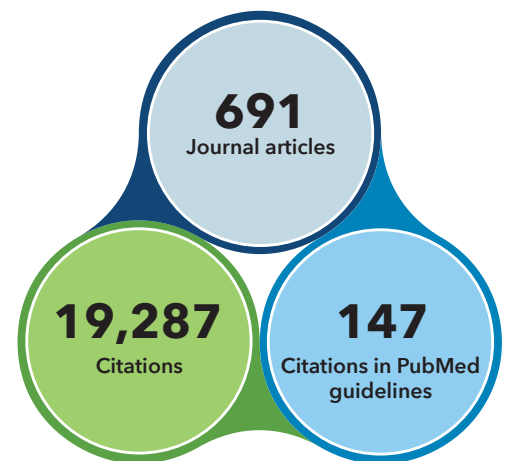


# Adolescent health

This brief summarizes the contributions of Kaiser Permanente Research since 2007 on the topic of adolescent health. Although this topic encompasses a wide array of health conditions, this brief will focus on a small number of specific issues affecting youth, including mental health disorders, high-risk behaviors, injuries and accidents, and issues related to the development of chronic illnesses in adulthood (such as obesity, exercise, nutrition).

Adolescence is widely considered to be a period of ideal physical health. However, the rapid physical, cognitive, and social changes teens experience can be associated with the onset of significant health problems. Poor nutrition<sup>1</sup> and inadequate exercise<sup>2</sup> are common problems that contribute to obesity<sup>3</sup> and place youths at risk for type 2 diabetes, cardiovascular disease, and other serious health problems.<sup>4</sup> Mental health conditions are also a concern for adolescents. The symptoms of mental health conditions, including depression and anxiety, often begin during the teen years. Approximately 1 in 8 adolescents and young adults in the United States live with depression,<sup>5</sup> and suicide is one of the most common causes of death in this age group.<sup>6,7</sup> Anxiety disorders affect approximately one-third of teens,<sup>8</sup> and attention deficit hyperactivity disorder and eating disorders are common in adolescence.<sup>9</sup> Mental health disorders and other health issues may result from adverse childhood experiences (such as traumatic events, economic hardship, or parental separation or divorce), which affect 45% of American youths.<sup>10</sup> More recently, the COVID-19 pandemic, with its associated physical and social isolation, lockdown measures, social unrest, and various economic and other stressors, has had an adverse effect on both the physical and mental well-being of adolescents. In many youth populations, rates of depression, anxiety, stress, suicidal ideation and behavior, and unhealthy substance use have increased,<sup>11</sup> as has utilization of emergency and other medical services for mental health problems.<sup>12,13</sup>

## Kaiser Permanente publications related to adolescent health since 2007



Source: Kaiser Permanente Publications Library and Scite metrics, as of November 8, 2021.

Moreover, as youth transition into the increased autonomy and independence of adulthood, they are more likely to engage in high-risk behaviors. Although use of alcohol, tobacco, and most illicit drugs among American teens has declined in recent years, marijuana use has increased among 10th graders, and the National Institute on Drug Abuse has reported a substantial increase in the use of tobacco and marijuana vaping products.<sup>14</sup> Moreover, recent surveys suggest that adolescents' perceptions of the risks of marijuana use have declined steeply.<sup>14</sup> High-risk sexual behavior among teens also remains common. According to the Centers for Disease Control and Prevention, 30% of U.S. high school students in 2017 reported having had sexual intercourse in the prior 3 months. Of these, nearly half had not used a condom, and nearly 20% had used drugs or alcohol prior to intercourse.<sup>15</sup> About 7% of students reported having been forced to have intercourse against their will.<sup>15</sup> As a consequence of risky sexual behavior, over 200,000 infants were born to teen mothers in 2016,<sup>16</sup> and half of new cases of sexually transmitted infections (including 21% of new HIV diagnoses<sup>17</sup>) occur in adolescents and young adults.<sup>18</sup> Finally, accidental deaths and injuries, primarily associated with driving, cycling, and walking,<sup>19</sup> represent the leading cause of death among teens.<sup>20</sup>

Adolescent health is an active area of study for Kaiser Permanente Research. Scientists across the organization have used our rich, comprehensive, longitudinal data to advance knowledge in the areas of understanding risk, improving patient outcomes, and translating research findings into policy and practice. We have published nearly 700 articles related to adolescent health since 2007; together, these articles have been cited more than 19,000 times.

These articles are the product of observational studies, randomized controlled trials, meta-analyses, and other studies led by Kaiser Permanente scientists. Our unique environment – a fully integrated care and coverage model in which our research scientists, clinicians, medical groups, and health plan leaders collaborate – lets us contribute generalizable knowledge on adolescent health and many other research topics.

## Understanding Risk

### For which health problems are adolescents at increased risk?

In exploring the risk factors associated with common health problems in adolescents, Kaiser Permanente researchers found the following to be predictors of mental health problems: onset of symptoms<sup>21;22</sup> and use of mental health services<sup>23</sup> at younger ages, insomnia,<sup>24</sup> diabetes,<sup>25</sup> parental depression,<sup>26;27</sup> and health risk behaviors such as smoking, substance use, and unsafe sexual behavior.<sup>28</sup> Our scientists have also explored factors associated with the use of tobacco, alcohol, or other drugs, which include vaping,<sup>29</sup> cigarette advertising,<sup>30;31</sup> characteristics of neighborhoods<sup>32;33</sup> and the school environment,<sup>34</sup> prior risky alcohol use,<sup>35</sup> and age.<sup>36</sup> Insufficient information<sup>37</sup> and inadequate screening<sup>38</sup> may be associated with increased risk of sexually transmitted infections such as HIV or chlamydia, and teens with inadequate access to contraception<sup>39-41</sup> may be at higher risk of pregnancy. In spite of early concerns, a study conducted among Kaiser Permanente members did not find an association between HPV vaccination and risky sexual behavior.<sup>42</sup> Other research has found that the risk of injury in adolescents is linked to mental health symptoms<sup>43</sup> and inadequate safety precautions.<sup>44</sup>

Research conducted by Kaiser Permanente scientists has also demonstrated that obesity and unhealthy behaviors in teens can lead to more serious health problems,<sup>45-51</sup> including metabolic and cardiovascular diseases,<sup>52;53</sup> and that youth with such health problems may experience serious consequences in early adulthood<sup>54-58</sup> or later in life.<sup>59</sup> One line of study explored the contributions of in utero conditions, such as maternal gestational diabetes,<sup>60;61</sup> to obesity in adolescence, and another recent study found that smoking during pregnancy increases the risk of pediatric asthma that persists into adulthood.<sup>62</sup> Maternal cardiovascular health during pregnancy has also been found to predict heart health in adolescents.<sup>63</sup> Our scientists have studied the increase in adolescent obesity during the COVID-19 pandemic,<sup>64</sup> and have explored neighborhood characteristics,<sup>65-69</sup> such as food retail density and recreational options, asso-

**As many as 60% of U.S. adults have at least 1 adverse childhood experience (ACE), including abuse, neglect, parental loss, or family dysfunction.**

**Kaiser Permanente research has linked ACEs with many serious health risks later in life:**



- **Mental health**<sup>77-80</sup>

- **Sexual behaviour**<sup>81</sup>

- **Smoking**<sup>82</sup>



- **Lung disease**<sup>83;84</sup>

- **Chronic pain**<sup>85</sup>



- **Autoimmune disease**<sup>86</sup>

- **Premature death**<sup>87</sup>

ciated with obesity. We have also studied the roles of parental<sup>70</sup> and peer<sup>71</sup> influences, sleep quality,<sup>72</sup> gender,<sup>73</sup> race,<sup>58</sup> parental diabetes,<sup>74</sup> and cancer<sup>75</sup> in the development of obesity and related cardiovascular conditions.

## **Are there subgroups of adolescents who are at particularly high risk for these health problems?**

Kaiser Permanente has long been a leader in research on the health impacts of adverse childhood experiences, or ACEs. These include abuse, neglect, loss of a parent, or family dysfunction.<sup>76</sup> In recent years, our scientists found these experiences to be associated with mental health problems,<sup>77-80</sup> high-risk sexual behavior,<sup>81</sup> smoking<sup>82</sup> and smoking-related illness,<sup>83;84</sup> chronic pain,<sup>85</sup> autoimmune disease,<sup>86</sup> and the risk of premature death.<sup>87</sup> A recent study conducted by Kaiser Permanente researchers suggested that ACEs related to mistreatment were more predictive of mental health symptoms than household dysfunction,<sup>88</sup> while another found that Latino adolescents experienced lower health-related quality of life following stressful life events.<sup>89</sup> Furthermore, as part of our organization's commitment to total health, we

have conducted extensive research on the role of socioeconomic factors in adolescent health risks. Household food insecurity has been linked to diabetes risk and greater use of emergency departments in youth,<sup>90</sup> and lower socioeconomic status has been associated with obesity,<sup>91;92</sup> lack of engagement with substance abuse treatment,<sup>93</sup> and lower health-related quality of life.<sup>94</sup> Youth of lower socioeconomic status may also be more likely to experience toxic stresses associated with health risks.<sup>95;96</sup> Our research has also found that peer influences play a significant role in teens' health-related behaviors, including physical activity,<sup>97;98</sup> use of alcohol and drugs,<sup>99</sup> and treatment-seeking for depression.<sup>100</sup> Finally, our scientists have studied a variety of long-term health risks in youth with spina bifida,<sup>101</sup> scoliosis,<sup>102</sup> preterm birth,<sup>103</sup> cancer,<sup>104;105</sup> and sickle cell disease.<sup>106</sup>

## **What key factors protect adolescents against these risks?**

In addition to studying risk factors, Kaiser Permanente scientists have explored the role of influences that are protective against the development of health problems in adolescents. Social support appears to protect teens from the development of depression<sup>107</sup> and to support recovery from substance use disorders.<sup>108</sup> In particular, studies conducted by our researchers have demonstrated that positive peer and family influences,<sup>109-111</sup> as well as the influence of trusted adults,<sup>37;112;113</sup> can support healthy behaviors<sup>39;70;114-116</sup> and aid in disease prevention.<sup>32;117;118</sup> A recent study conducted among pregnant Kaiser Permanente members found that personal resilience was protective against the development of mental health symptoms in adult women with ACEs.<sup>77</sup> Some of our scientists have also explored the benefits of extracurricular activities among youth.<sup>119;120</sup>

## **Improving Patient Outcomes**

### **What prevention or early intervention strategies are effective in mitigating the health risks faced by adolescents?**

Researchers at Kaiser Permanente have studied interventions for the prevention of common

health problems in adolescents. As part of our organization's approach to preventive medicine, our scientists have studied screening programs for obesity,<sup>45;121</sup> abnormal cholesterol,<sup>122;123</sup> substance use disorders,<sup>124-128</sup> and mental health conditions,<sup>129;130</sup> as well as efforts to screen sexually active adolescents for infections such as chlamydia<sup>131</sup> and HIV.<sup>132</sup> In addition, we have studied a number of counseling and other preventive

interventions targeting these conditions. For example, in a randomized controlled trial involving Kaiser Permanente members, a cognitive-behavioral intervention aimed at teens with depressed parents was found to have benefits over several years,<sup>26;27;133</sup> and pediatric patients undergoing brief behavioral therapy showed lower levels of anxiety at 5 months in another randomized study.<sup>134</sup> Our researchers have also investigated programs targeting risky behaviors such as tobacco use,<sup>135</sup> substance misuse,<sup>136;137</sup> and high-risk sexual behavior.<sup>138;139</sup> We have investigated ways of increasing use of birth control among sexually active teens,<sup>113;140-142</sup> as well as interventions to improve diet and exercise habits.<sup>98;143-146</sup>

## Kaiser Permanente employs a range of strategies with adolescents to prevent future health problems

### Future health problems:



- High cholesterol
- Mental health conditions
- Obesity



- Sexually transmitted infections
- Substance use



- Vaccine-preventable illnesses

### Prevention strategies:



- Behavioral counseling
- Birth control
- Brief counseling and referral



- Parental communication
- Provider training



- School-based services
- Screening



- Sexually transmitted infection testing
- Vaccination

Other research has explored primary-care-based interventions targeting multiple risk behaviors. Training to increase provider confidence,<sup>112</sup> and combining screening and brief intervention with a health educator visit,<sup>147</sup> each yielded positive outcomes, while a mental health intervention alone yielded mixed results.<sup>28</sup> We have also studied the impact of family involvement<sup>117</sup> and health care provider communication<sup>148</sup> on the efficacy of adolescent preventive health. A final component of prevention in adolescents involves vaccinations. The CDC recommends that adolescents receive vaccinations for HPV, meningococcal disease, and the flu in addition to the booster for tetanus, diphtheria, and acellular pertussis. Kaiser Permanente has conducted extensive research on both the effectiveness<sup>149-158</sup> and safety<sup>159-162</sup> of these vaccines, and the factors and strategies affecting their uptake.<sup>163-176</sup> Our scientists have also participated in studying the effectiveness and safety of COVID-19 vaccination in adolescents.<sup>177</sup>

## What are the key factors in effective treatment of the common health problems experienced by adolescents?

Kaiser Permanente scientists have studied many treatment strategies for adolescent health problems, including mindfulness-based therapy,<sup>178</sup> care pathways,<sup>179</sup> collaborative care,<sup>180</sup> cognitive-behavioral therapy with or without medications for mental health conditions,<sup>181-190</sup> 12-step treatment for substance use disorders,<sup>108;191;192</sup> cognitive-behavioral therapy for eating disor-

ders,<sup>193</sup> and insulin for pediatric diabetes.<sup>194</sup> Our research has also demonstrated that outcomes may be improved when providers take teens' growing autonomy into account,<sup>148;195-197</sup> work toward a smooth transition between pediatric and adult primary care,<sup>143;198;199</sup> and emphasize confidentiality in teens' interactions with the health care system.<sup>200-203</sup> In addition, our scientists have explored various ways of providing support for youth with life-threatening illnesses, including cancer.<sup>204-207</sup>

## What are the key components of approaches to reduce disparities in care and outcomes experienced by adolescents?

Researchers at Kaiser Permanente have identified a variety of disparities in access and outcomes among subgroups of adolescents. Our work has found that African American and Latino youth experience greater unmet needs for mental health services, and further work is needed to identify ways to increase the acceptability and cultural appropriateness of services for these teens.<sup>126</sup> Similarly, our research has also found that adolescents of minority sexual orientation may be at higher risk of HIV infection<sup>208</sup> and other negative health outcomes,<sup>209;210</sup> and efforts are needed to improve outreach and care delivery to these patients.<sup>209</sup> One approach to improve health care accessibility has been the delivery of services such as immunizations and screening outside of traditional health care settings; our scientists have evaluated programs delivered in school-based health centers<sup>35;167;173;174;211-214</sup> and other settings<sup>125;172;215</sup> that youth are less likely to find stigmatizing or inaccessible.

## Translating Research Findings Into Policy and Practice

Kaiser Permanente research on adolescent health has contributed to changes in policy and practice. As part of a learning health care organization that works to systematically use research to inform and improve practice, research, clinical, and operational partners within Kaiser Permanente have tested a range of interventions to reduce the risk of common adolescent

health problems and to improve the outcomes young patients experience. Pediatricians and researchers have developed and implemented interventions to address parental hesitancy regarding vaccines;<sup>216-219</sup> this work recently was expanded to include HPV vaccinations in adolescents. Kaiser Permanente also has implemented a successful intervention to screen adolescents for chlamydia in urgent-care settings.<sup>131</sup> However, further work is needed to increase adoption of other effective interventions studied by our scientists, including collaborative care for depression<sup>180</sup> and screening, brief intervention, and referral to treatment for adolescent substance misuse.<sup>35;126;136;220;221</sup> More recent research on the acceptability of gender identity screening and screening for sexual minority status during adolescent wellness visits has supported the implementation of these programs throughout Kaiser Permanente.<sup>222;223</sup> Finally, our integrated electronic health record system has been used to develop novel strategies for predicting higher risks of substance use disorders<sup>224</sup> and suicidal behavior<sup>225;226</sup> in adolescents.

Kaiser Permanente research contributes not only to policy and practice changes within our own care delivery model, but also to advanced national understanding of adolescent health. Kaiser Permanente's research on adolescent health since 2007 has been cited nearly 150 times within recent consensus statements and clinical practice guidelines published by a wide range of entities, including the American Diabetes Association,<sup>227</sup> the CDC,<sup>228</sup> and the American Academy of Pediatrics.<sup>229</sup> In addition, Kaiser Permanente researchers and clinician-scientists have directly contributed as authors of the Guidelines for Adolescent Depression in Primary Care<sup>230;231</sup> and the asthma guidelines of the National Asthma Education and Prevention Program,<sup>232</sup> as well as of guidelines and consensus statements from the U.S. Preventive Services Task Force,<sup>45;124;129;135;233-236</sup> the Advisory Committee on Immunization Practices,<sup>237;238</sup> the American Academy of Pediatrics,<sup>200</sup> the American Heart Association,<sup>239</sup> the Institute of Medicine,<sup>206</sup> and the CDC.<sup>240</sup> Finally, Kaiser Permanente has shown considerable leadership in the broader field of adolescent health research. Our scientists have led a number of prominent studies in this field,

### Collaborative care<sup>177</sup>

**50** adolescents with depression



A **depression care manager** delivered brief education and cognitive-behavioral therapy, and assisted in treatment planning

### Screening, brief intervention, referral to treatment<sup>122-124</sup>

**648** adolescents at Well Child visits



Either a **pediatrician** or a primary-care-embedded **mental health specialist** performed screening, brief intervention and referral to treatment if needed



**Both of these programs found increased treatment engagement and improved outcomes at 1 to 2 years. Currently, our attention is focused on addressing the challenges involved in scaling these programs to support broader implementation.**

including Treatment of Resistant Depression in Adolescents, a 6-site randomized controlled trial that studied the effect of adding cognitive-behavioral therapy to an intensification of pharmacotherapy;<sup>181</sup> the National Institute of Mental Health's Treatment for Adolescent Depression Study;<sup>241</sup> and the SEARCH for Diabetes in Youth study, a multicenter national study sponsored by the CDC and the National Institute of Diabetes and Digestive and Kidney Diseases.<sup>242-245</sup> We are involved in ongoing efforts to study the effectiveness and safety of vaccines delivered to adolescents as part of our involvement in the Vaccine Safety Datalink, a nationwide project sponsored by the CDC.<sup>246</sup> Our scientists were also involved in a National Cancer Institute symposium on data issues involved in studying cancer in adolescents.<sup>247</sup>

Kaiser Permanente's 185 research scientists and 1,530 support staff are based at 9 research centers. There are currently 2,355 studies underway, including clinical trials. Since 2007 our research scientists have published more than 19,000 articles in peer reviewed journals. Kaiser Permanente currently serves approximately 12.5 million members in 8 states and the District of Columbia.

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