Mobility and Health in Chicago

Exploring the Impact of Public Transportation on Individual Well-Being in Chicago's Communities

Victor Jiao
Vikram Srikonda
Nicole Gutierrez
Elena Gill
Francesca Carney
Meghana Halbe
Radha Ramanathan
Ava Hedeker
Ermelinda Calderón

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MISSION STATEMENT

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Abstract

This paper investigates the impact of transportation accessibility on public health outcomes in Chicago, and OLS regression analysis finds that reliable transportation facilitates better healthcare access and promotes healthier lifestyles. We analyze how the availability of public transit correlates with various health metrics including obesity rates, chronic disease management, and access to healthcare resources. Using Ordinary Least Squares (OLS) regression analyses, we explore the relationship between transit stop accessibility and health indicators such as routine checkups, prenatal care, and physical activity levels, while controlling for median household income. Our findings indicate that improved transit accessibility could increase the rates of early prenatal care and reduce physical inactivity, but the influence of socioeconomic status remains substantial. We also discuss the disparities in transit accessibility that exacerbate health inequities among Chicago's South and West Side communities. The study highlights the critical role of public transportation in enhancing public health and offers policy recommendations to improve transit reliability and access, particularly in underserved areas. We provide recommendations for addressing transportation barriers that would ensure a more equitable urban environment that supports the health and well-being of all Chicagoans.

Introduction

Much of the discourse around public transit, both within Chicago and nationwide, revolves around it being a manner of increasing convenience of commutes to work, and spreading the economic benefits of tourism around the city, as well as its positive environmental externalities. This paper seeks to expand that discourse to include public transit as a determinant of individual and community health outcomes. Existing literature, of which we provide an overview, has shown that reliable public transit is essential for connecting residents to healthcare resources, facilitating healthy lifestyles, and reducing health disparities between different neighborhoods. While these findings have been shown across many urban areas around the world, we seek to evaluate whether they can be replicated within Chicago, and explore the dynamic between transit access and public health among Chicago's communities.

Chicago, with its large public transit network and a varied demographic distribution across its many neighborhoods, offers a unique opportunity to explore how transportation accessibility intersects with health outcomes by comparing outcomes between communities within the city. The city's South and West sides, home to economically disadvantaged communities and higher proportions of minority residents, face greater transportation barriers than wealthier, predominantly white neighborhoods. We seek to quantitatively evaluate how these disparities are affected by variations in transit access across the city, influencing factors such as access to healthcare services, obesity rates, and physical activity levels.

Our study employs Ordinary Least Squares (OLS) regression analyses to examine the correlation between transit stop accessibility and health outcomes, controlling for socioeconomic status. We also consider how transit disparities exacerbate health inequities among Chicago's South and West Side communities, further emphasizing the need for targeted interventions. We suggest several ideas for policy reforms to enhance transportation infrastructure, particularly in underserved areas, as a means of fostering healthier, more equitable urban environments.

Literature Review

Our team performed a review of existing literature on the relationship between community health and transportation access. Our review focused on two broad categories of health factors that are affected by transit access; physical activity levels, and access to clinics and other healthcare services. An elaboration on each of those categories can be found in the section below, as well as some background information about the public transportation landscape in Chicago which informs our following quantitative analysis.

Physical activity and lifestyle changes in relation to public transportation

A study published by the Victoria Transport Policy Institute found that most regular public transit users meet the U.S. Center for Disease Control's (CDC) recommended amount of 22 daily minutes of moderate physical activity by walking to and from their transit stop, while less than half of the overall U.S. population meets this average daily activity level. A 2012 study by University of Sydney researchers found that a round trip on public transportation was associated with a walking time of about 8-33 minutes, with the most commonly found values falling in the range of 12-15 minutes (Rissel, et al.). Their model calculated that if only 20% of adults defined as "inactive" in the state of New South Wales were to walk an additional 16 minutes a day for 5 days a week, an additional 6.97% of the population would reach the state government's "sufficiently active" threshold. Another study by BMC Geriatrics found that particularly among older Americans, the density of neighborhood transit stops had a significantly positive effect on rates of walking for exercise.

This increase in overall lifestyle activity that arises from easier access to transit can also help with the prevention of diseases associated with physical inactivity. One longitudinal analysis study used aggregated county-level panel data to identify causal relations between public transit usage and obesity. Their results include a one percentage point increase in frequent public transit riders in a county population is estimated to decrease the county population obesity rate by 0.473% (She, et al. 2018). Another study published in the Journal of Transport and Health found a significant link between neighborhood walkability and Body Mass Index, finding that "for the average-height man (5'11", 1.75 m), moving from the worst to best transit environment is associated with a reduction in body mass of nearly five pounds (2.2 kg), and moving from the worst to best pedestrian environment with a reduction in body mass of about two pounds (<1 kg)." (Smart, 2018).

Access to Healthcare

In studies focusing on patients who missed healthcare appointments, one of the primary reasons was due to transportation barriers. A 1999 investigation elucidating the reasons for missed appointments found that 51% of child patients cited transportation barriers as the main reason for missed clinic appointments (Pesata et al.). Another study then investigated the impact of a policy change restricting Medicaid payments for transportation, leading to changes in healthcare utilization patterns, including increased visits to community clinics and slight increases in hospitalizations (Tierney et al., 2000). These findings demonstrate several ways in which unreliable transportation can impact the well-being of individuals as basic access to healthcare becomes increasingly difficult to obtain.

A study conducted on the extent of barriers and linkages to healthcare for Head Start children along with transportation as seen as a barrier to cancer treatment has also found that minority groups such as ethnic minorities, elderly and children, and those of low socioeconomic status face greater challenges accessing healthcare due to transportation barriers (Giambruno C et al., 1997; Guidry JJ et al., 1997). Giambruno and Guidry's studies supported this, showing higher burdens of travel for healthcare among African Americans compared to their White counterparts.

An investigation examining the "Impact of Transportation Interventions on Healthcare Outcomes initially identified 8 published articles out of 8708 unique records that met the inclusion criteria. These articles examined various transportation interventions, such as taxi vouchers, ridesharing services, van services, bus tickets, and parking vouchers, all focused on non-emergency transportation to healthcare facilities. The outcomes assessed included transportation services utilization, healthcare utilization measures (e.g., appointment rates, follow-up visit rates), and health measures (e.g., blood pressure, severity of diagnosis). The ultimate outcome of this research shows that subsidizing transportation services to improve health for patients facing transportation barriers has demonstrated little impact of transportation services on health or healthcare utilization (Solomon et al., 2020). Some studies show a more positive correlation, although there were challenges in implementation, and utilization rates varied across interventions.

A study focused on the social determinants of health shows that socioeconomically disadvantaged oncology patients found no change in appointment show rates for those receiving transportation assistance (Braveman et al., 2011). With original research highlighting the offering of free ridesharing services in clinics serving high-poverty patient populations, this resulted in increased primary care visit completion rates (Chaiyachati et al., 2018). However, a subsequent Randomized Controlled Trial (RCT) in the same population found no significant differences in appointment show rates between the intervention and control groups.

A large RTC in Los Angeles County examined the impact of transportation incentives on follow-up visit rates for women with abnormal pap smears (Marcus et al., 1992). The study found that transportation incentives increased the likelihood of a return visit, particularly among low-income patients. However, only a small percentage of women utilized the transportation incentives, suggesting that the increase in return rates might be due to the psychosocial impact of offering transportation assistance rather than its practical use. Another RCT compared prenatal visit attendance rates among low-income women receiving different interventions, including taxi vouchers, free baby blanket coupons, or follow-up appointment slips only (Melnikow et al., 1997). The study found that patients receiving taxi vouchers completed the most prenatal care visits, although the actual usage of vouchers was low.

Chicago's Transit Landscape

A study led by a researcher from the University of Illinois at Urbana-Champaign found that suburban Chicagoland neighborhoods had a higher healthcare accessibility value than those closer to the city, as measured by the distance and time needed to reach healthcare facilities (Liu, et al., 2021). However, we did not find existing research on the patterns that exist in transportation-based healthcare accessibility within Chicago's city limits, which is what our forthcoming quantitative analysis will attempt to provide. It will be a limited analysis, as we chose to focus on transit stop density due to the availability of data on this criterion that is available on the neighborhood level.

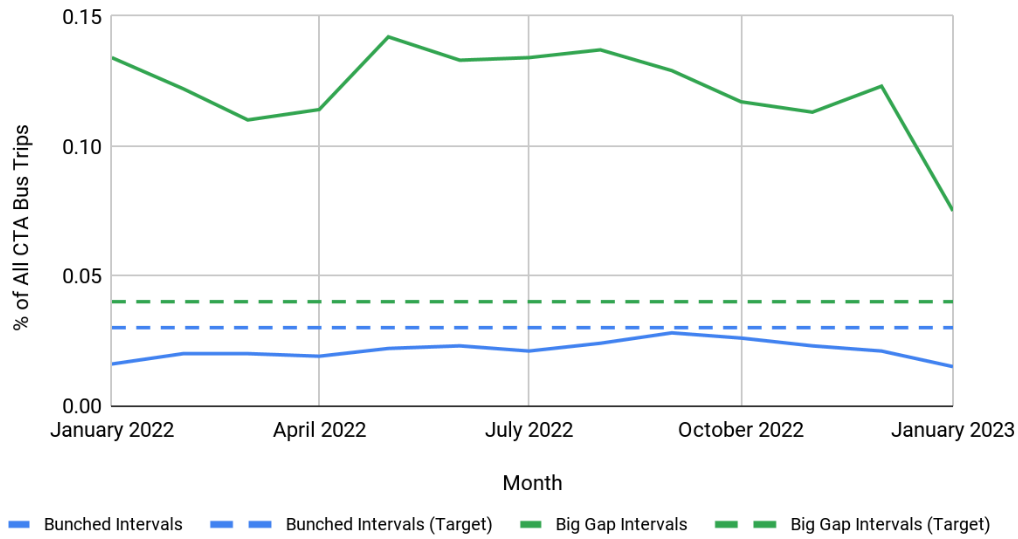
Transit reliability is a difficult metric to measure by area, as most of the data currently available relates to system-wide on-time percentages. According to the latest full-year CTA Service Report (2022-2023)[1], the system had over 4x the amount of "big gap intervals"[2], where services at a station are much too far apart, across the entire year (see **Figure 1**). At the same time, the CTA had a very small number of "bunched intervals"[3], which indicates that the problem was not *inconsistent* service, but *insufficient* service. For example, if buses A, B, and C are scheduled to a given stop, and there ends up being a larger-than-scheduled gap between A and B, it is reasonable to assume that there would be a smaller-than-scheduled gap between B and C if the situation was as simple as bus B being late. While there are plenty of possible extenuating circumstances that make this model an oversimplification, such a large inconsistency between "big gap intervals" and "bunched intervals" is highly unlikely if every bus came at some point, and thus is highly suggestive of a phenomenon of buses which never make it to their scheduled stops. Colloquially, these have come to be known as "ghost buses", a concept that has garnered significant concern among transit users in Chicago, with the phrase trending online in recent years.

[1] "January 2023 Performance Metrics." transitchicago.com, January 2023. https://www.transitchicago.com/assets/1/6/01-2023_PM_Report.pdf.

[2] Bunched Intervals defined as "Number of bus intervals (time between two buses at a bus stop) that are 60 seconds or less divided by the total number of weekday bus intervals traveled during the month."

[3] Big Gap Intervals defined as "Number of bus intervals (time between two buses at a bus stop) that are double the scheduled interval and greater than 15 minutes, divided by the total number of weekday bus intervals traveled during the month."

Figure 1: CTA On-time Bus Performance Compared to System Targets (2022-23)



Source: Chicago Transit Authority, January 2023 Performance Metrics

It is also important to note that frequency of service also plays an important role in transit accessibility across Chicago's communities, as routes can range from arriving at a given stop every few minutes, to an hour or more between arrivals. The CTA also has a separate schedule for service on weekends with lower frequencies across the system.

Quantitative Research

We conducted a series of Ordinary Least Squares (OLS) regression analyses to explore the relationships between health-related outcomes and the accessibility of transit stops, controlling for socioeconomic status as reflected by median household income.

Data and Variables

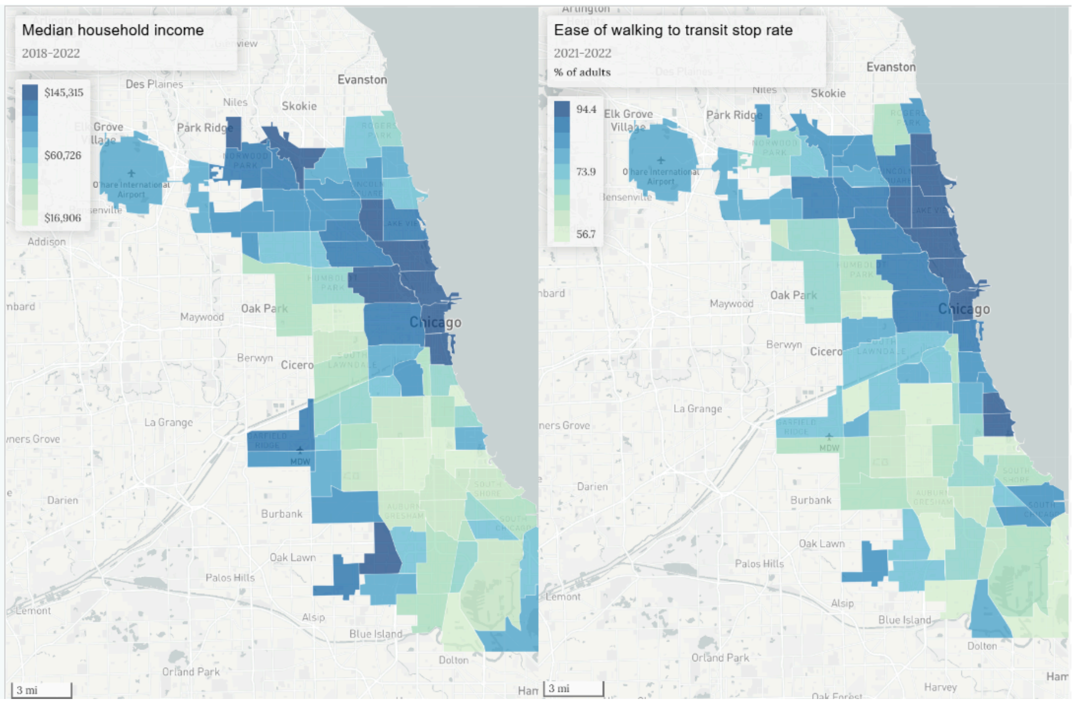
Our primary independent variable of interest was the percentage of residents in each of Chicago's 77 official Community Areas, which loosely correspond to various neighborhoods, who reported that they were within walking distance of a transit stop. It is important to note that while this metric is intended as a representation of transit stop density within a given community, it is a self-reported metric, so there may be slight inconsistencies in the data reported based on what respondents interpreted as being "walking distance". We feel that this subjectivity makes the self-reported metric a potentially better indicator of transit access within a community, as a more discrete metric like number of transit stops or average distance between transit stops would fail to account for numerous other variables like stop safety, walking conditions, or availability of benches at stops. The bottom line is that if people do not feel that a transit stop is accessible to them, the physical proximity to the transit stop is irrelevant.

The dependent variables of interest in our analyses were three health indicators – Routine Checkup Rate[4], 1st Trimester Prenatal Care Rate[5], and Adult Physical Inactivity Rate[6] – which were recorded by the latest Healthy Chicago Survey as obtained via the Chicago Health Atlas website. The first two indicators served as measures of access to clinical care and healthcare resources, and the Physical Inactivity Rate metric served as a measure of lifestyle quality, which were the two categories of public health impacts that we are interested in studying.

To control for the influence of socioeconomic status, we included the Median Household Income of each community area in the model. Median Household Income is a standard measure of economic well-being and is often correlated with both health outcomes and access to amenities, including public transportation. The overlap between our metric for transit proximity and Median Household Income is visualized in **Figure 2**, and the distributions for our public health variables look much the same when mapped using the interactive tool on the Chicago Health Atlas website[7].

[4] Defined as "Percent of adults who visited a doctor or health care provider for a routine checkup in the past year", 2021-22
[5] Defined as "Percent of births with entry into prenatal care in the first trimester", 2017-21
[6] Defined as "Percent of adults who reported that they did not participate in any physical activities or exercises in the past month", 2021-22
[7] Chicago Health Atlas. Accessed January 23, 2024. https://chicagohealthatlas.org/indicators.

Figure 2: Distribution of Median Household Income (2018-2022) Compared to Ease of Walking to Transit Stop Rate (2021-2022)



Source: Chicago Health Atlas, Tiles © Mapbox, Chicago Department of Public Health, Healthy Chicago Survey

Statistical Analysis

To examine the influence of transit stop accessibility on health outcomes, we conducted separate OLS regressions for each health indicator. In each model, the health indicator served as the dependent variable, while transit stop accessibility and median household income were the independent variables. The inclusion of median household income as a control variable allowed us to isolate the effect of transit stop accessibility from the confounding influence of economic status.

Before proceeding with the regression analyses, we addressed potential multicollinearity by calculating the Variance Inflation Factor (VIF) for each explanatory variable. The VIF results indicated that multicollinearity was not a concern, with both the transit stop accessibility and median household income variables showing VIF values significantly below the commonly used threshold of 5, suggesting that the independent variables did not exhibit problematic levels of linear dependence.

Our regression was modeled by the following equation:

$$Var = \beta_0 + \beta_1 * \%WD$$

In this model, Var represents one of three aforementioned health indicators, and $\%WD$ denotes the percentage of residents living within walking distance from a transit stop.

Results

Below are the key findings from each of our regressions. The tables are listed as **Figures 3, 4, and 5** in the Figures and Data Appendix.

1. Routine Checkup Rate

Based on the regression results, a 1% increase in residents living within walking distance from a transit stop is correlated with a 0.24% decrease in routine checkup rate. Contrary to our expectations, the association between transit stop accessibility and the rate of routine checkups was negative. The control for median household income weakened this association, which suggests that the initial observed negative relationship may be influenced more by socioeconomic factors than by the accessibility of transit alone.

```
                                   OLS Regression Results
==============================================================================================
Dep. Variable:     Q("Routine Checkup Rate (2021-2022)")   R-squared:                   0.077
Model:                                               OLS   Adj. R-squared:              0.064
Method:                                    Least Squares   F-statistic:                 6.233
Date:                                   Sun, 05 May 2024   Prob (F-statistic):         0.0147
Time:                                           12:44:50   Log-Likelihood:            -270.36
No. Observations:                                     77   AIC:                         544.7
Df Residuals:                                         75   BIC:                         549.4
Df Model:                                              1
Covariance Type:                               nonrobust
=====================================================================================================================================
                                                                           coef    std err          t      P>|t|      [0.025      0.975]
-------------------------------------------------------------------------------------------------------------------------------------
Intercept                                                               95.3999      7.160     13.325      0.000      81.137     109.662
Q("% of Residents Within Walking Distance of Transit Stop (2021-2022)")  -0.2375      0.095     -2.497      0.015      -0.427      -0.048
==============================================================================
Omnibus:                        0.389   Durbin-Watson:                   1.716
Prob(Omnibus):                  0.823   Jarque-Bera (JB):                0.549
Skew:                           0.006   Prob(JB):                        0.760
Kurtosis:                       2.587   Cond. No.                         576.
==============================================================================
```

2. Prenatal Care Rate in the First Trimester

The OLS regression revealed a statistically significant positive association between the percentage of residents within walking distance of a transit stop and the prenatal care rate in the first trimester, even after controlling for median household income. This suggests that better transit accessibility is associated with higher rates of early prenatal care. As can be seen in the figure below, a 1% increase in residents living within walking distance from a transit stop is correlated with a 0.6% increase in prenatal care rate in the first trimester.

```
                              OLS Regression Results
===========================================================================================================
Dep. Variable:     Q("Prenatal Care Rate in 1st Trimester (2017-2021)")   R-squared:                       0.444
Model:                                                              OLS   Adj. R-squared:                  0.437
Method:                                                   Least Squares   F-statistic:                     59.88
Date:                                                  Sun, 05 May 2024   Prob (F-statistic):           3.75e-11
Time:                                                          12:44:50   Log-Likelihood:              -255.14
No. Observations:                                                    77   AIC:                             514.3
Df Residuals:                                                        75   BIC:                             519.0
Df Model:                                                             1
Covariance Type:                                              nonrobust
====================================================================================================================================
                                                                          coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------------------------------------------------
Intercept                                                              24.4334      5.876      4.158      0.000      12.729      36.138
Q("% of Residents Within Walking Distance of Transit Stop (2021-2022)")  0.6041      0.078      7.739      0.000       0.449       0.760
==============================================================================
Omnibus:                        0.562   Durbin-Watson:                   1.253
Prob(Omnibus):                  0.755   Jarque-Bera (JB):                0.478
Skew:                           0.189   Prob(JB):                        0.787
Kurtosis:                       2.918   Cond. No.                         576.
==============================================================================
```

3. Adult Physical Inactivity Rate

Based on the regression results, a 1% increase in residents living within walking distance from a transit stop is correlated with a 0.6% decrease in physical inactivity rate. The model indicated a negative association between transit stop accessibility and physical inactivity, although this relationship did not reach conventional levels of statistical significance, even upon controlling for median household income. Note again that the dependent variable denotes physical INactivity, which in turn means proximity to the transit stop is correlated with an increase in physical activity.

```
                              OLS Regression Results
===========================================================================================================
Dep. Variable:     Q("Adult Physical Inactivity Rate (2021-2022)")   R-squared:                       0.280
Model:                                                         OLS   Adj. R-squared:                  0.270
Method:                                              Least Squares   F-statistic:                     29.18
Date:                                             Sun, 05 May 2024   Prob (F-statistic):           7.48e-07
Time:                                                     12:44:50   Log-Likelihood:              -282.94
No. Observations:                                               77   AIC:                             569.9
Df Residuals:                                                   75   BIC:                             574.6
Df Model:                                                        1
Covariance Type:                                         nonrobust
====================================================================================================================================
                                                                          coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------------------------------------------------
Intercept                                                              73.4476      8.430      8.712      0.000      56.654      90.242
Q("% of Residents Within Walking Distance of Transit Stop (2021-2022)") -0.6050      0.112     -5.402      0.000      -0.828      -0.382
==============================================================================
Omnibus:                        1.684   Durbin-Watson:                   1.642
Prob(Omnibus):                  0.431   Jarque-Bera (JB):                1.312
Skew:                           0.104   Prob(JB):                        0.519
Kurtosis:                       2.396   Cond. No.                         576.
==============================================================================
```

The relatively high R-squared values in the models, particularly for the prenatal care rate, demonstrate that a significant portion of the variance in these health outcomes can be explained by the predictors included in the model. This highlights the potential impact of transit accessibility on community health outcomes, independently of economic factors.

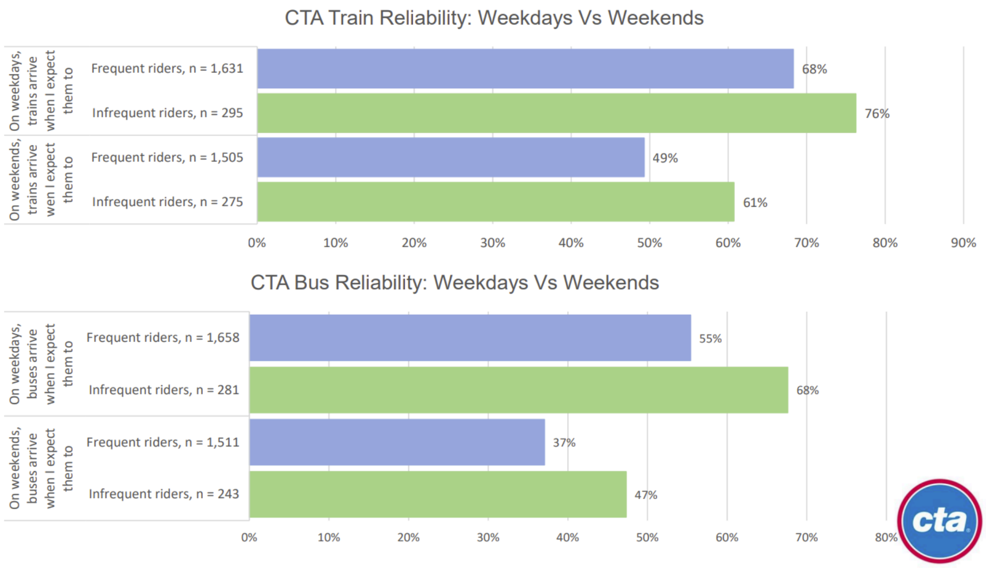
Discussion

Our analysis provides evidence that accessibility to transit stops is a factor in community health within Chicago, finding a particularly significant positive effect on early prenatal care engagement. The results point to a more nuanced relationship between transit accessibility and physical inactivity, as well as routine health checkups, with socioeconomic status playing a substantial confounding role. These findings corroborate the existing literature, supporting the idea that public health within an urban community can be negatively affected by a lack of access to transit within walking distance.

As mentioned in the Literature Review section, our findings offer only a partial view of the transit and public health dichotomy in Chicago, as they only measure transit in terms of density. Due to a lack of available data at the neighborhood level, our model fails to take into account several key metrics in determining transit accessibility. Concerns about safety at stops and spotty handicap accessibility can limit many Chicagoans' ability to rely on public transit for public health purposes, but the largest effects on the utility of transit in a given neighborhood for public health purposes come from the frequency and reliability of service. Lower frequencies on weekends and for routes that do not go into the city center are common across transit systems in the United States. This is a major inhibiting factor for whether residents have access to healthcare services, as many health-related trips fall into the category of non-city center trips outside of the work week. A future study could utilize scheduled runs for certain bus routes or scheduled arrivals at certain stops as a means of studying the level of overlap between areas with higher frequencies and those with better public health outcomes.

While the CTA does not publish information about which communities, routes, or stations have the lowest on-time percentages, CTA Customer Survey data from the same 2022-23 time frame as the data used above further illustrates that riders across the system had poor experiences with transit reliability overall (see **Figure 6**). In particular, riders identified as "frequent" and bus riders (as opposed to train riders) were especially unsatisfied with the reliability of service, particularly on weekends. The CTA provides some demographic and geographic information with regards to what kinds of riders identify as "frequent", although their geographic rider frequency breakdowns are stratified by extremely broad regions (i.e. "South", "West", "Suburbs", etc), within which there is too much neighborhood variation for the information to be pertinent to this paper. The February 2023 Customer Survey reports that "Frequent riders were more likely to identify as Black or African American or Hispanic and less likely to identify as White than infrequent riders… Frequent riders were more likely to identify as lower income than infrequent riders."

Figure 6: CTA Rider Poll on Reliability (2022)



Source: Chicago Transit Authority, 2022 Q4 Customer Survey Results

These findings are highly indicative of inequities in service reliability which may compound issues in frequency and density that affect public health in some communities within Chicago. Factors of income and race are clearly correlated to lower measures of transit density according to data from the Chicago Health Atlas, and this is corroborated by self-reported measures in the CTA Customer Surveys, suggesting that it may be many of the same neighborhoods whose residents lower access to transit across all of these metrics. These findings likely amplify the results we obtained in our original quantitative research, suggesting that infrequent and unreliable service compounds the negative effect that poor transit accessibility has on healthcare access and lifestyle factors in many communities, particularly on the South and West Side.

Suggestions for Policy Interventions

If increased transit access is to be used as a means of bolstering lifestyle activity in certain neighborhoods, The CTA should focus on building transit infrastructure that is easily and comfortably accessed on foot from where people live and work. Park-and-ride programs have been popular among transit systems in the U.S., but they are a prime example of transit infrastructure that primarily benefits commuters, whereas the largest transit-related public health impacts are felt by those who cannot drive to a clinic, and thereby also could not drive to a park-and-ride station. Additionally, the waiting experience of passengers is a factor in the utilization of transit stops that already exist. Many bus stops in Chicago are nothing more than a sign in the ground, and for many residents, especially older ones, the lack of a bench or covering could mean that while there is a transit stop physically close to them, they do not feel it is accessible.

While our literature review showed mixed results for transit interventions in increasing the utilization of healthcare resources, policymakers could consider the expansion of reduced fare programs as a means of removing barriers to clinical care. Another important step in expanding access to healthcare via transit would be to increase service frequencies on weekends and outside of rush hour, particularly in communities on the South and West sides that are further away from quality healthcare resources. While many of these interventions could cost significant municipal funds to implement, one issue that can be corrected quite cheaply is to improve the reliability of service and communication around delays. We supported anecdotal evidence of a large amount of scheduled service that fails to arrive, and delays are incredibly common. By improving the Ventra app's estimated arrival times to communicate delays quicker and more accurately, it could not only allow riders to miss fewer appointments due to missed transit links but also serve to attract new riders who previously felt they could trust their bus or train to arrive on time.

Conclusion

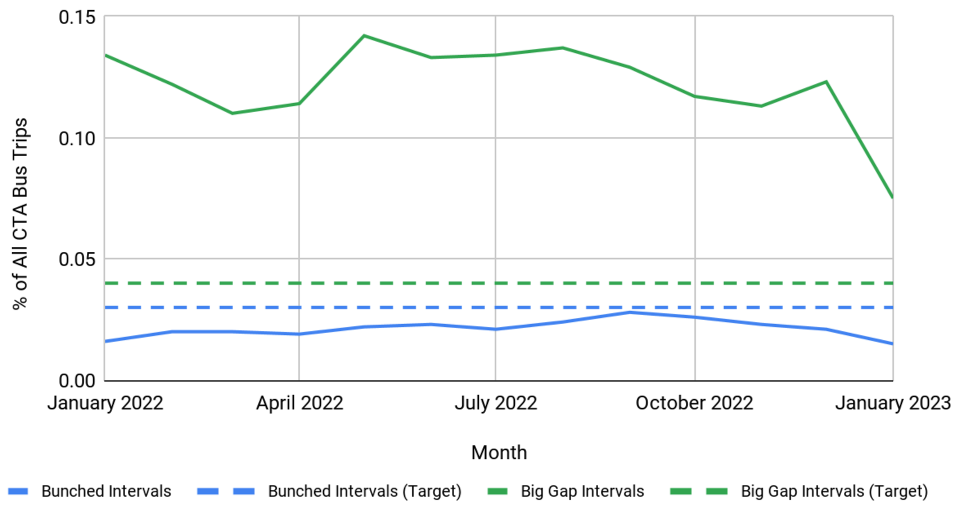
Our study underscores the significant connection between transportation accessibility and public health outcomes in Chicago. The analysis conducted demonstrates that enhanced access to reliable public transportation is correlated with improved healthcare access and healthier lifestyle choices among residents. Particularly, our findings reveal a marked increase in prenatal care during the first trimester and suggest a decrease in physical inactivity rates with better transit availability. These results are pivotal, as they highlight how integral transportation systems are to public health, beyond mere convenience and urban mobility.

Moreover, the disparities identified in transit accessibility and reliability, especially in economically disadvantaged areas on the South and West Sides of Chicago, point to a pressing need for targeted urban planning and policy reforms. These reforms should aim not only to enhance the frequency and reliability of transit services but also to ensure that these improvements are felt equitably across all neighborhoods.

In efforts to improve public health outcomes, policymakers must view investment in transportation infrastructure as an important factor, focusing on enhancing walking-distance stop accessibility and reducing service gaps that may disproportionately impact minority and low-income communities. By doing so, we can foster a more equitable and healthy urban environment that better supports the well-being of its residents.

Figures and Data Appendix

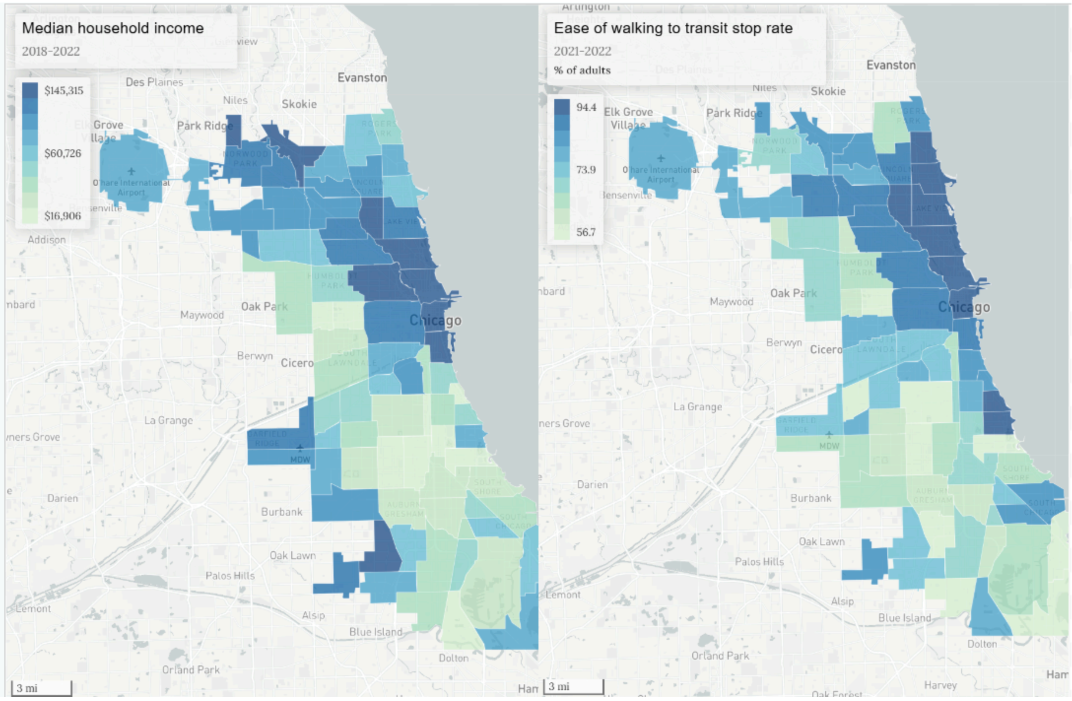
Figure 1: CTA On-time Bus Performance Compared to System Targets (2022-23)



*Bunched Intervals are defined as "Number of bus intervals (time between two buses at a bus stop) that are 60 seconds or less divided by the total number of weekday bus intervals traveled during the month."
*Big Gap Intervals are defined as "Number of bus intervals (time between two buses at a bus stop) that are double the scheduled interval and greater than 15 minutes, divided by the total number of weekday bus intervals traveled during the month."

Source: Chicago Transit Authority, January 2023 Performance Metrics

Figure 2: Distribution of Median Household Income (2018-2022) Compared to Ease of Walking to Transit Stop Rate (2021-2022)



Source: Chicago Health Atlas, Tiles © Mapbox, Chicago Department of Public Health, Healthy Chicago Survey

Figure 3: Regression results between "percentage of residents living within walking distance to a transit stop" and "routine checkup rate"

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                                      OLS Regression Results
=========================================================================================
Dep. Variable:     Q("Routine Checkup Rate (2021-2022)")   R-squared:                 0.077
Model:                                               OLS   Adj. R-squared:            0.064
Method:                                    Least Squares   F-statistic:               6.233
Date:                                   Sun, 05 May 2024   Prob (F-statistic):       0.0147
Time:                                           12:44:50   Log-Likelihood:          -270.36
No. Observations:                                     77   AIC:                       544.7
Df Residuals:                                         75   BIC:                       549.4
Df Model:                                              1
Covariance Type:                               nonrobust
==============================================================================================================================
                                                                      coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------------------------------------------
Intercept                                                          95.3999      7.160     13.325      0.000      81.137     109.662
Q("% of Residents Within Walking Distance of Transit Stop (2021-2022)")   -0.2375      0.095     -2.497      0.015      -0.427      -0.048
==============================================================================
Omnibus:                        0.389   Durbin-Watson:                   1.716
Prob(Omnibus):                  0.823   Jarque-Bera (JB):                0.549
Skew:                           0.006   Prob(JB):                        0.760
Kurtosis:                       2.587   Cond. No.                         576.
==============================================================================
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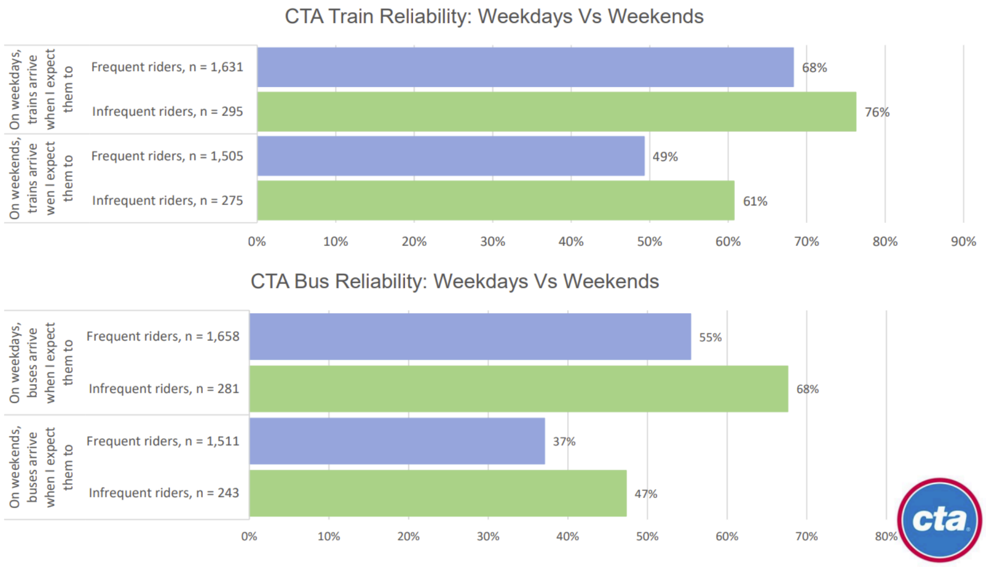
Figure 4: Regression results between "percentage of residents living within walking distance to a transit stop" and "prenatal care rate in the first trimester"

```
                                           OLS Regression Results
==============================================================================================================
Dep. Variable:     Q("Prenatal Care Rate in 1st Trimester (2017-2021)")   R-squared:                       0.444
Model:                                                              OLS   Adj. R-squared:                  0.437
Method:                                                   Least Squares   F-statistic:                     59.88
Date:                                                  Sun, 05 May 2024   Prob (F-statistic):           3.75e-11
Time:                                                          12:44:50   Log-Likelihood:                -255.14
No. Observations:                                                    77   AIC:                             514.3
Df Residuals:                                                        75   BIC:                             519.0
Df Model:                                                             1
Covariance Type:                                              nonrobust
====================================================================================================================================
                                                                          coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------------------------------------------------
Intercept                                                              24.4334      5.876      4.158      0.000      12.729      36.138
Q("% of Residents Within Walking Distance of Transit Stop (2021-2022)")  0.6041      0.078      7.739      0.000       0.449       0.760
==============================================================================
Omnibus:                        0.562   Durbin-Watson:                   1.253
Prob(Omnibus):                  0.755   Jarque-Bera (JB):                0.478
Skew:                           0.189   Prob(JB):                        0.787
Kurtosis:                       2.918   Cond. No.                         576.
==============================================================================
```

Figure 5: Regression results between "percentage of residents living within walking distance to a transit stop" and "adult physical inactivity rate"

```
                                        OLS Regression Results
=====================================================================================================
Dep. Variable:     Q("Adult Physical Inactivity Rate (2021-2022)")   R-squared:                       0.280
Model:                                                         OLS   Adj. R-squared:                  0.270
Method:                                              Least Squares   F-statistic:                     29.18
Date:                                             Sun, 05 May 2024   Prob (F-statistic):           7.48e-07
Time:                                                     12:44:50   Log-Likelihood:                -282.94
No. Observations:                                               77   AIC:                             569.9
Df Residuals:                                                   75   BIC:                             574.6
Df Model:                                                        1
Covariance Type:                                         nonrobust
====================================================================================================================================
                                                                          coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------------------------------------------------
Intercept                                                              73.4476      8.430      8.712      0.000      56.654      90.242
Q("% of Residents Within Walking Distance of Transit Stop (2021-2022)") -0.6050      0.112     -5.402      0.000      -0.828      -0.382
==============================================================================
Omnibus:                        1.684   Durbin-Watson:                   1.642
Prob(Omnibus):                  0.431   Jarque-Bera (JB):                1.312
Skew:                           0.104   Prob(JB):                        0.519
Kurtosis:                       2.396   Cond. No.                         576.
==============================================================================
```

Figure 6: CTA Rider Poll on Reliability (2022)



Source: Chicago Transit Authority, 2022 Q4 Customer Survey Results

Data Used in OLS Regression

GEOID	Community Area Name	Median Household Income (2018-2022)	Walking Access to Transit Stop Rate (2021-2022)	Routine Checkup Rate (2021-2022)	Prenatal Care Rate in 1st Trimester (2017-2021)	Adult Physical Inactivity Rate (2021-2022)
1	Rogers Park	$53,438	84.23	72.1	62.8	20.4
2	West Ridge	$64,316	69.21	74	64.3	26.4
3	Uptown	$63,204	87.03	65.9	75.8	20.9
4	Lincoln Square	$81,358	86.61	68.8	79.2	17.3
5	North Center	$141,151	87.5	70.4	87.5	12.1
6	Lake View	$105,166	94.08	70.3	86.2	10.2
7	Lincoln Park	$145,315	94.39	73.3	87.6	8.5
8	Near North Side	$118,408	92.83	74	81.5	7.4
9	Edison Park	$109.771	82.68	72.6	85.5	9.4
10	Norwood Park	$98,471	70.41	83.5	83.4	27.3
11	Jefferson Park	$85,019	73.14	70.7	77.9	23.6
12	Forest Glen	$130,092	83.4	84.1	83.5	13
13	North Park	$65,645	83.08	86.1	70.9	24.7
14	Albany Park	$72,881	76.49	65.8	70	24.3
15	Portage Park	$79,293	85.94	79	74.5	35.2
16	Irving Park	$81,727	86.65	78.1	76.6	31
17	Dunning	$77,316	76.07	78	74.8	25.8
18	Montclare	$67,104	65.6	78.8	73.9	31.4
19	Belmont Cragin	$57,619	71.72	73.9	69.2	26
20	Hermosa	$59,771	64.78	77.6	71.1	44.2
21	Avondale	$82,958	87	64.3	76.4	26.3
22	Logan Square	$93,904	86.57	68.7	82.4	13.4
23	Humboldt Park	$47,128	69.01	79	66.6	40.3
24	West Town	$121,913	86.03	64.2	85	12.1
25	Austin	$43,109	72.49	79.8	62.7	37.7
26	West Garfield Park	$33,214	64.63	96.1	55.9	41
27	East Garfield Park	$30,946	60.2	81.2	59	39
28	Near West Side	$97,636	85.71	75.4	79.8	24.7
29	North Lawndale	$33,608	75.13	83.7	62	41.8

GEOID	Community Area Name	Median Household Income (2018-2022)	Walking Access to Transit Stop Rate (2021-2022)	Routine Checkup Rate (2021-2022)	Prenatal Care Rate in 1st Trimester (2017-2021)	Adult Physical Inactivity Rate (2021-2022)
1	Rogers Park	$53,438	84.23	72.1	62.8	20.4
2	West Ridge	$64,316	69.21	74	64.3	26.4
30	South Lawndale	$41,571	73.18	76.3	69.4	49.5
31	Lower West Side	$66,706	73.24	68.2	74	20
32	Loop	$113,488	90.34	67.4	80.5	9
33	Near South Side	$115,353	86.92	75.8	80.9	9.9
34	Armour Square	$43,787	69.82	70.7	64.5	34.1
35	Douglas	$52,565	82.93	83	63.5	31.4
36	Oakland	$24,413	81.51	87	68.9	18.6
37	Fuller Park	$16,906	70.9	76	60.4	43.3
38	Grand Boulevard	$42,981	76.24	80.3	66.5	33.1
39	Kenwood	$53,777	89.37	85.8	70.9	28.9
40	Washington Park	$32,608	71.26	88.2	61	41.8
41	Hyde Park	$66,280	88.56	69.4	76.2	8.3
42	Woodlawn	$32,189	60.26	82	65.4	14.7
43	South Shore	$36,391	67.46	88.2	59.5	21.7
44	Chatham	$39,952	63.17	84.5	57.5	37.6
45	Avalon Park	$48,206	74.6	89	65.1	38.7
46	South Chicago	$43,316	78.43	73.4	59	37.9
47	Burnside	$42,059	70.49	84.3	59.7	41.9
48	Calumet Heights	$62,515	80.05	92.4	64.1	37.5
49	Roseland	$45,878	71.64	89.2	58.2	21.6
50	Pullman	$52,782	65.33	76.3	60.7	16
51	South Deering	$38,072	66.7	84.9	58.1	19.6
52	East Side	$59,683	56.71	72.8	64.8	47.6
53	West Pullman	$43,871	60.59	80.9	58.8	28
54	Riverdale	$19,978	76.55	82.6	54.5	49.3
55	Hegewisch	$64,476	57.37	71.3	63.4	33.7
56	Garfield Ridge	$83,088	74.78	86.5	74.5	26.1
57	Archer Heights	$55,328	60.04	67.6	66.9	44
58	Brighton Park	$47,842	73.84	74.4	67	32.7
59	McKinley Park	$63,710	77.74	70.9	69.4	25.7

GEOID	Community Area Name	Median Household Income (2018-2022)	Walking Access to Transit Stop Rate (2021-2022)	Routine Checkup Rate (2021-2022)	Prenatal Care Rate in 1st Trimester (2017-2021)	Adult Physical Inactivity Rate (2021-2022)
1	Rogers Park	$53,438	84.23	72.1	62.8	20.4
2	West Ridge	$64,316	69.21	74	64.3	26.4
60	Bridgeport	$68,505	73.24	59.5	69.4	15.6
61	New City	$40,608	59.32	82.1	65.6	31.3
62	West Elsdon	$57,940	75.22	72.5	67.4	46.7
63	Gage Park	$45,828	61.31	66	67.6	32.7
64	Clearing	$68,281	67.56	83.9	71.9	30.2
65	West Lawn	$64,542	68.57	76	66.9	31.6
66	Chicago Lawn	$40,945	66.07	89.5	66.5	47.1
67	West Englewood	$28,468	57.11	85.1	58.3	20.9
68	Englewood	$27,317	69.18	80.6	57.2	32.5
69	Greater Grand Crossing	$39,832	69.97	77.1	59.4	38
70	Ashburn	$71,941	69.92	65.1	67	33.3
71	Auburn Gresham	$40,373	61.29	81.5	58.9	36.5
72	Beverly	$119,492	74.02	85.9	83.5	17.9
73	Washington Heights	$63,117	61.2	92.4	60.7	29.9
74	Mount Greenwood	$102,171	78.91	94.6	88.5	21
75	Morgan Park	$64,961	74.64	92.1	70.9	38.8
76	O'Hare	$64,433	77.4	58.8	69.1	36.1
77	Edgewater	$65,694	89.15	69.8	74.3	21.5

Source: Chicago Health Atlas, https://chicagohealthatlas.org/indicators

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