

# Social Determinants of Autism in the U.S.: Conceptualizing a Public Health Analytics Framework to Address Health Disparities

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**Abstract-** Autism spectrum disorder (ASD) is a neurodevelopmental condition with significant disparities in diagnosis, treatment, and outcomes in the United States. These disparities are shaped by social determinants of health (SDOH), including socioeconomic status, access to healthcare, geographic location, racial and ethnic inequalities, and cultural perceptions. This paper proposes a conceptual public health analytics framework to address these inequities. The framework integrates clinical, demographic, and SDOH sources data to identify patterns and gaps in autism care, employs predictive modeling to allocate resources efficiently, and emphasizes community engagement to ensure culturally sensitive interventions. Policy alignment is also highlighted to translate data insights into actionable reforms for equitable autism care. By addressing SDOH through innovative public health analytics, this framework offers a scalable and adaptable solution to mitigate health disparities, improve early diagnosis, and foster inclusivity in autism care. The findings underscore the importance of interdisciplinary collaboration, robust data systems, and community-driven approaches to achieve equitable outcomes for individuals with autism.

**Indexed Terms-** Autism spectrum disorder (ASD), Social determinants of health (SDOH), Health disparities, Public health analytics, Predictive modelling, Equitable healthcare

## I. INTRODUCTION

Autism spectrum disorder (ASD), commonly referred to as autism, is a developmental condition characterized by challenges in social interaction, communication, and repetitive behaviors. The

spectrum nature of the disorder indicates a wide range of symptoms and abilities, making each individual's experience with autism unique (Hirota & King, 2023). In the United States, the prevalence of autism has risen significantly in recent years. According to the Centers for Disease Control and Prevention (CDC), approximately 1 in 36 children in the U.S. was diagnosed with autism as of 2023. While this rise in diagnosis can partly be attributed to increased awareness and improved screening practices, disparities in access to early diagnosis and intervention remain a critical public health concern (Chihuri, Blanchard, DiGuseppi, & Li, 2023). These disparities are heavily influenced by social determinants of health (SDOH), which are non-medical factors such as socioeconomic status, education, and access to healthcare that influence health outcomes (Shenouda et al., 2023).

The concept of social determinants of health underscores the idea that health is not solely determined by genetics or individual behavior but is also shaped by the social and environmental contexts in which people live. For autism, these determinants play a pivotal role in shaping who receives an early diagnosis, the quality of care provided, and the long-term developmental outcomes of those affected (Martin, Ghastine, Lodge, Dhingra, & Ward-Caviness, 2022). For example, families from low-income backgrounds often face systemic barriers such as limited access to specialized healthcare services, lower awareness of developmental milestones, and geographic inequities in service availability. Similarly, racial and ethnic minorities frequently encounter biases in the healthcare system, leading to delays in diagnosis and misdiagnosis. These inequities highlight the urgent need to examine autism through the lens of public health and SDOH to develop targeted

interventions that address the root causes of these disparities (Hairston, Gibbs, Wong, & Jordan, 2019). Health disparities in autism care and diagnosis have profound implications for individuals, families, and communities. Early diagnosis is a critical factor in improving outcomes for children with autism, as it allows for timely intervention during the brain's most plastic developmental stages (Hus & Segal, 2021). However, disparities in diagnosis rates across socioeconomic and racial groups mean that many children, particularly those from marginalized backgrounds, do not receive the benefits of early intervention (Lord et al., 2022). For example, research has consistently shown that Black and Hispanic children are less likely to be diagnosed with autism compared to their White peers, even when exhibiting similar symptoms. When they are diagnosed, it often occurs later in life, limiting the effectiveness of available treatments. These disparities perpetuate cycles of inequity, as children who do not receive early support are more likely to experience challenges in education, employment, and independent living later in life (Pham & Charles, 2023).

To address these disparities, it is imperative to develop innovative solutions that leverage data and analytics to inform public health strategies. Public health analytics, which involves the systematic analysis of health-related data to inform policies and interventions, offers significant potential in this regard. By integrating data on SDOH with health outcomes, public health analytics can provide a more comprehensive understanding of the factors driving disparities in autism care. This approach enables stakeholders to identify underserved populations, allocate resources more effectively, and design targeted interventions to address inequities.

This paper aims to conceptualize a public health analytics framework that can address health disparities related to autism in the U.S. This framework will integrate data on SDOH, healthcare access, and autism outcomes to identify gaps in care and propose evidence-based solutions. It will also emphasize the importance of community engagement in designing culturally sensitive and contextually relevant interventions. By focusing on the intersection of autism, social determinants, and public health analytics, the proposed framework aims to contribute

to a more equitable healthcare system where all individuals with autism, regardless of their background, have the opportunity to thrive.

In conclusion, the rising prevalence of autism in the U.S. necessitates a shift in focus from solely improving diagnostic tools and interventions to addressing the broader social determinants that influence health outcomes. By conceptualizing a public health analytics framework, this paper seeks to provide a roadmap for addressing health disparities in autism care and diagnosis. Such an approach has the potential to not only improve individual outcomes but also promote social equity and strengthen communities, aligning with the broader goals of public health.

## II. THE SOCIAL DETERMINANTS OF AUTISM: IDENTIFYING KEY FACTORS

### 2.1 Socioeconomic Status (SES)

Socioeconomic status is critical in determining access to autism-related care and resources. Families with higher incomes are more likely to afford private diagnostic evaluations, specialized therapies, and educational support services. Conversely, families from low-income backgrounds often face financial barriers that limit access to these resources. For example, Applied Behavioral Analysis (ABA), a widely recommended therapy for autism, is costly and may not be fully covered by insurance. Low-income families may also have limited transportation options, making it difficult to access autism specialists or therapy centers (Malik-Soni et al., 2022).

Moreover, parents in lower SES brackets often work multiple jobs or have irregular work schedules, leaving less time to advocate for their children in educational or healthcare settings. This lack of advocacy can delay diagnosis and intervention, leading to poorer developmental outcomes. Studies have shown that children from low-income families are more likely to receive an autism diagnosis later in life compared to their peers from higher-income households. These delays exacerbate health disparities and reduce the effectiveness of early intervention strategies, which are critical for improving outcomes in children with autism (Smith-Young, Chafe, & Audas, 2020).

## 2.2 Access to Healthcare and Education

Access to healthcare and education is another key determinant of autism-related disparities. Inadequate access to primary care providers or specialists who are trained to recognize autism symptoms can lead to delayed or missed diagnoses. For instance, pediatricians in underserved areas may lack the resources or expertise to conduct autism screenings during routine check-ups. This gap is particularly concerning, given the importance of early identification in improving long-term outcomes (Bilaver & Havlicek, 2019).

Educational access also plays a significant role in shaping outcomes for individuals with autism. Public schools in underfunded districts often lack the resources to provide specialized programs or individualized education plans (IEPs) for students with autism. Without adequate support, these students may struggle academically and socially, further widening the gap in outcomes between underserved populations and their more privileged counterparts (McCormack, Dillon, Healy, Walsh, & Lydon, 2020).

## 2.3 Geographic Disparities

Geographic location is a significant determinant of access to autism-related services. Urban areas typically have a higher concentration of specialists, diagnostic centers, and therapy providers, making it easier for families to access care. In contrast, rural communities often lack these resources, forcing families to travel long distances for diagnosis or treatment. This geographic disparity creates additional financial and logistical burdens for rural families, many of whom may already face economic challenges (Kelvin-Agwu, Adelodun, Igwama, & Anyanwu, 2024b; Majebi, Adelodun, & Anyanwu, 2024b).

The scarcity of services in rural areas also limits opportunities for early intervention, which is crucial for improving social, communication, and behavioral outcomes in children with autism. Furthermore, the limited availability of autism specialists in rural regions can result in longer wait times for evaluations, delaying access to therapies that could significantly improve developmental trajectories. Geographic disparities thus contribute to unequal access to care, with rural families experiencing worse outcomes than

their urban counterparts (Yingling, Ruther, Dubuque, & Mandell, 2021).

## 2.4 Racial and Ethnic Disparities in Diagnosis Rates

Racial and ethnic disparities are well-documented in autism diagnosis and care. Research consistently shows that Black and Hispanic children are less likely to be diagnosed with autism compared to White children. When they are diagnosed, it is often at a later age, reducing the effectiveness of early intervention. Multiple factors, including implicit bias in the healthcare system, differences in parental awareness, and language barriers influence these disparities (Donohue, Childs, Richards, & Robins, 2019).

For example, healthcare providers may misinterpret autism symptoms in children from minority backgrounds, attributing them to behavioral issues or other developmental disorders. Language barriers and a lack of culturally appropriate screening tools can also hinder effective communication between providers and non-English-speaking families. Additionally, systemic issues such as underinsurance or lack of Medicaid acceptance among autism specialists disproportionately affect minority families, further limiting access to care (Zelege, Hughes, & Drozda, 2019).

## 2.5 Cultural Perceptions and Stigma Surrounding Autism

Cultural perceptions and stigma surrounding autism significantly impact whether families seek and receive appropriate care. In some communities, developmental disorders like autism are highly stigmatized, leading parents to avoid seeking a diagnosis due to fear of social ostracization or shame. For instance, cultural norms in certain minority groups may discourage discussing mental health or developmental concerns, perpetuating delays in diagnosis (Barrio, Hsiao, Prishker, & Terry, 2019).

In addition to stigma, cultural beliefs about child development can influence how autism symptoms are perceived. For example, some parents may view delayed speech or social difficulties as part of normal child development rather than potential signs of autism. These cultural misunderstandings can prevent early recognition of autism and delay access to intervention services. Addressing these issues requires

culturally sensitive outreach and education programs that build trust and raise awareness within underserved communities (de Leeuw, Happé, & Hoekstra, 2020).

The interplay of these social determinants contributes to significant health disparities in autism care and outcomes. Families facing multiple barriers—such as low SES, limited healthcare access, and cultural stigma—are less likely to receive timely diagnoses and effective treatments. These disparities perpetuate a cycle of inequity, as children who do not receive early intervention are more likely to face long-term challenges in education, employment, and independent living. Moreover, the cumulative impact of these factors extends beyond individual families to affect entire communities. For example, underfunded schools and healthcare systems in low-income or rural areas cannot often address the needs of children with autism, creating systemic gaps in care (Papoudi, Jørgensen, Guldborg, & Meadan, 2021). These gaps highlight the need for comprehensive public health strategies that address the root causes of disparities and promote equity in autism diagnosis and treatment.

### III. PUBLIC HEALTH ANALYTICS: A TOOL TO ADDRESS DISPARITIES

#### 3.1 The Role of Public Health Analytics in Addressing Disparities

Public health analytics bridges raw data and actionable insights, enabling policymakers and healthcare providers to make informed decisions. For autism, disparities in diagnosis and treatment often stem from systemic issues such as unequal access to resources, geographic disparities, and cultural biases. Public health analytics helps uncover these underlying factors by analyzing large datasets to reveal disparities across different demographic groups (Paul, Saha, Hasan, Noori, & Moustafa, 2024). For example, analytics can identify variations in autism diagnosis rates by race, ethnicity, income level, or geographic location, highlighting areas where resources are scarce or interventions are insufficient. By uncovering these disparities, public health officials can allocate funding more effectively, prioritize underserved populations, and design interventions tailored to specific community needs. Moreover, public health analytics facilitates longitudinal studies that track changes in autism prevalence, access to care, and treatment

outcomes over time, ensuring that strategies remain responsive to evolving challenges (Green, Leadbitter, Ainsworth, & Bucci, 2022).

In addition to identifying disparities, public health analytics supports evaluating existing programs and policies. By analyzing data on program performance, decision-makers can determine which interventions are most effective in reducing inequities and replicate successful models in other regions. This iterative process ensures that public health initiatives remain evidence-based, efficient, and impactful (Adelodun & Anyanwu, 2024; Kelvin-Agwu, Adelodun, Igwama, & Anyanwu, 2024a).

#### 3.2 Key Data Sources for Analyzing Autism-Related Disparities

The effectiveness of public health analytics in addressing autism-related disparities depends on access to diverse and reliable data sources. These sources provide the foundation for identifying diagnosis and treatment patterns, gaps, and trends. Key data sources include:

- **Healthcare Records:** Electronic health records (EHRs) from hospitals, clinics, and pediatric practices offer detailed information on autism diagnoses, comorbidities, and treatments. These records can be analyzed to identify disparities in diagnosis rates and treatment access across different demographic groups.
- **Community Health Surveys:** National and local health surveys, such as the National Survey of Children's Health (NSCH), provide valuable data on autism prevalence, parental awareness, and access to services. These surveys often include questions on SDOH, enabling researchers to examine the relationship between social factors and autism outcomes (Zhan et al., 2023).
- **Insurance Claims Data:** Claims data from Medicaid and private insurers provide insights into the utilization of autism-related services, including therapy, diagnostic evaluations, and behavioral interventions. These datasets can reveal disparities in service access and affordability.
- **Educational Records:** Data from schools and special education programs shed light on how children with autism are supported in educational settings. This information is critical for

understanding disparities in access to individualized education plans (IEPs) and other resources (Rakap, 2024).

- **Geospatial Data:** Geographic information systems (GIS) integrate spatial data with health outcomes, enabling the identification of geographic disparities in autism diagnosis and treatment. GIS can pinpoint regions with limited access to specialists or therapy providers, guiding resource allocation efforts (Drahota, Sadler, Hippensteel, Ingersoll, & Bishop, 2020).

By leveraging these diverse data sources, public health analytics creates a multidimensional view of autism-related disparities, providing the evidence needed to design targeted interventions.

### 3.3 Applying Analytics to Identify Patterns, Gaps, and Trends

Public health analytics involves using statistical and computational methods to analyze data, uncover patterns, and generate actionable insights. For autism, this process can be applied to identify disparities in diagnosis rates, treatment access, and outcomes across different populations. For instance, analytics can reveal whether certain demographic groups, such as low-income families or racial minorities, are less likely to receive an autism diagnosis. These patterns can guide the development of targeted outreach campaigns to raise awareness and improve access to diagnostic services in underserved communities. Similarly, analytics can identify gaps in service availability, such as regions with a shortage of autism specialists or therapy providers. Addressing these gaps through policy changes or resource reallocation can improve access to care for marginalized populations (Keikhosrokiani, 2022).

Public health analytics also enables trend analysis, essential for tracking progress and reducing disparities over time. For example, analyzing trends in autism diagnosis rates can reveal whether recent policy initiatives, such as expanded Medicaid coverage for autism services, have successfully reduced inequities. This continuous monitoring ensures that public health strategies remain effective and responsive to changing needs (Joudar et al., 2023).

### 3.4 Integrating SDOH Data into Public Health Analytics

To fully address autism-related disparities, it is essential to integrate data on SDOH into public health analytics. SDOH, such as income, education, housing, and transportation, significantly influence health outcomes and access to care. By incorporating SDOH data into analytics frameworks, researchers can uncover the root causes of disparities and design interventions that address these systemic barriers. For example, linking autism diagnosis data with socioeconomic indicators can reveal whether families in low-income neighborhoods face greater challenges in accessing care. Similarly, integrating geospatial data with SDOH metrics can identify regions where transportation barriers limit access to autism specialists. These insights enable policymakers to design interventions beyond healthcare delivery, addressing the broader social and economic factors contributing to inequities (Ahmed, Mohamed, Zeeshan, & Dong, 2020).

The integration of SDOH data also supports predictive analytics, which can identify populations at high risk of delayed autism diagnosis or inadequate treatment. For instance, predictive models can combine income, education, and healthcare access data to estimate which communities are most likely to experience disparities. These predictions can guide proactive interventions, such as mobile diagnostic units or community-based therapy programs, to reach underserved populations before disparities worsen (Wallisch et al., 2023).

A comprehensive public health analytics approach incorporating SDOH data is essential for reducing autism-related disparities. By addressing both the immediate barriers to care and the broader systemic factors that perpetuate inequities, public health analytics provides a pathway to more equitable outcomes. However, achieving this goal requires collaboration across sectors, including healthcare, education, and social services, to ensure that data is shared and interventions are coordinated (Ramgopal et al., 2023).

#### IV. CONCEPTUALIZING A PUBLIC HEALTH ANALYTICS FRAMEWORK FOR AUTISM

##### 4.1 Data Integration

The cornerstone of this framework is the integration of diverse data sources to provide a comprehensive understanding of autism-related disparities. Currently, autism-related data often exists in silos—clinical data is maintained separately from demographic and social determinants of health (SDOH) data, which limits the ability to analyze disparities holistically.

The proposed framework emphasizes the integration of clinical data (e.g., electronic health records, diagnostic evaluations, therapy outcomes) with demographic data (e.g., age, race, ethnicity, geographic location) and SDOH data (e.g., income levels, education, access to healthcare). Combining these datasets enables a multidimensional analysis that captures not only the prevalence of autism but also the systemic barriers individuals face in accessing care (Stadnick et al., 2019). For example, integrated data can reveal whether children from low-income families or rural areas are disproportionately underdiagnosed due to limited access to specialists. Similarly, it can uncover patterns such as delays in diagnosis for minority groups, enabling targeted interventions. Data integration also supports interoperability between healthcare providers, schools, and community organizations, ensuring that individuals with autism receive coordinated and comprehensive care (Stadnick et al., 2022).

##### 4.2 Predictive Modeling

The framework's second component involves applying advanced analytics, such as artificial intelligence and machine learning, to predict areas with high unmet needs. Predictive modeling enables public health officials to anticipate disparities before they manifest, allowing for proactive interventions. AI algorithms can analyze large datasets to identify patterns and trends in autism diagnosis and treatment. For example, predictive models can assess the likelihood of delayed diagnosis in specific communities based on socioeconomic status, geographic isolation, or provider shortages. By highlighting these at-risk populations, policymakers can allocate resources more effectively, such as establishing diagnostic clinics in underserved areas or offering telehealth services to

overcome geographic barriers (Uddin, Wang, & Woodbury-Smith, 2019).

In addition to identifying disparities, predictive modeling can forecast the long-term impacts of interventions. For instance, it can estimate how expanding Medicaid coverage for autism services might reduce disparities in access to therapy or improve outcomes for low-income families. These insights enable data-driven decision-making that maximizes the impact of public health initiatives (Joudar et al., 2023).

##### 4.3 Community Engagement

While data analytics provides valuable insights, community engagement is essential for ensuring that these insights are accurate, relevant, and actionable. The framework prioritizes partnerships with communities, particularly those most affected by autism-related disparities, to validate and contextualize data findings.

Community engagement involves collaborating with local organizations, advocacy groups, parents, and autistic individuals to understand their experiences and needs. These stakeholders can provide qualitative data that complements quantitative analyses, offering a richer and more nuanced understanding of disparities. For example, a community might highlight cultural stigma as a barrier to seeking an autism diagnosis—an issue that might not be apparent in the data alone.

Involving communities in the decision-making process also ensures that interventions are culturally sensitive and tailored to the specific needs of each population. For instance, outreach campaigns in minority communities can incorporate culturally relevant messaging to reduce stigma and promote early diagnosis. Community engagement fosters trust and buy-in, increasing the likelihood that interventions will be accepted and successful (Joudar, Albahri, & Hamid, 2022).

##### 4.4 Policy Alignment

The final component of the framework focuses on translating data insights into actionable policies. Addressing autism-related disparities requires alignment between public health analytics and

polymaking to ensure that findings inform equitable solutions. For example, data on geographic disparities in autism care can support policies that incentivize providers to work in underserved areas, such as offering loan forgiveness for specialists who practice in rural regions. Similarly, insights into racial and ethnic disparities can guide policies that mandate cultural competency training for healthcare providers, improving their ability to serve diverse populations. Policy alignment also ensures that interventions are adequately funded and sustained over the long term. Public health analytics can provide evidence of the cost-effectiveness of interventions, such as expanding access to early intervention programs, to justify increased funding. Furthermore, the framework emphasizes the importance of advocacy to ensure that autism care remains a national priority, particularly for marginalized communities (Majebi, Adelodun, & Anyanwu, 2024a; Soyombo, Kupa, Ijomah, & Stephen, 2024).

A key strength of this framework is its scalability and adaptability to other public health challenges. While it is designed to address autism-related disparities, data integration, predictive modeling, community engagement, and policy alignment principles can be applied to various conditions, from diabetes to mental health. For example, integrating SDOH data with clinical records can help address disparities in cardiovascular disease outcomes, while predictive modeling can identify communities at high risk for opioid addiction. Similarly, community engagement ensures that interventions are tailored to the unique needs of each population, regardless of the health issue.

The adaptability of the framework is particularly important in an era of rapid technological advancement and changing public health priorities. By incorporating emerging technologies such as AI and big data analytics, the framework remains flexible and responsive to new challenges.

## CONCLUSION

Autism spectrum disorder is a complex neurodevelopmental condition that requires equitable and accessible care to ensure that individuals across all demographics receive the support they need.

Disparities in autism diagnosis and treatment, often shaped by social determinants of health (SDOH), represent a significant public health challenge in the United States. This paper has explored the multifaceted impacts of SDOH—including socioeconomic status, geographic location, racial and ethnic disparities, and cultural perceptions—on autism care. Additionally, it introduced a conceptual public health analytics framework that integrates data, predictive modeling, community engagement, and policy alignment to address these inequities. Such a framework holds the potential to advance autism care by reducing health disparities and ensuring that underserved populations have access to timely and effective interventions.

The analysis highlighted how systemic inequities within SDOH exacerbate disparities in autism care. Individuals from low-income families, racial and ethnic minority groups, and rural communities face significant challenges in accessing diagnostic and therapeutic services. These barriers often result in delayed diagnoses, which limit the effectiveness of early intervention—a critical factor in improving developmental outcomes for individuals with autism. Compounding these challenges are cultural stigmas and a lack of provider awareness in underserved communities, which further marginalize vulnerable populations. Addressing these issues requires a comprehensive, data-driven approach that considers affected communities' diverse needs and emphasizes accessibility and inclusivity.

The proposed public health analytics framework offers an innovative solution to these challenges by integrating advanced data analytics with actionable policy and community-driven strategies. By combining clinical, demographic, and SDOH data, this framework provides a holistic view of disparities in autism care. Predictive modeling, powered by artificial intelligence and machine learning, can identify high-risk populations and predict areas with unmet needs, enabling targeted resource allocation. Moreover, including community engagement ensures that interventions are culturally sensitive and reflect lived experiences, fostering trust and collaboration among stakeholders. Finally, aligning the insights derived from analytics with policy reforms creates a

pathway for systemic change, addressing the root causes of inequities in autism care.

The framework's potential extends beyond autism care, as its scalable and adaptable nature makes it applicable to other public health challenges. However, its success depends on the availability of resources, sustained funding, and strong interdisciplinary collaboration. Adequate investments in public health data infrastructure are essential to support clinical and SDOH data integration. Policymakers must also prioritize reforms that incentivize equitable healthcare delivery, expand autism services to underserved areas, and incorporate cultural competency into provider training. Community-driven initiatives, such as awareness campaigns and grassroots engagement, are equally important to combat stigma and promote early diagnosis, especially in marginalized populations.

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