Review article

Twenty-Five Years of National-Level Research on Adolescent and Young Adult Mental Health in the United States

Robert Crosnoe, Ph.D. *, and Jared Thorpe, M.A.

University of Texas at Austin

A B S T R A C T

The longitudinal, population-level, biosocial data in the National Longitudinal Study of Adolescent to Adult Health (Add Health) have elucidated the developmental course of mental health across early stages of the life course. This data set also has been invaluable for documenting and unpacking disparities in these developmental patterns by race, ethnicity, socioeconomic status, gender, immigration, and sexuality. Reflecting the larger focus of this special supplement on Add Health as a tool for connecting adolescence to adulthood, this article reviews Add Health research since 2000 based on a search of key mental health terms, primarily describing patterns of two key markers of psychopathology (depressive symptoms, suicidal ideation) that were consistently measured across waves. It situates these patterns from adolescence into adulthood within the developmental ecology organized by the proximate settings of everyday life, the larger social structures organized by a highly stratified society, and the relations of these ecological and structural forces to biological processes. Major foci are the dynamic nature of mental health across the life course and the ways that ecological and physiological influences on mental health differ by group identity and social position.

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IMPLICATIONS AND CONTRIBUTION

This article reviews innovative uses of the National Longitudinal Study of Adolescent to Adult Health that advance knowledge of the social and structural contexts that influence and stratify the developmental course of individual well-being from adolescence through young adulthood, highlighting critical points of vulnerability and resilience to guide intervention.

Mental health is an individual characteristic that also helps us understand society at large. Indeed, research on the mental health of individual people can shed light on how they are faring in their lives and coping with challenges. At the same time, systematically investigating population trends in mental health can shed light on how societies are faring and how they are or are not serving their people [1,2]. For the past two and half decades, the National Longitudinal Study of Adolescent to Adult Health (Add Health) has been a proven resource for the study of mental health on both levels—elucidating where in the early life course mental health is particularly vulnerable and which groups of young people in the population are particularly vulnerable; identifying what supports the emotional and psychological resilience of individual youth and larger social groups of youth in the face of hardships and setbacks [3]. It has been such a resource because of its span (e.g., covering a broad swath of the life course over several decades), reach (e.g., offering a national picture that can be broken down to focus on diverse groups), and scope (e.g., collecting detailed information on systems of human life under the skin, within the proximate environments of everyday life, and across institutions and broader social structures). As such, Add Health has empowered scholars from an array of disciplines to track aspects of mental health—particularly poor mental health, drawing on its consistent cross-wave measurement of two indicators of psychopathology (e.g., depressive symptomatology, suicidal ideation)—as it unfolds from adolescence

through young adulthood at the intersection of biology and social life in a highly unequal but evolving national context.

Mental health, therefore, is an appropriate addition to this special supplement that considers how research on Add Health has advanced understanding of the implications of experiences in adolescence for health and wellbeing in adulthood. Following the invitation to focus on *mental health* as part of this broader goal, this article reviews the multidisciplinary investigation of Add Health on mental health as both a developmental and population phenomenon. Reflecting the focal themes of the special supplement described by the co-editors in the introduction, it covers the dynamic nature of mental health across stages of the life course, the multilevel nature of mental health across influences inside and outside the body, and the stratified nature of mental health across diverse segments of the population. More specifically, we take a developmental perspective by focusing on research exploiting the longitudinal design of Add Health to examine trajectories of the aforementioned markers of psychopathology as well as the genetic and ecological forces (e.g., relationships, schools) linked with continuity and change in such trajectories. This developmental perspective is coupled with a population perspective that focuses on research exploiting the nationally representative design of Add Health to examine shorter- and longer-term disparities in mental health by race, ethnicity, immigration, socioeconomic status, and sexuality related to discrimination and associated biosocial stress.

In addition to describing in the introduction to this supplement the core themes of the special supplement related to why Add Health was designed to be a resource for understanding the implications of adolescence for adulthood, the co-editors provide a detailed overview of Add Health's sampling, longitudinal design across waves/life stages, and core/supplemental collections of environmental, biological, and other data, including in figures and tables. With this general overview of themes and study design as background, this review focuses on its specific topic, which is mental health research using Add Health. For this purpose, we conducted a thorough search of the Add Health library and Google Search for articles published in peer-reviewed journals since 2000 using relevant terms related to relevant Add Health surveys and measures (e.g., mental health, depression), and then confirmed the use of Add Health data and the focus on mental health constructs as focal predictors or outcomes in the sampled articles. Furthermore, as prompted by the co-editors of the supplement, we give special attention to articles that leverage the longitudinal nature of Add Health as opposed to utilizing data from only a single wave of data collection. This process, therefore, was more akin to a thematic review rather than the systematic review of topics often published in this journal.

The goal of this special supplement and this specific article is not simply to take stock on what has been learned with Add Health, but also to forecast what could be learned with Add Health in the future. Summarizing the state of the field enables the articulation of what is known and unknown and what could be known with the extant waves of Add Health as well as any waves of Add Health yet to come. In the case of both the knowns and unknowns, we should point out that Add Health was designed as a resource for population/epidemiological science, meaning that its value is in sketching out the big picture as a means of helping scholars, policymakers, and other stakeholders understand general patterns of health rather than providing concrete guidance for practice. As such, Add Health is a complement to more intensive clinical work in the public understanding of health, and this review treats it as such.

A Developmental Lens on Adolescent and Young Adult Mental Health

Figure 1 presents the conceptual model organizing the discussion of research reviewed for this article. It considers mental health (specifically the two markers of psychopathology) as unfolding over time (A), within ecological contexts and influenced by genetic processes as well as gene x environment interplay (B and C), stratified according to inequalities across sociodemographic groups (D), and ultimately interacting with physical health over time (E).

The general developmental course of mental health

To begin, we can discuss the dynamic component of this model (A). Because Add Health has followed a sample of young people as they grew up from adolescence into adulthood, it is better suited than many other population studies to be analyzed with statistical methods that capture dynamic trajectories of mental health within and across stages of the life course. Because its sample is large and nationally representative, Add Health is better suited than many developmental (often community-based) studies to reveal trajectories without the truncation of developmental dynamics that may occur when studying a narrow range of the population or working with small cell sizes [4].

Indeed, health scholars have frequently applied such statistical techniques to multiple waves of Add Health to estimate *average trajectories* of mental health within the population of young people. For example, Add Health fielded a modified version of the Center for Epidemiologic Studies-Depression Scale (CES-D), a well-validated measure of depressive symptoms for population studies, across its first four waves. Prior to the most recent fifth data release, these four waves spanned two closely spaced waves during adolescence and two waves during the transition into and through young adulthood, each spaced roughly seven years apart and ending when the youngest people in the sample were 24 and the oldest were 32. Growth curve models capturing the mean level and rate of change in CES-D scores across these waves revealed an average trajectory in which low-level depressive symptoms decreased across the teens (i.e., within the second decade of life, with variation from early to late adolescence based on age at first wave) and the 20's before an uptick in the early thirties [3]. Such average trajectories speak to the aforementioned big picture of mental health by identifying the general developmental windows in which young people in the United States are most likely to require attention as a group and how the transition between stages of the early life course may offer new vulnerabilities or turning points. These averages also provide a population-level comparison point for individual experiences.

Just as average trajectories provide a population frame for understanding the developmental dynamics of individual mental health, exploring the great deal of variability within the larger *group* can advance developmental understanding by identifying *subgroups* of youth who are most and least likely to require attention within general developmental windows. Fortunately, other statistical techniques can disaggregate average trajectories to identify *common types of trajectories* within the average. For example, latent class analyses of the CES-D across the first three waves revealed that the most common trajectory in the sample was not that aforementioned
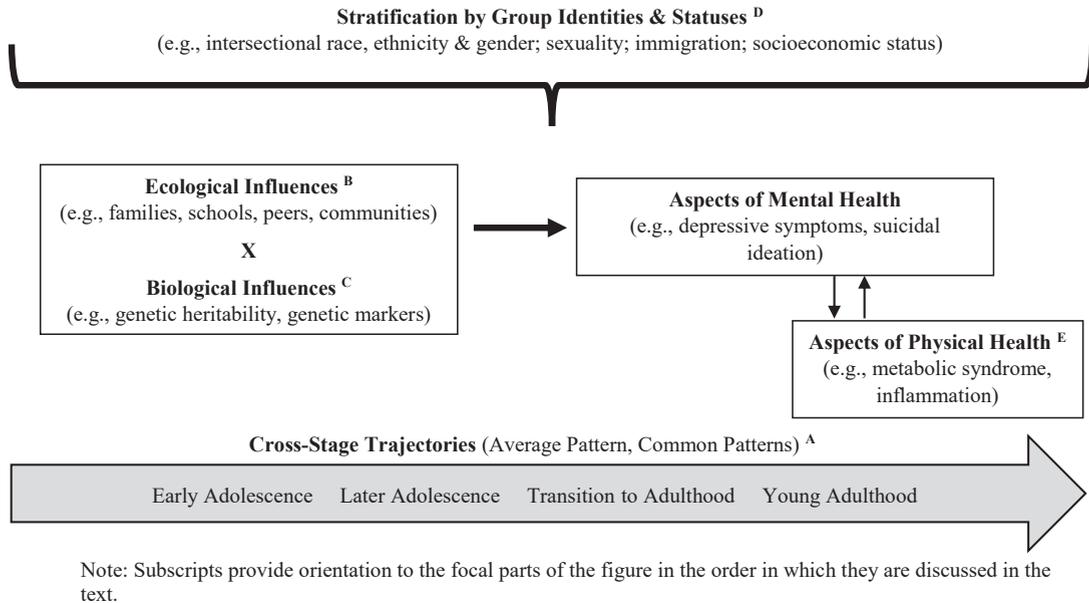
Stratification by Group Identities & Statuses [D]
(e.g., intersectional race, ethnicity & gender; sexuality; immigration; socioeconomic status)

Ecological Influences [B]
(e.g., families, schools, peers, communities)

X

Biological Influences [C]
(e.g., genetic heritability, genetic markers)

Aspects of Mental Health
(e.g., depressive symptoms, suicidal ideation)

Aspects of Physical Health [E]
(e.g., metabolic syndrome, inflammation)

Cross-Stage Trajectories (Average Pattern, Common Patterns) [A]

Early Adolescence   Later Adolescence   Transition to Adulthood   Young Adulthood

Note: Subscripts provide orientation to the focal parts of the figure in the order in which they are discussed in the text.

Figure 1. Conceptual model organizing review of Add Health research on mental health. Note: Subscripts provide orientation to the focal parts of the figure in the order in which they are discussed in the text.

general decline in depressive symptoms from adolescence into the early 20's but instead a stable low level of symptoms. Other youth had higher levels of symptoms in adolescence that declined as they transitioned into young adulthood, had low levels of symptoms that escalated, or had chronically moderate-to-high levels over time [5]. Similar patterns—a few common trajectories subsumed within the average trajectory—extend to the case of suicidal ideation, which Add Health measured each wave with a question about whether young people had seriously considered committing suicide in the past year. Growth mixture modeling of these longitudinal data revealed that most young people had stably low odds of suicidal ideation from adolescence into young adulthood. Of the minority who did not, some youth consistently had elevated odds of suicidal ideation while others had a sharp spike in their teens followed by an even sharper decline into their 20's and consistently low odds thereafter [6,7].

By enabling attention to shift from static statuses to dynamic trajectories, Add Health has offered a better picture of the reality of the *developmental course* of mental health issues during the early life course—as conditions felt occasionally by many but frequently by far fewer, as generally declining as the tumult of adolescence gives way to increasingly adult experiences, and as a variable in ways that potentially can be obscured by a focus on normative trends.

Ecological influences on developing mental health

A major concern of modern developmental research has been the ecological contextualization of developmental trajectories [8]. Most often, this ecological contextualization situates the experiences of young people within their proximate environments, such as the interpersonal and organizational settings in which they live their daily lives. Add Health's focus on the proximate ecology in data collection positions it as a valuable resource for this strand of development research on a national scale (see B in Figure 1).

Looking across the proximate ecology, the settings of everyday life are often where young people experience stressful events that shape their mental health. Add Health has allowed researchers to track exposure to such stress as a trajectory that is inter-related with other developmental trajectories. One study counted the number of stressful life events (e.g., running away from home, death of a parent, school expulsion, intimate partner violence, and community violence) reported in each of the first three waves, estimated latent class models to identify the most common longitudinal trajectories in these events, and used the resulting trajectories to predict mental health in the third wave. Doing so revealed that stressful events across adolescence were associated with elevated depressive symptoms during the transition into young adulthood and that this association grew stronger with longer durations of exposure to such events. This pattern is in line with a cumulative model of stress and mental health in the early life course, akin to the concept of developmental cascades in which even small amounts of stress can build on each over time to create large effects on adjustment and functioning [9,10].

Turning to specific settings within the proximate ecology, Add Health has long supported research on family contexts of mental health. Notably, it weds rich data on family relationships and processes more common to developmental studies with in-depth data on family structure more common to demographic studies, adding value to both. Scholars have integrated these two types of data to connect an interpersonal dimension of family life to a structural dimension, revealing the interplay between how families are organized and how they operate as a characteristic of the developmental ecology. For example, family belonging is a commonly studied aspect of family life that can be linked to mental health trajectories. Although Add Health youth were more likely to report a better sense of family

belonging when they lived with both their parents than when they lived in a single parent or stepparent family, the link between greater family belonging and fewer depressive symptoms was virtually the same across diverse family structures. Moreover, within and across family structures, closeness with parents was a major factor in whether young people reported feelings of family belonging, but it was certainly not the only family relationship that affected how much belonging young people reported [11].

The other ecology in which young people spend the most time is school, which schedules their daily lives, creates an opportunity structure for achievement, and, importantly, also organizes peer dynamics on a large scale within concrete boundaries. Add Health was a school-based study with a major social network data component that mapped the complex direct and indirect ties among friends within schools. As such, it is an innovative resource for contextualizing the mental health of young people in schools while recognizing that schools are social contexts and not just academic institutions. A good example concerns a classic focus of research on the social nature of mental health: suicide. Network analyses of Add Health have documented the "contagion" of suicidal ideation and depressive symptoms among adolescent friends inside schools. Even though depressive symptoms are a risk factor for suicidal ideation at the individual level, peer contagion of depressive symptoms within schools does not lead to an increased prevalence of suicidal ideation. In other words, mental health issues can become a feature of schools, not simply an individual condition, which is not surprising given that adolescence is a developmental period of heightened susceptibility to social influence in an institutionalized setting that is an arena for such influence to play out [12].

Importantly, the longitudinal design of Add Health allows the study of how links between family and peer contexts on one hand and mental health on the other evolve *across* stages of the life course (e.g., the dynamic nature of both sides of developmental exchanges between person and context). Indeed, as new waves of data were collected, insights from short-term adolescent-focused perspectives on mental health could be juxtaposed with longer-term cross-stage perspectives. Consider how the association between romantic relationships and depressive symptoms in Add Health changes as new waves were released. Early analyses of the initial adolescent waves of Add Health revealed that, for girls, engagement in romantic relationships predicted escalating depressive symptomatology [13]. The addition of follow-up waves in young adulthood revealed that the risks of dating for girls' depressive symptoms faded as they transitioned from adolescence into young adulthood, especially when dating in adolescence was coupled with singlehood in young adulthood during this transition [14]. Another example concerns the strong associations between different measures of close family bonds and lower levels of depressive symptomatology commonly reported by early studies of Add Health [15,16]. Taking advantage of later waves of Add Health yielded new insights into the legacy of these early bonds. Adolescents who were well integrated into their families tended to report fewer depressive symptoms even long after they exited adolescence, and this protective legacy was stronger during stages of the life course in which there were normative upticks in symptomatology [17]. In both of these examples, adding new waves of data that crossed life course stages qualified and/or amplified trends seen in earlier stages, offering a better sense of the longer arc of developmental dynamics.

Ecological and genetic influences on developing mental health

A notable feature of modern ecological approaches to development is the recognition of the developmental significance of the intersection between contextual forces and genetic influences, including in mental health (see C in Figure 1) [8]. Add Health is *not* a key study in the field of genetics. It is, however, one of the few population data sets that included genetic data for social and behavioral scientists to parse out influences of environmental and genetic factors and to explore the interplay of the two [18].

For example, behavioral genetic analyses have exploited the sibling subsample of Add Health—which included a large number of sibling pairs with a range of genetic relatedness—to demonstrate that contextual (vs. genetic) influences on depressive symptomatology were more pronounced when symptoms neared clinical thresholds and were far less pronounced at lower (and more normative) levels [19]. Similar analyses also showed that a specific observed contextual influence on depressive symptoms—adverse early childhood experiences—could not be solely accounted for by genetic traits simultaneously selecting young people into exposure to such experiences and mental health issues [20].

Later waves of Add Health collected information on specific genetic markers, such as the 5HTTLPR serotonin transporter polymorphism. These data allowed scholars to replicate on a national level past community-based research showing that young people with the short allele of 5HTTLPR reported more depressive symptoms when they experienced stressful life events while also demonstrating that this moderating role of the short allele did not extend to other key mental health issues, such as suicidal ideation [21]. Thus, the ability to explore genetic influences on mental health in Add Health, especially in relation to contextual influences, has led to greater insights into *when* and *how* genes play a role in the development of mental health issues during a stage of the life course when these issues often emerge.

A Population Lens on Adolescent and Young Adult Mental Health

In recent decades, multiple data sets have been leveraged to investigate the scope and nature of sociodemographic disparities in mental health in the early life course. The cumulative knowledge arising from the myriad studies of these data generally indicate: White youth tend to have more positive mental health outcomes than youth of color (especially African-American and Latino/a); girls have a mental health disadvantage relative to boys that emerges in adolescence and increases into young adulthood; there is a strong and persistent socioeconomic gradient in mental health; and LGBTQ youth have elevated levels of mental health problems compared to their peers [3,22–24]. Many features of Add Health's design position the study as a resource on which to build this foundation of knowledge about mental health disparities, enabling scholars to elucidate new insights about seemingly old issues (see D in Figure 1).

Major disparities in mental health

One valuable feature of Add Health for this line of research is that its large and nationally representative sample provides an opportunity for finer-grained analyses of mental health

disparities with less concern about sparse cell sizes. This value can be seen in research that moves past studying race, ethnicity, and gender as separate lines of stratification to consider how they intersect. For example, one study compared depressive symptoms across the first four waves of Add Health by multiple combinations of racial, ethnic, and gender categories, many of which would be underrepresented in a study below the national level. This intersectional extension of prior research on dynamic trajectories revealed the special risks faced by African-American and Asian-American women during the third decade of the life course [3].

A second valuable feature of Add Health for research on mental health disparities is that its longitudinal design allows the examination of fluctuations in mental health not only across the life course but also fluctuations in the group identities that predict mental health. This approach is perhaps best exemplified by studies that have examined mental health disparities related to LGBTQ status while simultaneously recognizing that such a status can be far from static or set. Indeed, latent class and growth curve analyses of Add Health's multi-wave data on multiple dimensions of sexuality have revealed that the *assumption* of same-sex statuses and the *transition* from same-sex attraction to behavior and identity are particularly vulnerable periods for the mental health of young people [25,26]. These longitudinal approaches capture nuances in sexuality-related disparities beyond standard comparisons of LGBTQ versus not.

A third valuable feature of Add Health is that the timing and multilevel nature of its data collection position it as a valuable resource for individual- and community-level research on mental health disparities focusing on immigration. It was fielded well into the population changes associated with the reform of federal immigration laws in the 1960s that increased and diversified migration flows into the United States, which means it contains large subsamples of immigrant youth from Latin America, Asia, Africa, and other regions. For this topic, early analyses of the adolescent waves of Add Health once again gave way to new insights from analyses incorporating the young adult waves. For example, despite the suggestion of an immigrant advantage in psychological wellbeing during adolescence, the children of immigrants did not differ on mental health outcomes once the temporal lens was extended to young adulthood [27,28]. Analyses of the immigrant subsample of Add Health have also been supplemented by the formal linkages between Add Health and neighborhood-level data from the U.S. Census Bureau. In this spirit, research showed that youth from Latino/a immigrant families did exhibit a mental health advantage over their peers when they lived in neighborhoods with denser concentrations of Latino/a immigrants [29]. This research is important because it situates mental health within the interplay of proximate contexts that define ecological investigation with larger social structures that define stratification and demographic research.

A fourth valuable feature of Add Health for research on mental health disparities is its genetically informed design. One of the seminal findings of a gene × environment interaction in mental health research concerned the greater emotional and psychological resilience of young people social stressors when they had the long allele of the MAOA gene, which leads to the greater production of an enzyme involved in the regulation of serotonin and other key neurotransmitters [30]. Social stressors are more common in socioeconomically disadvantaged segments of the population at the core many mental health disparities. The availability of genetic markers in the population data of Add Health has enabled scholars to establish a similar pattern of MAOA moderation of the socioeconomic disparities in adolescent and young adult depression, with socioeconomic conditions proxied by receipt of public assistance [31]. This extension connects processes inside the body to processes outside the body, a common aim of contemporary research on health disparities, but does so on the population level.

Related disparities in mental and physical health

The innovative possibilities of a dynamic, multilevel, population approach to disparities in mental health is crystallized in the growing literature linking mental health to physical health, including disparities in both (see E in Figure 1). This line of research exploits the biosocial data in Add Health within and across groups of young people who are often the focus of research on mental health disparities. For example, adolescent reports of suicide attempts—by the adolescent or by family and friends—predicted adult measures of hypertension and high-sensitivity C-reactive protein, a marker of inflammation. These longitudinal linkages between mental and physical health, however, were only found for boys. Disparities in one dimension of health often are not isolated from disparities in another dimension [32].

Another strand of this research considers the physiological wear and tear of discrimination and other experiences of racial, ethnic, and socioeconomic inequality and how they differentially affect mental and physical health [33]. This strand has been advanced by Add Health's biosocial data. Consider the paradoxical patterns of physical and mental health related to social mobility uncovered by analyses of Add Health. In short, intergenerational income mobility was associated with better mental health (as measured by lower CES-D scores) but poorer physical health (as measured by higher metabolic syndrome rates) [34]. These observed tradeoffs are also seen in Add Health evidence that the associations of college completion with *lower* CES-D scores and *higher* metabolic syndrome rates were most pronounced for minority youth from disadvantaged backgrounds [35]. Such a paradoxical finding illuminates how the stress engendered by climbing the social ladder in an unequal society may affect the body even if it is not being emotionally processed in ways that lead to conscious levels of distress.

Looking to the Next 25 Years

As noted at the start of this article, the value of Add Health for studying mental health through a life course lens lies in the advancement of knowledge that can be derived from population/epidemiological *research*. Such research is also relevant to policy and intervention. It can help to identify critical points of mental health intervention, such as the aforementioned research identifying the 20's as a time in which the mental health of women of color warrants special attention [3]. It can also identify levers of mental health intervention, such as research using Add Health's peer network data to demonstrate how the use of psychological counseling services in times of distress can promote friendship formation in the future [36].

A greater focus on this translational role could be one way to increase the impact of Add Health moving forward. One example might be linking Add Health to other data bases tracking interactions with institutional systems (e.g., health and human services, criminal justice) that may affect the mental health—or

moderate the effects of mental health—within and across diverse groups. Another example might be supplementing attention to the mental health impact of services and programs with equal attention to the environmental and genetic mechanisms of selection into use of such services and programs across groups, relevant to the help-seeking agenda of the Mental Health First Aid approach [37,38]. There are also broader impacts to be realized. One might involve the integration of Add Health research on the ecological contexts of racial and ethnic discrimination with other developmental research to build and refine programs on the early life course development of anti-racism [39,40]. Another could involve retroactively recognizing the value of incorporating youth into research about youth. Adolescents were not involved in designing Add Health, but the original participants could be brought back in now to reflect on how the data have been used so far and advise on new waves of data collection [37]. In both cases, opening up data access—within guidelines for handling sensitive data—could expand how Add Health informs population/epidemiological science and its translation.

Of course, there are many aspects and predictors of mental health that Add Health did not collect data when it was launched, because not all issues of the time could be covered in one study (e.g., community service) or because issues had not yet emerged (e.g., cyberbullying, COVID). Although the adolescent and young adult data in Add Health cannot be changed now, the future data collections designed to gauge long-term implications of adolescent and young adult experiences can. As the original young people in Add Health continue to age through adulthood and into their later years, their experiences—and the data collected on these experiences—will provide the groundwork for research on this legacy of early life.

Funding Sources

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