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Original Research

The Social Determinants of Health and Athletic Trainer Availability in Indiana Secondary Schools

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Context: The social determinants of health (SDOH) are circumstances under which individuals are born, work, and live that influence health outcomes. Previous researchers have examined 1 determinant of economic stability and found disparities in socioeconomic status and athletic trainer (AT) availability.

Objective: To examine the SDOH characteristics of Indiana secondary schools and AT availability.

Design: Cross-sectional study.

Setting: Database secondary analysis.

Patients or Other Participants: A total of 426 secondary schools.

Main Outcome Measure(s): All data were collected from publicly available databases. The independent variable was AT availability, and schools were classified as having a full-time AT, a part-time AT only, or no AT. The SDOH variables were gathered for each school (at the school and county levels). Data were summarized using measures of central tendencies, 1-way analysis of variance, and Kruskal-Wallis tests.

Results: School enrollment was larger in schools with greater AT availability ($P < .001$). The proportion of non-White students was greater in schools with more AT availability ($P = .002$). Greater AT availability was present in counties with higher graduation rates ($P = .03$). Post hoc comparisons revealed differences in graduation rates between schools with a part-time AT and those with no AT ($P = .04$). Schools with less AT availability were located in counties with a slightly higher percentage of the population uninsured ($P = .02$). Schools with greater AT availability were located in counties with a higher ratio of population to primary care physicians ($P = .03$). Schools with less AT availability were located in counties with a higher population experiencing severe housing problems ($P = .02$). No differences were found in AT availability based on the 3 social and community context variables ($P > .05$).

Conclusions: Differences were noted in AT availability and SDOH characteristics at the secondary school level. We observed less AT availability where high school graduation rates and the population of primary care providers were lower. Strategies should be implemented to improve access to athletic health care in underresourced communities.

Key Words: health care access, athletic health care, health determinants

Key Points

- Greater athletic trainer availability occurred in communities with higher graduation rates and higher socioeconomic status.
- Future researchers should explore strategies to help athletic trainers leverage their role as health care providers in areas with less primary care provider access and smaller insured populations.
- Athletic trainers should explore and educate themselves on the social determinants of health factors of the populations and patients for whom they provide care.

The health of patients is largely determined by the places and circumstances in which individuals are born, work, grow, and live, which are collectively referred to as the *social determinants of health* (SDOH). The SDOH are largely influenced by policy, economics, and social interactions within communities.[1] The role of SDOH in health care and patient outcomes has been illuminated by the recent rise in attention to health disparities of patients from minoritized populations, as well as how the SDOH influence health outcomes.[1–3] Yet the efforts to address these disparities are largely reactive and on an individual patient basis; indeed, providers aim to address the resulting symptoms in patient care rather than the fundamental cause.[2] If athletic trainers (ATs) better understand how SDOH influence the patients with whom they interact, ATs can improve the care they provide through whole-person health care. To consider the larger effect of the SDOH on population health, ATs must understand how the SDOH of their patient populations influence health care.

The SDOH consist of 5 major domains: (1) education access and quality, (2) health care access and quality, (3) neighborhood and built environment, (4) social or community context, and (5) economic stability. Each category contains targeted considerations and examples that demonstrate how each determinant can positively or negatively affect the health of patients. Examples of SDOH include high-quality educational systems, literacy, access to nutritious food, and clean air or water (Figure).[4] The recognition

Education Access and Quality	Health Care and Quality	Neighborhood and Built Environment	Social and Community Context	Economic Stability
School enrollment	Uninsured percentage	Severe housing problems	Residential segregation index	County median household income
School demographics (% White, % non-White)	Primary care physician ratio	Severe housing cost	Single-parent household	Percentage of students eligible for free or reduced lunch
High school graduation rate		Rural percentage		Child poverty percentage
		Violent crime rate		

Figure. Social determinants of health and relevant study variables (adapted from the Centers for Disease Control and Prevention: https://www.cdc.gov/about/sdoh/index.html).

and consideration of SDOH in health care decisions provide a more effective route for addressing population health challenges.[3,5] However, the SDOH and health outcomes of communities are caused by the intersection of complex political and economic structures. Therefore, ATs should become more familiar with the SDOH to continue to integrate patient-centered care into their practice.

Although few researchers have examined the intersection of the SDOH and athletic training, more recently, investigators have illuminated the importance of SDOH within athletic health care.[6] With increasing attention paid to incorporating whole-person health care in athletic training, ATs need to better recognize and appreciate how the SDOH may influence the health of their patients.[6] Some authors have focused on effective instructional strategies for learners in professional education programs[6]; however, strategies for teaching practicing clinicians have not been explored as thoroughly.[7] Similar to many educational concepts in athletic training, the profession has identified ways of addressing the knowledge gap for the SDOH in professional-level learners but not those in need of continuing professional development. Regardless, the knowledge gap is problematic, and ATs should consider how the SDOH affect patient health in their communities, particularly that of adolescent patients.

Adolescents are influenced differently by SDOH. Researchers[8] have suggested that the SDOH of developing adolescents can influence future health behaviors that will eventually transfer to their families. With more than 8 million US high school students participating in sports,[9] we should consider how different SDOH may affect the health outcomes of these patients. Previous investigators[10–13] have shown that the presence of an AT was positively associated with health outcomes, including fewer cardiac-related deaths, fewer emergency room visits, and better concussion management. If ATs can incorporate a more comprehensive approach to patient care, including how the SDOH influence their patient-centered care, that care will be more effective. Nonetheless, most earlier authors focused on 2 SDOH, namely, the domains of economic stability and health care access and quality. They studied differences in AT availability at the secondary school level based on economic measures, such as median household income or the percentage of students on free or reduced-cost lunch programs, and found that schools with higher economic status had more access to ATs.[13–15] Although the SDOH are the product of many factors, including public policy, economic structures, and geographic location, a greater understanding of the relationship between different SDOH and AT availability can provide avenues for addressing disparities in care at the local level. Thus, the purpose of our exploratory study was to compare school- and county-level SDOH characteristics of Indiana secondary schools and AT availability. We hypothesized that across all 5 SDOH domains, secondary schools with greater AT availability would be located in areas with higher economic status and associated with more positive health outcomes.

METHODS

Participants

We accessed the data for this study through several publicly available databases: (1) the Athletic Training Locations and Services (ATLAS) Project, (2) the Indiana Department of Education (IDOE), and (3) the County Health Rankings and Roadmaps project. The ATLAS project is a publicly available database that lists whether a high school uses athletic training services for all US high schools with school-sanctioned interscholastic athletic programs in the United States.[16] The County Health

Table 1. County Health Ranking Measures and Data Sources

Variable	Definition	Source
High school graduation rate	Percentage of ninth-grade cohort that graduates in 4 years	Indiana Department of Education
Uninsured	Percentage of population under age 65 without health insurance	US Census Bureau, Small Area Health Insurance Estimates
Primary care physician ratio	Ratio of population to primary care physicians	Area Health Resource File/American Medical Association
County median household income	The income at which half of households in a county earn more and half of households earn less	US Census Bureau, Small Area Income and Poverty Estimates
Children in poverty	Percentage of people under age 18 in poverty	US Census Bureau, Small Area Income and Poverty Estimates
Severe housing problems	Percentage of households with at least 1 of 4 housing problems: overcrowding, high housing costs, lack of kitchen facilities, or lack of plumbing facilities	US Department of Housing and Urban Development
Severe housing cost burden	Percentage of households that spend 50% or more of their household income on housing	American Community Survey
Rural	Percentage of the population living in a rural area	US Census Bureau, Population Estimates Program
Violent crime	Number of reported violent crime offenses per 100 000 population	Federal Bureau of Investigation, Uniform Crime Reporting Program
Residential segregation	Index of dissimilarity at which higher values indicate greater residential segregation between non-White and White county residents	American Community Survey
Children in single-parent households	Percentage of children who live in a household headed by a single parent	American Community Survey

Rankings and Roadmaps project is a program of the University of Wisconsin Population Health Institute[17] that collects county-level health data from a variety of national surveillance systems managed by the US government.

We included public and private high schools in Indiana that had AT availability data reported in the ATLAS Project database; of the possible 438 schools in the ATLAS database, 426 high schools had responded and were eligible for analysis. Institutional review board approval for this study was not required, as all data were publicly available at the school or county level.

Instruments

We determined AT availability for each Indiana school by using the ATLAS project database. We classified each school as having a full-time AT, a part-time AT only, or no AT. By using the ATLAS project database, our analysis remained consistent with previous definitions of *full-time ATs* at schools that received AT services for $\geq$30 hours per week, $\geq$5 days per week, and $\geq$10 months per year. *Part-time AT* was defined as any service less than full time.

For this study, we examined differences in AT availability through the lens of the SDOH framework. Relevant variables of interest were determined for each of the 5 SDOH domains: (1) education access and quality, (2) health care access and quality, (3) neighborhood and built environment, (4) social and community context, and (5) economic stability. The SDOH variables of interest in this study for each domain are provided in the Figure. These SDOH variables were gathered for each school at either the school level or the county level.

We gathered school-level variables from the IDOE. These variables were the total student enrollment at the school, the school's race or ethnicity demographics, and the percentage of students eligible for free or reduced-cost lunch at the school (%Free). School race or ethnicity demographics were used to determine the proportion of White and non-White students at each school. A larger proportion of %Free indicated lower school socioeconomic status (SES), whereas a smaller proportion of %Free indicated higher school SES. School race or ethnicity demographics and % Free were not publicly available through the IDOE for private schools, so private schools were excluded from all analyses involving these 2 variables. We gathered county-level variables from the County Health Rankings and Roadmaps project. The definitions and data sources for all variables gathered from the County Health Rankings and Roadmaps project are shown in Table 1. Although SDOH characteristics are the result of the complex intersections among policy and economic systems at multiple levels (local, state, and federal), the County Health Rankings and Roadmaps project supplies the most localized SDOH characteristics that are available to compare across communities within the state.

Statistical Analysis

Data were summarized using means and SDs, medians and interquartile ranges (IQRs), and frequencies and percentages (%). Assumptions of normality were determined via visual inspection of histograms and the calculation of skewness or kurtosis values for all variables in both the overall sample and separately based on school AT availability (full-time AT, part-time AT only, or no AT).

We used 1-way analyses of variance to identify differences in normally distributed SDOH variables based on school AT availability and Tukey honestly significant difference post hoc testing to examine pairwise differences. Kruskal-Wallis 1-way analyses of variance by ranks were calculated to characterize differences in non-normally distributed SDOH variables based on school AT availability.

Table 2. School Characteristics

Characteristic	Value
Total schools, N (%)	426 (100)
School type, No. (%)	
Public	352 (82.6)
Private	74 (17.4)
Student enrollment, median [IQR]	568 [368–1049]
Students eligible for free or reduced-cost lunch (%), mean ± SD	43.4 ± 16.4
Student race or ethnicity (%), median [IQR]	
Non-White	11.4 [6.5–28.0]
White	88.6 [72.0–93.6]
Athletic trainer employment, No. (%)	
Full time	233 (54.7)
Part-time only	125 (29.3)
None	68 (16.0)

Abbreviation: IQR, interquartile range.

Statistical significance was set at 2 sided a priori at $P < .05$. All analyses were performed using R statistical software (version 4.03; The R Foundation).

RESULTS

A descriptive summary of schools is provided in Table 2. A total of 426 schools were included in this study (public = 352, 82.6%; private = 74, 17.4%). Most schools (358, 84.0%) reported having AT availability, with either at least 1 full-time AT (233, 54.7%) or a part-time AT (125, 29.3%). No AT was available at 68 schools (16%).

Education Access and Quality

Schools with greater AT availability had larger student enrollments (full-time AT = 747 [489–1390]; part-time AT = 500 [357–735]; no AT = 274 [183–440]; $P < .001$). The proportion of non-White students was greater in schools with more AT availability (full-time AT = 14.2% [7.5%–31.2%]; part-time AT = 8.5% [5.7%–18.2%]; no AT = 7.7% [4.9%–44.6%]; $P = .002$). Greater AT availability was present in counties with higher high school graduation rates (full-time AT = 87.4% ± 6.6%, part-time AT = 89.7% ± 5.5%, no AT = 88.4% ± 6.4%; $P = .03$). Post hoc comparisons revealed a difference in graduation rates between schools with part-time ATs and those with no AT ($P = .04$) but not between any other group pairs.

Health Care and Quality

Schools with less AT availability tended to be located in counties with a slightly higher percentage of the population uninsured (full-time AT = 10% [8%–11%]; part-time AT = 9% [8%–10%]; no AT = 10% [9%–12%]; $P = .02$). Schools with more AT availability were located in counties with a higher ratio of population to primary care physicians (full-time AT = 1861 [1272–2560]; part-time AT = 1956 [1539–2550]; no AT = 1539 [1239–2125]; $P = .03$).

Neighborhood and Built Environment

Schools with less AT availability were located in counties with a greater percentage of the population experiencing severe housing problems (full-time AT = 12.5% ± 3.1%, part-time AT = 12.3% ± 2.6%, no AT = 13.5% ± 3.1%; $P = .02$). Post hoc comparisons revealed a difference in the percentage of the population experiencing severe housing problems between schools with a part-time AT and no AT ($P = .02$) and between those with a full-time AT and no AT ($P = .04$) but not between those with a full-time AT and part-time AT ($P = .73$). Although the difference was not significant, schools with less AT availability were located in counties with a larger proportion of the population experiencing a severe housing cost burden (full-time AT = 10.6% ± 3.1%, part-time AT = 10.4% ± 2.5%, no AT = 11.4% ± 3.3%; $P = .06$). No difference was found in AT availability based on the proportion of the county population living in a rural area (full-time AT = 34.9% ± 28.3%, part-time AT = 38.4% ± 25.0%, no AT = 34.7% ± 23.0%; $P = .50$).

Social and Community Context

We demonstrated no differences in AT availability based on the 3 social and community context variables examined ($P > .05$). A nonsignificant tendency was seen such that schools with less AT availability were located in counties with higher violent crime rates per 100 000 residents (full-time AT = 278 [108–395]; part-time AT = 223 [114–395]; no AT = 457 [189–426]; $P = .07$). No differences were apparent in the residential segregation index based on AT availability (full-time AT = 42.4 ± 10.4, part-time AT = 39.4 ± 11.5, no AT = 42.4 ± 10.4; $P = .11$). Also, we found no differences in the percentage of single-parent households in a county based on AT availability (full-time AT = 32.7% ± 8.3%, part-time AT = 33.9% ± 7.2%, no AT = 34.8% ± 8.6%; $P = .13$).

Economic Stability

We saw differences in county median household income based on AT availability. Schools with more AT availability were located in counties with greater median household incomes (full-time AT = $54 718 [$50 500–$60 596]; part-time AT = $54 674 [$48 606–$57 367]; no AT = $52 301 [$48 409–$55 518]; $P = .001$). Similarly, schools with no AT availability had a larger proportion of students eligible for %Free (54.0% ± 25.0%) than schools with a full-time AT (41.4% ± 15.1%, $P < .001$) or part-time AT (44.1% ± 14.0%, $P = .005$). No post hoc differences were evident in the proportion of students eligible for %Free between schools with a full-time AT and those with a part-time AT ($P = .33$). Finally, AT availability was greater in counties with a smaller percentage of children living in poverty (full-time AT = 17.2% ± 6.1%, part-time AT = 18.8% ± 5.6%, no AT = 19.2% ± 5.9%; $P = .007$). Post hoc comparisons revealed a difference in the child poverty percentage between schools with a full-time AT versus no AT ($P = .04$) and between schools with a full-time AT versus a part-time AT ($P = .03$) but not between those with a part-time AT versus no AT ($P = .93$).

DISCUSSION

We sought to compare school- and county-level SDOH characteristics and AT availability in Indiana secondary schools. Although previous investigators have looked at county or school SES and race or ethnicity demographics, here we aimed to expand on all domains of the SDOH and AT availability.

Education

The availability of ATs differed based on school enrollment, student demographics, and high school graduation rates. Similar to previous researchers who examined AT availability and school enrollment, we observed greater AT availability at schools with higher enrollments.[18] We also noted that schools with greater populations of non-White students had greater AT availability. Although findings in the broader medical literature suggest that ethnic and racial minority populations have decreased access to health care, our finding is in agreement with another study in which the authors studied AT availability and indicated that schools with greater populations of non-White students may have greater AT availability.[14] When one considers the geographic location of schools in densely populated areas such as urban locations, these populations may also be more diverse, resulting in this consistent result across studies. We used school-level data for student enrollment and race and ethnicity data to allow the most local assessment of AT availability and these school characteristics. By using school-level data rather than community- or state-based data, we can better understand any relationship and thereby improve patient care delivery. The differences in these findings on AT access and race or ethnicity may be explained by the school designation (urban, rural, or suburban); schools with diverse communities in urban settings have increased sport participation.

To our knowledge, this is the first evaluation of AT availability and additional county educational metrics of high school graduation rate and some college completion. Previous researchers[19] have shown that low educational attainment was linked to future negative health outcomes, including increased rates of depression, chronic illness, and obesity. In addition, less education was linked with poor health behaviors, such as smoking and not meeting physical activity guidelines, among young adults.[19] The link between high school graduation and health literacy has been demonstrated: populations in areas that had higher rates of high school graduation demonstrated greater health literacy.[20] Additionally, *concentrated disadvantage*, or neighborhoods with a higher percentage of residents of lower SES, has been linked to graduation and violent crime rates.[21,22] Students who are exposed to concentrated disadvantage over longer periods of time were less likely to graduate high school.[21] We found that in counties with higher high school graduation rates, schools had more AT availability, with differences between schools with a part-time AT and no AT. Given the association between less educational attainment and poor long-term health outcomes, coupled with the differences in AT access based on high school graduation rates, the disparities in the SDOH of the communities with low graduation rates may be exacerbated. Those ATs working in communities with lower graduation rates should implement strategies to improve the health literacy of their patients and promote positive health behaviors.

Health Care

The most noteworthy finding in the health care SDOH domain was a difference in AT availability and access to health care; specifically, schools with greater AT availability were located in areas with higher ratios of population to primary care providers. Secondary school ATs can improve access to health care for these communities with limited primary care providers by serving as community health care providers. The link between health literacy and patient engagement in health care has been shown in previous literature,[23] in which those with lower health literacy engaged in fewer health-promoting behaviors. Additional researchers have determined that individuals with less health literacy self-reported delaying care and more difficulty in finding a health care provider.[24] Finally, when we consider the intersection of education and health care, other potential avenues exist for students to receive health care in schools, including from nurses and mental health counselors. In the state of Indiana, school corporations are required to provide at least 1 registered nurse for every 750 students.[25] Yet ATs are uniquely positioned to serve as a greater access point to the health care system, particularly in communities with less access to health care, while working with the health care already in place in these schools.

Notably, despite AT availability being higher in areas with fewer primary care physicians, AT availability was lower in areas with less educational attainment, demonstrating that the AT can have an important role in these communities. Although ATs interact with patients on the individual level, implementing targeted efforts to improve access to health care and improve the health literacy of patients can positively influence health outcomes. Specific actions to increase AT availability in these underresourced communities can aid in increasing access to health care and improving health literacy, which may improve overall health outcomes for secondary school patients. Furthermore, the data from this study, as well as those from other researchers who investigated local- and community-based SDOH, should be presented beyond athletic training to advocate for health care access from the perspective that ATs can help create greater access to the larger health care system. In particular, these findings should be shared with school boards and legislators at both the local and national levels to drive more systemic change and increase funding for AT positions, which in turn will provide greater access to care.

Neighborhood and Built Environment

We found less AT availability in counties with more severe housing problems. Additionally, we saw a trend toward less AT availability in counties experiencing a higher cost burden for housing. These SDOH factors related to housing and neighborhood environments can be linked to economic stability, in which communities with higher SES standing are able to afford more stable and reliable housing.[26] However, in a previous investigation[26] of housing instability, SES, and health care access, worsening housing instability and lower SES were associated with less health care access. Even though our outcomes reflect preliminary data, they align with earlier work that revealed a link between factors related to housing and access to health care.[26] Moreover, given that previous authors[13–15] identified less AT availability in lower SES communities, our data complement earlier findings and add housing variables related to SES. The consistency in these results may represent greater health care access because of the economic gradient between wealthier and underresourced areas.

Social and Community

We observed no differences between the social and community SDOH factors and AT availability. However, ATs should take individual action to understand the roles of these social and community SDOH and health outcomes for their patients. Previous investigators[27–30] indicated that higher community violence rates can negatively influence child mental health and academic achievement. Additionally, higher rates of chronic illness and negative health outcomes have been seen in children with single-parent family structures.[31,32] Furthermore, in the broader context of a community, those who are exposed to concentrated disadvantage have higher rates of crime.[22] The accumulation of these influences and toxic stress can have long-term negative physical and mental health consequences for children.

Athletic trainers should take more time to understand the social and community factors of each of their patients and develop strategies to modify the care they are providing in light of these potential negative health outcomes. Such strategies can include incorporating a disablement model framework into their care to know how a patient's condition influences the social and environmental contexts. Also, appropriate mental health professionals should expand their collaboration and integration. Increasing awareness of the role of SDOH and consideration of a whole-person approach to care can aid ATs in providing holistic, individualized care for each patient.

Economic Stability

Perhaps the most widely examined SDOH factor in athletic training is economic stability, and most of the research regarding AT availability focused on measures of SES. Our findings align with those of earlier investigators[13–15] who examined access to athletic training services through different measures of economic stability. We determined that counties with higher county median household incomes had greater AT availability. In our previous work,[14] we evaluated 5 states with low, middle, and high poverty rates and found that schools in lower SES counties had less access to AT services. Similarly, we demonstrated that schools with more students eligible for %Free had less access to ATs, which was consistent with a report[13] that schools with greater AT access had fewer students eligible for %Free.

However, we also explored child poverty by county, which includes the percentage of children under the age of 18 years living in poverty. Earlier authors have established consequences of child poverty on health outcomes, including chronic illness, poor health literacy, avoidance of care, and malnourishment.[33,34] Previous researchers[33,34] found that families living in poverty were less likely to access the health care system, limiting the care that their children may need. Here, we saw that counties with higher child poverty rates had less AT availability. As stated earlier, ATs can be an avenue to increase access to the broader health care system, especially for those underresourced populations in the secondary school setting. Although the fight against poverty is multifaceted and complex, requiring actions from the individual level to public policy, ATs can take small steps to help in their local practice, such as screening for socioeconomic risk factors or serving as advocates to connect patients with community-based health resources. Finally, the SDOH are largely influenced by complex policy and economic structures, yet ATs should continue to participate in discussions on public health policy that will directly influence the health outcomes of adolescent patients.

Limitations and Future Directions

We note several important limitations of our study. First, we examined access to AT services at the secondary school setting in just 1 state (Indiana). Therefore, our results may not be generalizable to other states that differ from Indiana in demographics, SES, or health characteristics. We chose to focus on a single state due to the novelty of incorporating county-level SDOH characteristics from the County Health Rankings and Roadmaps project. Future researchers should assess whether the county-level SDOH characteristics we identified also vary based on AT access in a national sample of secondary schools. Second, we analyzed race and ethnicity as White or non-White because of the demographics of the state being examined. Although these categories were chosen intentionally for this analysis, future authors should evaluate a more diverse state and pursue race or ethnicity further. Third, although we evaluated AT availability and different SES factors, we found that schools with higher student enrollment had greater AT availability, which may reflect the economic gradient for more urban and wealthy areas. Future investigators should characterize the effect of AT availability on long-term health outcomes.

Additionally, we chose to focus on county-level SDOH characteristics due to the public availability of those data, but multiple secondary schools are located within a county and secondary schools may vary widely in their SDOH characteristics based on the local community. Moreover, although county-level data can capture a community group, the schools and communities in these counties can vary widely in school enrollment (eg, urban, suburban, and rural). Therefore, future researchers should try to identify relevant SDOH data that are publicly available at the school level to better determine the associations between SDOH and AT access at the secondary school level.

CONCLUSIONS

Differences in access to AT availability at the secondary school level were based on a variety of community SDOH characteristics. Efforts should be made to improve the AT availability in areas where high school graduation rates and the population of primary care providers are lower to improve access to quality health care. Also, individual ATs should take steps to understand how the SDOH influence their patients and work to intervene where low health literacy may be present. Finally, a critical need exists to develop and implement strategies that can be scaled nationally for improving access to AT services in secondary schools located in underresourced communities.

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