in Pilot regions than non-Pilot regions. However, screening still needs to expanded further to reach all Medicaid beneficiaries in Standard Plans; there is room for improvement in both Pilot and non-Pilot regions. North Carolina's efforts to improve screening, including the application of financial withholds related to health-related social needs screening, should help with this.

Fourth, Pilot participation seems to be having a clear impact on health-related social needs. Since the Driver Diagram that underlies the Pilots emphasizes the importance of addressing social needs

to improve health, healthcare utilization, and healthcare spending, establishing the impact of Pilot participation on health-related social needs is an important step in understanding the Pilots' impact. The pattern observed is overall one that was hypothesized—high (and rising) needs around the time of enrollment, with decline as participation continues. We did find evidence that IPV and/or toxic stress needs decreased with Pilot participation for the subgroup of pregnant individuals, but we did not find significant differences for Pilot participants overall or for other subgroups. Interpreting these findings requires caution, however, as IPV services were added only in April 2023 (late in this evaluation period) and the low number of individuals reporting these needs means estimates are imprecise.

Fifth, we do not yet have a good understanding of whether Pilot participation affects clinical outcomes. This will require further investigation in subsequent evaluation reporting.

Sixth, Pilot participation appears to be having an impact on adverse healthcare utilization—particularly emergency department visits. Emergency department utilization was high around the time of Pilot enrollment, and we estimated that enrolling in the Pilots led to a decreasing utilization trend over a 12-month follow-up period. A similar pattern was seen for inpatient admissions overall, although the estimated decrease in inpatient admissions overtime was not statistically significant. However, there was more heterogeneity across eligibility subgroups for inpatient admissions than for emergency department visits.

Seventh, we have seen little impact of the Pilots on outpatient utilization. Changes in outpatient utilization are difficult to interpret, as outpatient utilization can reflect either poor health or use of preventive services for effective chronic disease management, unlike emergency department utilization which typically reflects poor health. The impact, if any, of Pilot participation on outpatient utilization will require further investigation in subsequent evaluation reporting.

Eighth, we did observe lower healthcare spending attributable to Pilot participation, considering both medical care and the cost of invoiced Pilot services. This supports the overall idea that improvements in health-related social needs could reduce healthcare spending by improving health.

Policy Implications

There are several key policy implications of the Pilots to date. First, the structure of service delivery used in the Pilots is feasible, reaches those in need, and appears to be functioning as intended. Second, the array of services available seems to be having an impact on reducing health-related social needs for Pilot

participants. Third, Pilot services seem to be having an impact on adverse healthcare utilization (particularly emergency department visits) and healthcare spending. Overall, this supports continuing the Pilots, perhaps with expansion to other areas of North Carolina, in order to better pursue the state of North Carolina's goal of improving health for those experiencing health-related social needs across the entire state.

Interactions with Other State Initiatives

At this stage, the focus of evaluation has been on the performance of the Pilots, and thus we have not yet assessed how the Pilots integrate with other state initiatives, which are subject to separate evaluation reports. The summative report will assess these interactions in detail.

Lessons Learned and Recommendations

Lessons learned from this Interim Evaluation suggest several recommendations for the Healthy Opportunities Pilots activities going forward. These are:

1. Maintain Efforts to Screen, Enroll, and Deliver Healthy Opportunities Pilots Services to Medicaid Beneficiaries. Compared with the prior evaluation report, screening and enrollment is substantially greater, and delivery of services to those enrolled is higher as well. Thus, efforts taken to improve these numbers appear to have been successful. Maintaining these efforts is likely beneficial for both Medicaid beneficiaries and the purposes of evaluation. If Medicaid beneficiaries who could benefit from Pilot services are not enrolled, it could leave them in need. In addition, as Pilot enrollment is linked to decreasing healthcare costs, greater enrollment could lead to increasing Medicaid costs savings. Moreover, greater enrollment would also help increase the power of evaluation activities, and permit evaluation of a broader set of questions. This is particularly important for detecting differences in response to services across groups, and for more in-depth analysis of groups that are of interest to the state of North Carolina, but are less common among Pilot participants—such as pregnant individuals. Without adequate numbers of individuals from categories of interest, there will be substantial uncertainty in any conclusions drawn from evaluation activities. Given the overall rate of screening of Medicaid beneficiaries in Pilot regions, there may yet be substantial numbers of individuals who could enroll in the Pilots.
2. Do Not Limit Service Duration. For most areas where Pilot services appear to be improving outcomes (e.g., health-related social needs, adverse healthcare utilization, and healthcare spending), we found that longer periods of time after Pilot enrollment were expected to result in better outcomes. Within the inherent limitations of this evaluation and the duration of time studied, the evidence to date is consistent with allowing Pilot participants to receive services if they feel they are benefitting from them. Consistent engagement with care management can repeatedly assess if there is a continued need for services. Of course, if participants feel they no longer need services, there is no reason to continue. However, routinely ending services at a particular cut-off (e.g., after 6 months) may decrease the overall impact of the Pilots. Analyses in subsequent reporting periods will also help to further elucidate this relationship.

3. Understand the Relationship between Pilot Services and Social Needs. The key focus of the Healthy Opportunities Pilots is to address health-related social needs to improve health. How to operationalize 'addressing' health-related social needs is complex, however. Though resolution of a need (defined as no longer reporting a previously reported need) is likely to be beneficial, it is also important to recognize that needs could get worse in the absence of the Pilots, and thus services may be beneficial even if individuals do not report a need as fully resolved. Indeed, our interrupted time series estimates did suggest that much of the difference between the probability of needs experienced by Pilot participants and what we estimate would have happened in the absence of the Pilots was driven by worsening needs in the counterfactual condition. Thus, assessment of whether Pilot services are 'addressing' needs should attend to the nuance of the situation Pilot participants experience.
4. Expansion of Pilot Services to Other Regions of North Carolina is Reasonable. Although this is only an interim evaluation, there are clear signals that key features of the Healthy Opportunities Pilots are working as intended. Screening for social needs is greater in Pilot regions than non-Pilot regions. The HOP approach to service delivery has established an extensive network of HSOs, delivering services at scale to over 10,000 individuals. We estimate that these services reduce social needs, improve adverse healthcare utilization relative to what would have been experienced in the absence of the program, and reduce healthcare spending. Therefore, offering Pilot services in additional parts of the state, assuming similar operating conditions can be established, is well-supported by the available data.

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Attachments

CMS Approved Evaluation Design

Please see separate PDF of the CMS approved Evaluation Design

Healthy Opportunities Pilots Fee Schedule

Please see separate PDF of the Healthy Opportunities Pilots Fee Schedule

Appendices

Table A1: New Enrollment by Month & Region

	Access East	CCLCF	Impact Health	Grand Total
2022	**725**	**880**	**666**	**2,271**
March*	--	--	--	19
April	20	22	13	55
May	44	33	34	111
June	82	68	58	208
July	66	73	53	192
August	96	126	93	315
September	85	141	90	316
October	107	111	106	324
November	117	132	114	363
December	100	168	100	368
2023	**2,857**	**4,255**	**3,728**	**10,840**
January	99	202	135	436
February	132	213	195	540
March	158	354	283	795
April	211	365	247	823
May	219	553	341	1,113
June	293	597	374	1,264
July	412	489	304	1,205
August	454	462	484	1,400
September	305	347	469	1,121
October	331	418	513	1,262
November	243	255	383	881
Grand Total	**3,582**	**5,135**	**4,394**	**13,111**

**counts for specific regions suppressed for low cell counts in March 2022*

Notes: 160 participants missing region information excluded. Statistics later in 2023 may be affected by data lag.

Figure A1: New Enrollees per Month by Region

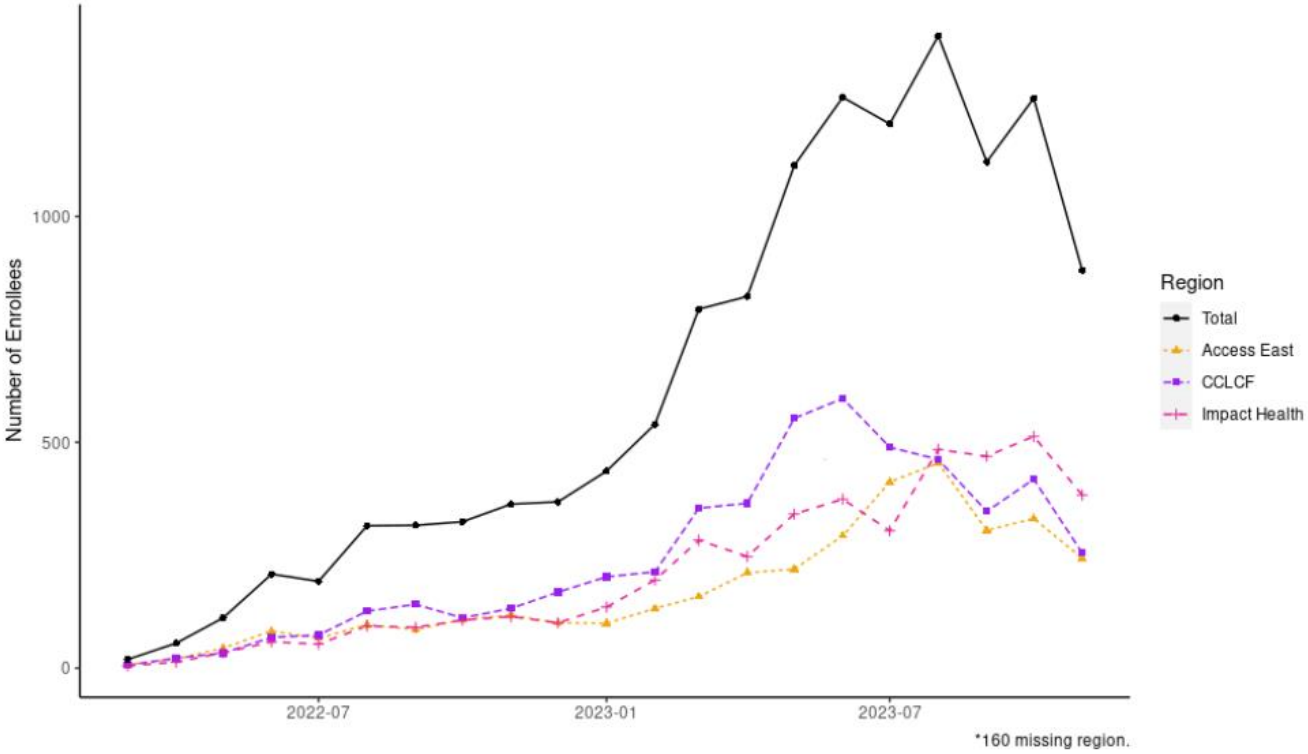

Figure A1 Legend: Number of new Pilot Enrollees per month, overall and by Region. Note that months later in 2023 may be affected by data lag.

Figure A2: New Enrollees per Month by Eligibility Category

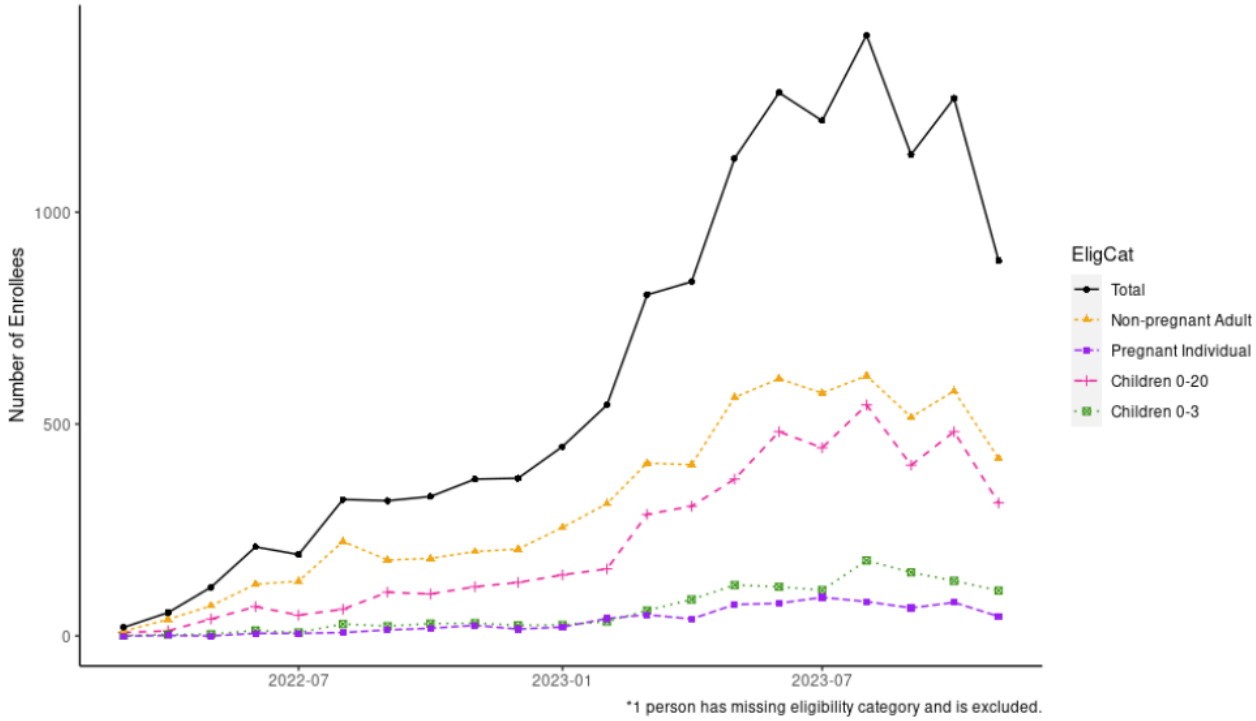

Figure A2 Legend: Number of new Pilot Enrollees per month, overall and by eligibility category. Note that months later in 2023 may be affected by data lag.

Figure A3: New Enrollees per Month by Prepaid Health Plan

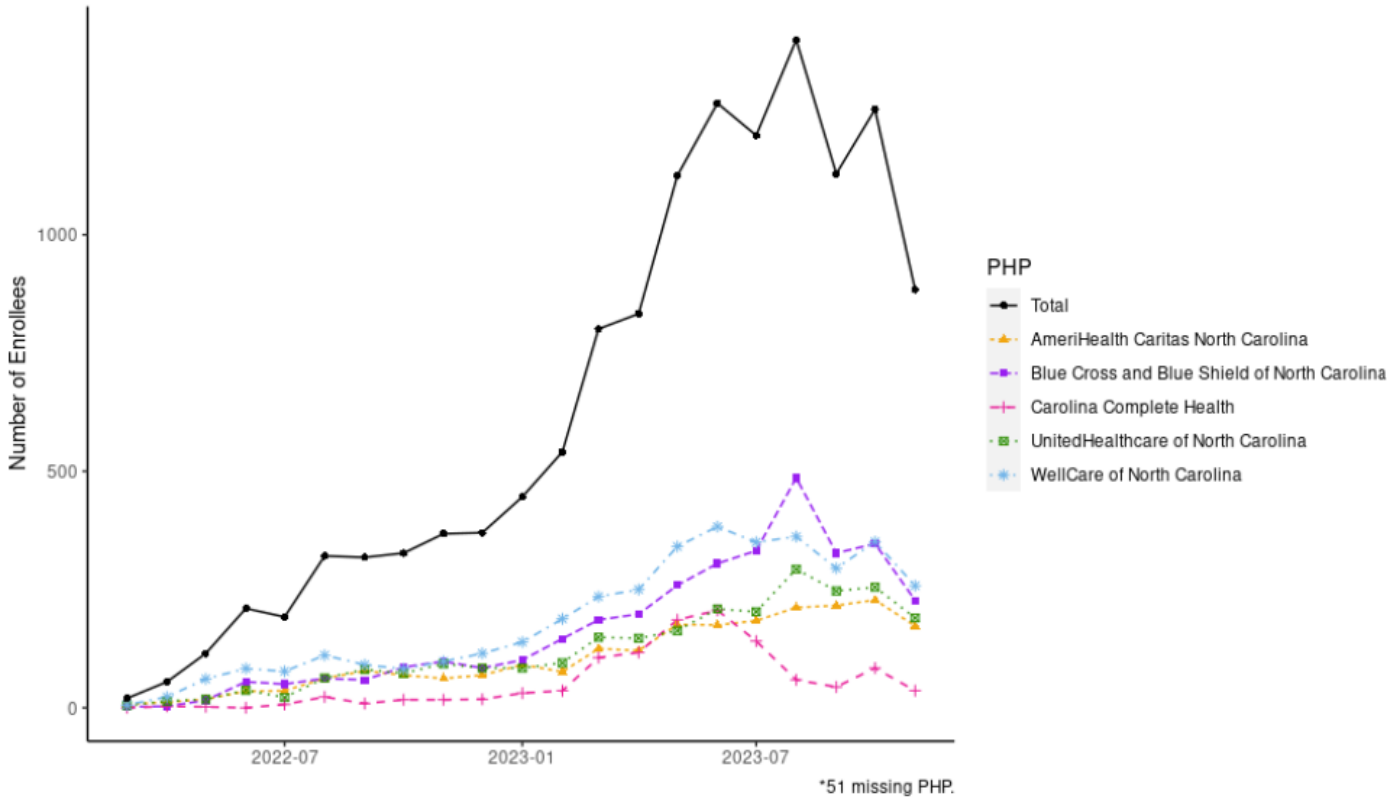

Figure A3 Legend: Number of new Pilot Enrollees per month, overall and by Prepaid Health Plan. Note that months later in 2023 may be affected by data lag.

Figure A4: Needs Identified per Month

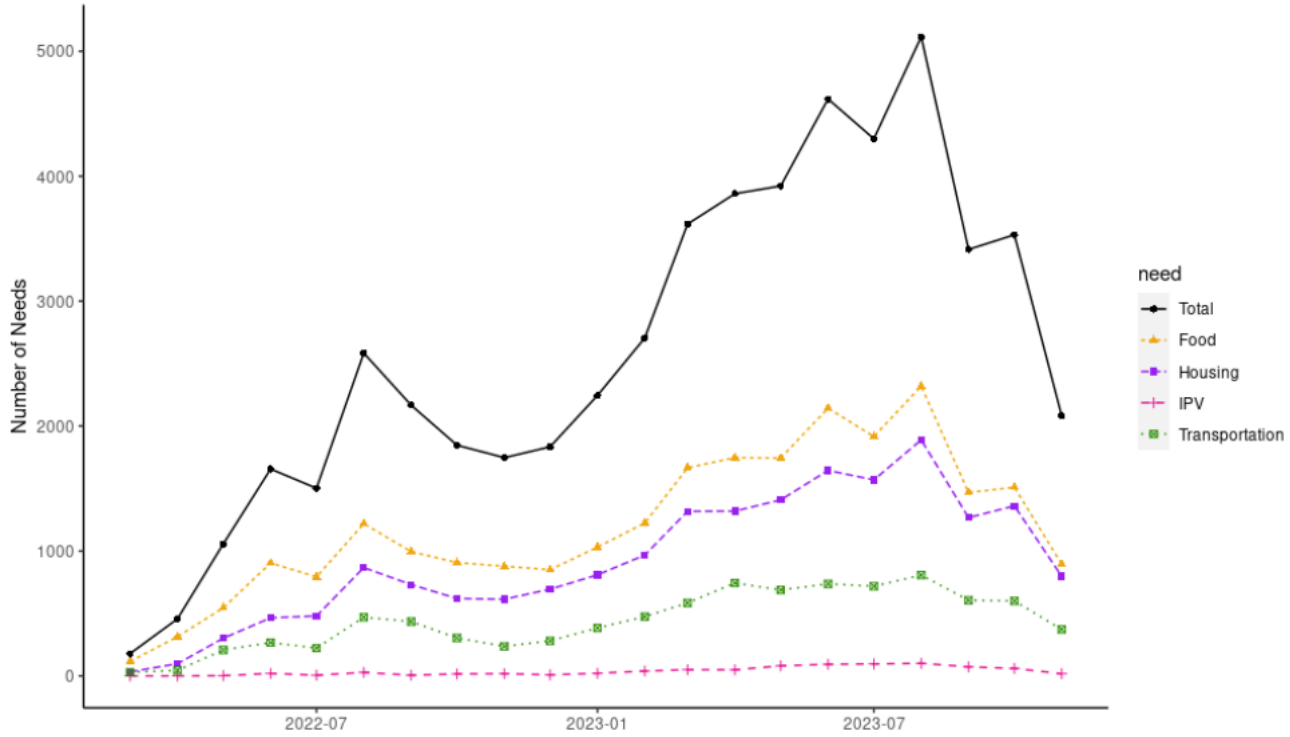

Figure A4 Legend: Number of needs identified per month, overall and by need type. Note that months later in 2023 may be affected by data lag.