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3 **Turning vicious cycles into virtuous ones:**
4 **The potential for schools to improve the life course**

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36 authors approved the final manuscript as submitted and agree to be accountable for all aspects of
37 the work.
38

39 **Abbreviations:** Life course health development (LCHD); Centers for Disease Control (CDC);
40 Whole School, Whole Community, Whole Child Model (WSCC)
41

42 **Article Summary:** This study describes the importance of adolescence as a key transition period
43 and the potential for schools to improve life course trajectories.
44

45 **Word count:** 4263

46 **Introduction**

47 A central idea to life course health development (LCHD) is the idea of timing-- that
48 certain transition periods exist during which biological, social, behavioral, and other factors are
49 particularly influential on health and the acquisition of capabilities.¹ Much of the focus of life
50 course research has been on early childhood due to the rapid changes that occur during that time.
51 However, important transitions arise throughout the life span. In this paper, we discuss the
52 importance of adolescence and the risks and opportunities that this transition period presents for
53 later adult health. We also discuss the effect that education and school environments have on
54 health trajectories. Current thinking about LCHD asserts that social and cultural factors create a
55 “social scaffolding” that can support and promote health development.¹ During adolescence,
56 teachers, coaches, school counselors and peers are often highly influential. Harnessing these
57 influences could be an important way to re-engineer the social scaffolding during the vulnerable
58 period of adolescence.

59 Perhaps one aspect not fully appreciated in current LCHD models is the impact of
60 political and sociological timing. Currently in the U.S., health care systems have increasingly
61 recognized the importance of social determinants on health. While these ideas are not new,
62 health care systems are more receptive to addressing the social needs of patients in part due to
63 the Affordable Care Act, which incentivizes value-based care and population health
64 improvements.² Concurrently, primary and secondary public schools in the U.S. have had a
65 similar transition. In 2001 with the passage of the No Child Left Behind Act, school
66 accountability and benchmarking was central to this policy and “success” was largely measured
67 by standardized test results. The narrow focus of this policy in defining school success based on
68 acquisition of cognitive skills led to push back and a subsequent recognition that non-cognitive

69 skills, often referred to as “social-emotional learning,” are also important. The Every Student
70 Succeeds Act passed in 2015 allowed schools to expand the definitions of school success beyond
71 test scores and permitted states to create more holistic measures of child development.³ While
72 there remains great debate on school accountability and how to measure success, schools have
73 increasingly embraced the need to address child health and well-being. In short, the U.S. health
74 care and education systems have taken a step closer to recognizing that health and education are
75 intertwined and that success in one perhaps cannot be achieved without addressing the other.
76 While this step might be arguably small, it is a step in the right direction, and this paper discusses
77 the opportunity for a societal transition to improve life course trajectories through schools.

78 79 **The importance of adolescence**

80
81 Adolescence is a critical transition period that sets the stage for adulthood and future
82 health outcomes. It is marked by key developmental milestones and brain maturation in regions
83 that influence cognitive and decision-making skills and executive functioning. Adolescents seek
84 greater independence from their parents, increasing their connections to peers, and looking
85 beyond family members for support. As part of this separation from family, they continue to
86 formulate their self-concept and social identity, which is intertwined with the growing
87 importance and influence of peers. As teens broaden their social networks and look to peers for
88 social acceptance, social-emotional capabilities develop and become increasingly salient to their
89 well-being.^{4,5} These social-emotional capabilities are related to self (e.g. confidence, esteem, self-
90 concept, conscientiousness, control of emotions), skills related to social relationships (e.g.
91 empathy, cooperation, social awareness, communication, leadership) and skills related to tasks
92 (e.g. patience, resiliency, growth mindset, persistence, optimism, creativity).⁶

93 During this transition to adulthood, adolescents are also exposed to heightened risk from
94 various behavioral health problems including substance use, violence, delinquency, and mental
95 health issues. Stress increases for a variety of reasons related to growing academic pressures,
96 relationships with peers, and family conflict as teens strive for greater independence. Due to this
97 psychosocial stress as well as biological changes involving cognitive maturation and sex
98 hormones, the prevalence of depression and anxiety also increases during these years.⁷ For
99 example, the annual prevalence of depression increases from less than 1% during childhood to 4-
100 5% during adolescence.⁷⁻⁹ Substance use increases as teens begin experimenting with new
101 behaviors, exhibit independence, and look for acceptance from peers. Some teens may use drugs
102 and alcohol to cope with stress. Greater engagement with risky peers reinforces risky behaviors
103 and may increase risk for conflict, violence, and exposure to the criminal justice system. The
104 long-term effects of these adolescent problems can be profound. For example, three-quarters of
105 adults with depression were diagnosed during adolescence or earlier.¹⁰

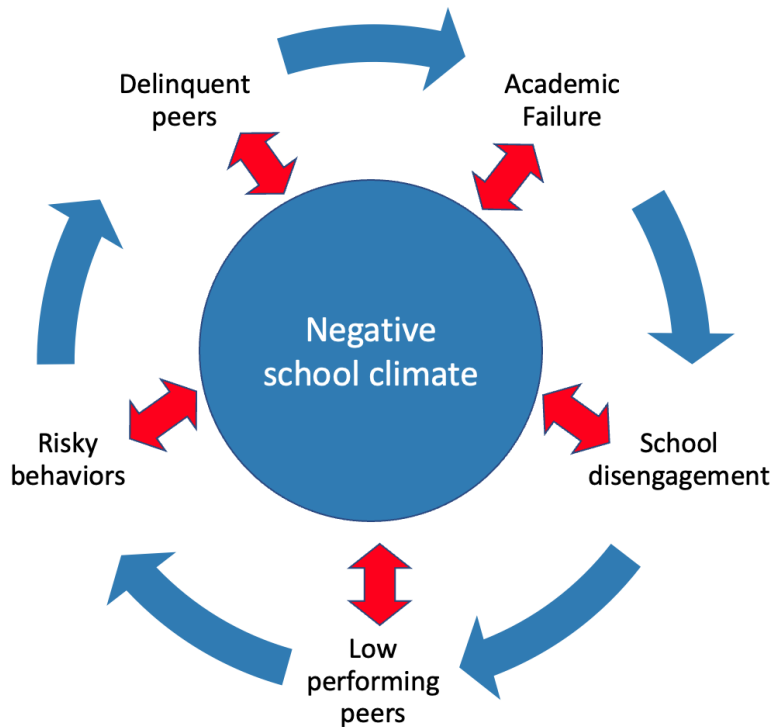
106 Finally, one of the most significant life course milestones during adolescence is the
107 completion of secondary education. High school completion is a powerful social determinant of
108 health and health disparities throughout the life course.^{11,12} Observational studies have found that
109 students who complete their education without a high school diploma have worse health
110 outcomes in adulthood across a wide spectrum of acute and chronic diseases, such as heart
111 disease, cancer, obesity, and human immunodeficiency (HIV) infection.^{13,14} Greater investments
112 in education and more school rigor is linked to better health, particularly among low-income and
113 minority populations,^{15,16} and experimental and quasi-experimental studies suggest the impact of
114 education on health is causal.¹⁷⁻²⁰ Obtaining a high school diploma is the gateway to higher

115 education, employment opportunities, and socioeconomic success. Thus, poor educational
116 outcomes are a precursor of other key social determinants of adult health including under and
117 unemployment, incarceration, poverty, housing instability, family instability, and limited access
118 to healthcare,^{13,21,22} further increasing the risk of poor health in adulthood.

119 **The vicious cycle of poor academic performance and behavioral health problems**

120 Three decades ago, in his Theory of Problem Behavior, Richard Jessor theorized that
121 many of the developmental, behavioral, and academic milestones of adolescence are intertwined.
122 He posited that adolescent health behaviors and mental health problems are closely tied to poor
123 educational outcomes and peer network formation in a reinforcing feedback loop often leading to
124 school disengagement, school failure, and incompleteness of high school.^{23,24} **(Figure 1)**

Figure 1. Vicious cycle of academic failure and risky behaviors



Adapted from Jessor's Theory of Problem Behavior^{23, 24}

125

126 Friendship networks coalesce around teens with similar interests and behaviors. When applied to
127 poor performing, disengaged, and misbehaving students in schools, the result has been described
128 as “deviancy clustering.” This concept may capture the complexity of issues facing students but
129 may also fail to recognize the agency of students who disengage or violate norms because their
130 schools are not structured to support their engagement. For example, it has been proposed that
131 schools that track students into classes based on school performance may be creating
132 environments that perpetuate inequities.²⁵ Academic policies and other school factors (often
133 referred to as “school climate”), such as teacher support and school safety are thought to shape
134 adolescent academic and behavioral outcomes.²⁶

135 Adolescents who do not experience school success may develop a poor self-concept that
136 propels disruptive behavior. Furthermore, executive function is a critical component of brain
137 function that primarily develops during the teenage years²⁷ and is impaired by substance use.²⁸
138 Substance use, comorbid mental health problems, and poor executive functioning in turn
139 negatively influence academic engagement and achievement.²⁹ Poor academic achievement
140 further drives poor self-concept, deviancy clustering and more delinquent behaviors. This vicious
141 cycle all takes place in school settings where peers adopt behaviors from each other via social
142 influence. Jessor’s theory suggests that this vicious cycle can lead to an overall negative school
143 climate, which then further contributes to both academic failure and delinquency.

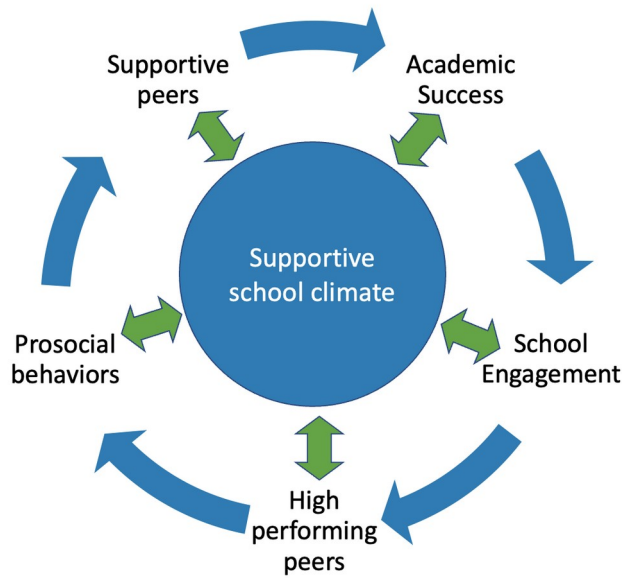
144 The life course implications of entering the vicious cycle are enormous given the
145 importance of educational, developmental, and behavioral health capabilities that are often
146 acquired during and essential to adolescence.^{30,31} For example, puberty and sex hormone changes
147 increase the risk for depression.⁷ Substance use often complicates depression;^{32,33} impairs

148 cognitive capabilities including verbal and working memory, visual-spatial functioning, and
149 psychomotor speed; and has been linked to changes in brain structure, such as declines frontal
150 and temporal grey matter volume.^{28,34} Executive functioning, decision-making, and emotional
151 control have not fully matured, leading teens to make poor decisions that are largely influenced
152 by a need to fit in among their peers who are also not fully mature. Setbacks in school can
153 cascade into larger problems that reverberate through the transition to college and adulthood.
154 Substance use and engagement in other risky behaviors can lead to school disciplinary action,
155 such as suspension and expulsion, which can then deprive teens of the support of teachers and
156 staff when they need it most. Since teens are also developing their sense of identity, self-concept
157 and worth, negative feedback from peers and adults can be particularly devastating, especially
158 among those who have not yet developed coping strategies and resiliency skills. Recovering
159 from this vicious cycle during the transition to adulthood is very difficult, especially as the adult
160 support network that is present in childhood contracts as the teen strives to be more independent.

161 **Virtuous cycles and the promise of schools as a platform for improving life trajectories**

162 In short, education and health outcomes (including cognitive development, mental health,
163 social-emotional outcomes) are closely linked, which creates great risk for adolescents who enter
164 a vicious cycle of poor school performance and risky health behaviors. But by disrupting this
165 vicious cycle, it can be converted into a virtuous cycle whereby *improvements* in education lead
166 to *better* health and vice versa. (Figure 2)

Figure 2. Virtuous cycle of academic success and positive behaviors



167

168 Within the school environment, just as poor performing peers (academically and behaviorally)
169 reinforce each other's academic and adolescent behaviors, academically engaged and pro-social
170 peers can also reinforce positive and adaptive adjustment during this vulnerable period of
171 heightened sensitivity to social influence.³⁵ Consequently, positive school environments can
172 create the social scaffolding that supports and promotes the acquisition of essential cognitive,
173 social, emotional, and behavioral capabilities that are important during adolescence and later
174 adult life.

175 Jessor's theory may be limited in suggesting that student behaviors drive school climate,
176 rather school climate can also drive student behavior. Teachers, staff, school policies,
177 pedagogical practices, and structure can create a supportive environment, one in which students
178 are empowered, connected, and successful. This supportive environment creates normative
179 behaviors and attitudes that further promote academic engagement, support of others, and

180 prosocial behaviors. If so, schools could be a transformative platform for improving life
181 trajectories.

182 **Evidence that virtuous cycles can be achieved through schools**

183 Early education interventions studies including the Carolina Abecedarian and Perry
184 Preschool Projects suggest that starting children on the right educational path from the beginning
185 is remarkably powerful and protective over the life course.³⁶⁻⁴¹ These randomized trials
186 demonstrated that preschool programs can improve the life course trajectory across multiple
187 domains, including health (blood pressure, obesity, cholesterol and cortisol levels, exercise,
188 substance use, diabetes, and executive functioning), employment, income, and incarceration.

189 While numerous observational studies have found very strong associations between
190 health and education,^{14,42} the *effect* of secondary education on health is less well documented.
191 Causal evidence comes from a few charter school studies that used admissions lotteries to
192 conduct natural experiments.^{17-19,43} These studies sampled teens who lived in low-income
193 neighborhoods and applied to high performing charter schools (identification of high performing
194 schools was based on standardized test results). Comparing students who “won” the lottery with
195 those who “lost” the lottery, the charter school studies demonstrated that exposure to high-
196 performing schools not only increased the likelihood of academic success, but also reduced
197 substance use, delinquent behaviors, and incarceration. While these studies may not be
198 generalizable to all families and adolescents living in low-income neighborhoods of color, they
199 provide a more rigorous study design in which to understand the causal impact of education and
200 school environments on academic and behavioral health. Specifically, these natural experimental
201 studies avoid potential confounding due to selection bias that is likely to exist in observational

202 studies. For example, well-behaving, more motivated students are likely to seek out more
203 rigorous, higher performing schools, and wealthier families have greater access to supportive
204 resources and better schools.

205 There is further evidence that interventions purely focused on academic behavior have
206 spillover effects on health. Bergman devised a simple intervention to encourage middle and high
207 school students to complete homework by notifying parents by text message or email if their
208 child was behind on their homework, only providing the details of the missing assignment. In
209 just 6 months, grades and standardized tests scores significantly and substantially improved.⁴⁴
210 The impact of this intervention on educational outcomes has since been confirmed in other
211 studies, including schools in several other U.S. cities and four other countries.⁴⁵⁻⁴⁷ The
212 intervention was also replicated in 4 middle schools and found to reduce alcohol and marijuana
213 initiation by almost 50%.⁴⁸ In another set of studies, Van Ryzin and colleagues implemented
214 cooperative learning into school pedagogy and studied its effects. By having students engage in
215 group-based learning, they found academic outcomes improved along with reductions in alcohol
216 and tobacco use, and this effect was mainly mediated by peer and friendship networks.⁴⁹⁻⁵¹ These
217 controlled randomized trials provide the strongest evidence in support of Jessor's Theory of
218 Problem Behavior and the capacity to create virtuous cycles in schools that simultaneously
219 improve both education and health.

220 **Schools have the potential to transform health trajectories**

221 The limitations of our health care and public health systems were starkly visible this last
222 year during the COVID-19 pandemic, exposing what we already knew-- biomedical discovery
223 by itself is not enough to protect or improve population health. The changes that are needed are

224 not just limited to improving health care delivery and making it more equitable. They must
225 address the root causes of health and health disparities. Transformative changes are needed to
226 effectively and significantly improve the life course starting from birth for everyone, especially
227 the most vulnerable segments of our society.

228 What does it mean to be transformative? Truly transformative interventions need to be
229 more than effective, they also need to be scalable, targeted, timely, transmissible, inheritable, and
230 multi-level. While having any one of these characteristics might be enough to make an
231 intervention transformative, employing schools as a platform to improve education and health
232 outcomes has *all* these attributes. We assert that when schools are structured to improve both
233 education and health outcomes, our system of public education offers the best hope for social
234 transformation and improvements in the life course.

235 Scalable. The financial and human capital costs of implementation of many health
236 interventions are common critical barriers to dissemination. Scalability increases as the marginal
237 cost of treating an additional person reaches zero, essentially becoming self-sustaining.
238 Approaching schools as a “systems change” has a fixed cost that would not require perpetual
239 public health investments of time or money to reach large numbers of individuals on a
240 continuous basis. Investing in high quality schools as a health intervention continues to benefit
241 future cohorts of students. Furthermore, converting the vicious cycle of poor school performance
242 and poor behavioral health among teens into a virtuous cycle of education achievement,
243 engagement and pro-social behaviors could be self-sustaining and self-reinforcing.

244 Targeted. In health care systems, patients in greatest need are often the hardest to reach. In
245 contrast, schools provide teachers and staff access to students daily during the academic year and

246 thus much greater potential to influence teens than health care professionals. Schools have access
247 to all adolescents including those who are vulnerable to academic and behavioral setbacks.
248 Public schools are particularly well situated to reach minority children from low-income
249 families.

250 Timely. Because schools have daily access to teens, teachers and staff can potentially
251 monitor for early markers of health problems and engage parents and health care providers for
252 help before these problems become more difficult to address. For example, school absence is
253 sometimes the first signs of depression,⁵² and thus chronic absenteeism could trigger a screen by
254 a school psychologist or counselor.

255 Transmissible. While it is commonly recognized that some diseases are communicable,
256 health behaviors (good and bad) are also transmissible. For example, individuals are more likely
257 to lose weight or start smoking when their friends and family members do so.^{53,54} Thus, a
258 “behavioral vaccine” has been proposed as a potential transformative way to change behavior at
259 a population level whereby good behaviors transmitted to enough persons within a social
260 network has the potential to inoculate others in the network.⁵⁵ Teens are particularly susceptible
261 to the influence of peer networks.^{56,57} Focusing on schools has the potential to provide “herd
262 immunity” if normative behavior in a school community can be shifted toward academic
263 engagement and pro-social behaviors.

264 Inheritable. Interventions would have greater impact if protecting patients also protects
265 their children. Poverty and its negative effects on health are inheritable, not genetically but in the
266 sense that poverty and its effects are passed between generations.^{58,59} Studies have shown that
267 young adults who are set on a better life course trajectory more often convey benefits to their

268 children.^{58,60,61} By improving education and health outcomes among teens before they become
269 adults and start a family, schools could greatly improve later adult health and socioeconomic
270 status, transmitting those benefits to their children.

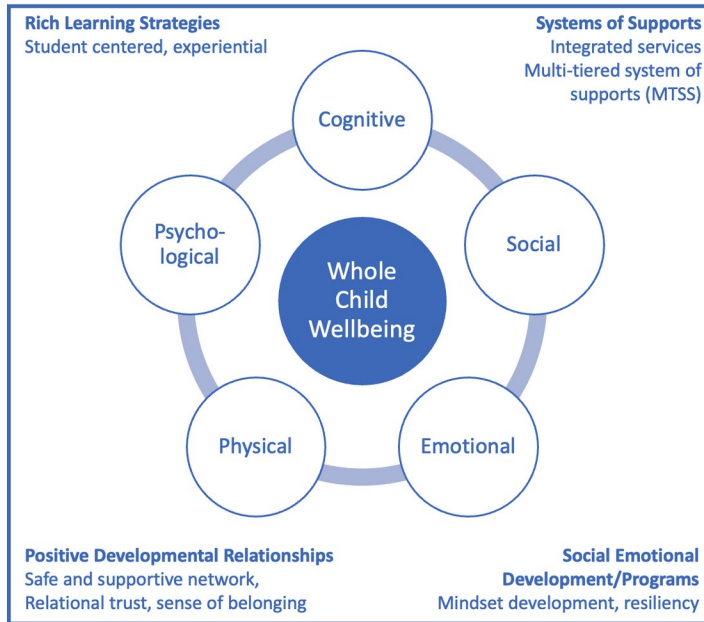
271 Multi-level. The causes of health and health disparities are complex and thus solutions are
272 more likely to be transformative if they impact multiple levels. At the student level, positive
273 school climates promote well-being, academic success and reduce risky and delinquent
274 behaviors.²⁶ At the peer network level, schools could cultivate social inclusion and
275 connectedness, reduce bullying, and counteract pressure by peers to engage in delinquent and
276 disruptive behaviors.⁶² At the family level, successful schools could increase parental
277 involvement and self-efficacy, which are significant protective factors.⁶³⁻⁶⁶ Schools could also
278 serve as entry points for reaching families, including recent immigrants and refugees,⁶⁷ and
279 deliver interventions aimed at improving family outcomes.⁶⁸ Systems change at the school level,
280 not just placement of interventions targeting youth located in schools, has the potential to
281 improve the whole school environment and influence the entire social network of adolescents. At
282 the community level, schools can play a unique role in creating and nurturing healthy
283 neighborhoods, becoming catalysts for placed-based development and change.⁶⁹

284 **Transformative Schools**

285 To create schools as a transformative platform for improving health, it is first necessary to
286 recognize the critical impact that education and school environments have on adolescents and the
287 role they play in helping teens acquire the developmental and behavioral capacities they need to
288 achieve a healthier life course. The Centers for Disease Control (CDC) has proposed an
289 important model for how schools should be re-designed-- the Whole School, Whole Community,

290 Whole Child Model (WSCC).⁷⁰⁻⁷² (**Figure 3**) Schools have traditionally focused primarily on the
291 cognitive development of children and the acquisition of specific academic skills centered on
292 traditional academic outcomes, including grades and test scores.

Figure 3. Whole school, whole community, whole child model



293 Adapted from Darling-Hammond and Cantor

294 The CDC has promoted the concept that whole child well-being includes not only cognitive
295 development but also social, emotional, psychological, and physical development. Recognizing
296 the growing literature that schools have an important influence on all these components, the
297 whole child model suggests schools should be explicitly designed around achieving a broader set
298 of developmental goals for children, which is key to improving population health outcomes.

299 An important element of the CDC model acknowledges the importance of “whole
300 community.” Many community resources are available to children and adolescents to support
301 their well-being and growth. These resources are not limited to physicians and mental health
302 professionals in health care systems, but also include parents, teachers, school counselors, and

303 coaches, constituting a network of supportive adults and services. They could even include
304 businesses, the justice system, and other community and religious organizations. While current
305 health care guidelines recommend physicians screen for behavioral health problems, only one-
306 third of adolescents have a well-child visit in a given year.⁷³ Furthermore, teens often become
307 less communicative with parents as they strive to be more independent, and thus less likely to
308 disclose problems around mental health, substance use, and academic problems.⁷⁴ Consequently,
309 reliance on traditional health care settings to screen for adolescent health problems often means
310 these problems are recognized too little and too late. However, early signs of behavioral health
311 problems often manifest as poor school performance, disruptive behaviors, and poor
312 attendance.^{52,75} Thus, schools and teachers are much better positioned to identify adolescent
313 health problems early before teens get caught too far in the vicious cycle and refer for further
314 care and support. For vulnerable youth, including those who have suffered trauma or have fewer
315 resources at home, schools may be the main source of support and services.

316 Unfortunately, the family, school, community, and health system that should form a
317 network of supportive adults and services around adolescents are often fragmented and
318 disconnected, making it difficult to identify and address student's needs. In recent years, health
319 care systems have increasingly recognized the importance of social determinants of health,
320 including education.⁷⁶ At the same time, schools and educators have also realized the importance
321 of addressing health and social-emotional problems. Despite this recognition that health and
322 education outcomes are intertwined, there are limited mechanisms to share relevant information
323 and coordinate the network of supportive adults and services surrounding children and
324 adolescents. Even within schools, adolescent students rotate through multiple teachers and

325 classrooms each day and few systems provide a child-centered holistic view of overall function
326 and well-being. Even fewer systems allow for care coordination and closed loop communication
327 to ensure that students receive the needed support services and the desired improvement occurs.
328 Given the daily exposure of children to schools, teachers and other school-related adults can play
329 a central role in monitoring child well-being and identifying when more supports and services
330 are needed. At the same time, we need to overcome the barriers to sharing information about
331 youth so that health care and education systems can expand beyond their silos and coordinate
332 their efforts to improve child well-being and promote positive health and resiliency.

333 **The Full-Service Community School**

334 The CDC's WSCC model is similar to the approach taken by the US Department of
335 Education to advance Full-Service Community Schools, which are defined by four pillars: 1)
336 integrated student supports, 2) expanded learning time and opportunities, 3) family and
337 community engagement, and 4) collaborative leadership and practice.⁷⁷ These mutually
338 reinforcing pillars have been shown to positively impact student and school outcomes,
339 particularly in communities facing concentrated poverty.^{77-79 77,80} When schools serve as the hub
340 to coordinate all available resources (e.g. education, health, social work, housing, food), they are
341 able to better support and respond to the needs of children and families in the neighborhood.
342 Community schools integrate these resources with the help of coordinators, counselors, teachers,
343 and other professionals.⁸¹ A recent RAND study of community schools in New York City, found
344 they significantly improve academic outcomes including attendance and standardized test scores,
345 graduation rates, and reduced disciplinary incidents on campus.⁷⁹ There is some evidence that

346 mental health outcomes were also improved, particularly in those community schools with
347 greater integration of mental health services.

348 Although there is a renewed interest in community schools, they are not new. As a
349 reform, community schools date back more than a century to the Settlement House movement
350 led by Jane Addams and the democratic education ideals of John Dewey. The movement was
351 strengthened in the civil rights era and formalized in policies that support community school
352 development, such as the Community Schools Act of 1974. There are currently an estimated
353 8,000-10,000 community schools, between 6-8% of the nation’s schools, and the numbers are
354 increasing given the influx of state and federal support, such as the Full-Service Community
355 School Expansion Act of 2021.⁸² The global pandemic has hastened the need for the wrap-
356 around supports provided through community schools and the racial justice uprisings have
357 underscored the value of pedagogy that builds on the local assets of communities of color.

358 The most prevalent critique of community schools comes from advocates for
359 desegregation. Neighborhood community schools have been criticized as engines of racial and
360 economic segregation, with desegregation advocates arguing instead for schools of choice such
361 as magnets and permit programs or redistricting strategies to disrupt patterns of racial isolation.⁸³
362 Indeed, neighborhood community schools are defined by the demographics of their student body
363 —demographics that mirror broader patterns of residential segregation. There is ample evidence,
364 however, that community schools can serve as a strategy to strengthen communities and rebuild
365 or reimagine historic neighborhood schools—those under threat of school closures—as pillars of
366 their communities. By broadening the responsibility for student well-being beyond traditional
367 educational entities to the interconnected systems that serve young people and their families,

368 community schools aim to disrupt the deep and enduring social and racial inequalities suffered
369 by our most marginalized communities.

370 **Conclusion**

371 Present in every neighborhood, schools are a way to reach every school-age child and
372 improve their health trajectory. This opportunity could be particularly impactful for adolescents,
373 who are not only at a critical and vulnerable juncture in life but are often difficult to reach.
374 Despite the dangers posed by the vicious cycle of academic failure and adolescent health
375 problems, there is the promise that we can leverage the mechanisms of adolescent development
376 and create virtuous cycles. If so, then the right investments in schools could potentially transform
377 health trajectories positively in a scalable way. Our society has already invested substantially in
378 schools. Similar to international comparisons of health care expenditures, the U.S. spends
379 relatively more on education per pupil compared to other countries.⁸⁴ Yet many schools struggle
380 to provide the developmental capabilities that children need due to the challenges of poverty and
381 inequities in society. Despite the many barriers to improving our educational system, we would
382 argue that finding solutions should be a priority as a life course intervention. We believe there is
383 enormous opportunity to maximize the utility of educational investments and to better coordinate
384 the network of supportive adults and services to ensure adolescents successfully achieve provide
385 youth the cognitive, behavioral, social and other developmental capabilities that are essential for
386 health over the life course.

387

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