

## Kaiser Permanente Research Brief

# OBESITY

This brief summarizes the contributions of Kaiser Permanente Research since 2007 on the topic of obesity, including risk factors, strategies for improving member health and well-being, and translation of research into policy and practice.

Obesity is a common but serious health condition defined by high weight relative to a person's height. Weight-to-height ratios are measured using the BMI (Body Mass Index) scale. In general, a BMI of 18.5 to 24.9 is considered a healthy weight. BMIs in the range of 25 to 29.9 are classified as overweight, and BMIs of 30 or greater are classified as obese.<sup>1</sup> According to the National Center for Health Statistics, more than 39 percent of U.S. adults are obese,<sup>2</sup> and obesity prevalence among children age 2 to 19 is 18.5 percent.<sup>3</sup>

Obesity is an active area of study for Kaiser Permanente Research. Scientists across the program 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 more than 500 articles related to obesity since 2007.<sup>4</sup> Together, these articles have been cited 20,800 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, and medical group and health plan leaders collaborate – lets us contribute generalizable knowledge on obesity, and many other topics of research.

### Kaiser Permanente Publications Related to Obesity since 2007



Source: Kaiser Permanente Publications Library and PLUM metrics, as of 7 July 2018.

a Number of citing journal articles, according to Scopus.

b Number of references in PubMed guidelines.

c Citations in DynaMed Plus, a point-of-care clinical reference tool.

This brief summarizes a selection of the publications contained within the Kaiser Permanente Publications Library, which indexes journal articles and other publications authored by individuals affiliated with Kaiser Permanente. The work described in this brief originated from across Kaiser Permanente's 8 regions and was supported by a wide range of funding sources including internal research support as well as both governmental and non-governmental extramural funding.

## Understanding Risk

Kaiser Permanente researchers have contributed to understanding the risk of developing obesity, as well as the other health risks that people with obesity face.

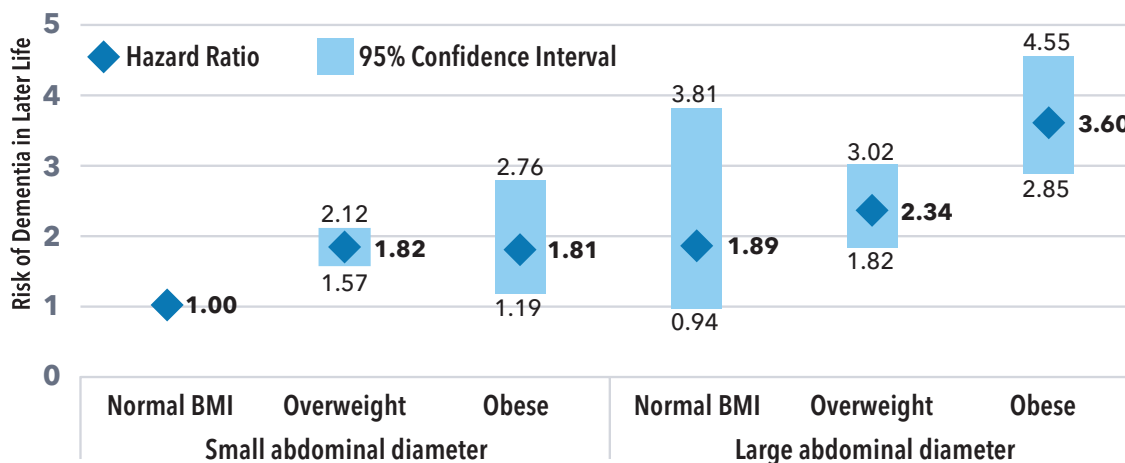
### Who is at risk for developing obesity?

Obesity risk is present throughout a person's lifespan, and no one is immune to obesity. Our researchers have identified a host of specific risk factors for overweight and obesity. These include food-related factors (such as eating patterns, the food and food culture at home and in the community, and availability or affordability of healthy and unhealthy eating options),<sup>5-9</sup> physical activity behaviors and sedentary time (for example, television and screen time),<sup>10</sup> and genetic factors.<sup>11-14</sup> For children, growing up in a household with overweight and obese adults is a risk factor.<sup>15,16</sup> Obesity is also associated with factors for which the causal pathway is not entirely clear, such as sleep duration and sleep quality.<sup>17-21</sup> Obesity prevalence is higher among certain racial and ethnic populations, a difference that is attributed to a mix of genetic and non-genetic factors.<sup>11,22</sup>

### What other health risks do people with obesity face?

People with obesity experience a range of health risks. Among the most pervasive and well-known are cardiovascular and metabolic diseases,<sup>11,23</sup> select cancers,<sup>24-27</sup> lower-extremity injuries,<sup>28-31</sup> and breathing and sleep disturbances such as sleep apnea or chronic obstructive pulmonary disease.<sup>11,24,32-37</sup> In the Patient Outcomes Research to Advance Learning study's "weight cohort"<sup>38</sup> and other studies, our researchers have described specific cardiometabolic risks that are known to be frequently present among people who are overweight or obese. These include elevated blood pressure; elevated levels of low-density lipoprotein cholesterol (LDL-C), triglycerides, fasting plasma glucose, and C-reactive protein; and low levels of high-density lipoprotein cholesterol (HDL-C or "good cholesterol").<sup>39,40</sup>

**Central obesity in midlife is an independent risk factor for dementia in later life.** Compared to adults with normal BMI and small abdominal diameter, overweight and obese adults were more likely to develop dementia. For those with both obesity and large abdominal diameter, the risk of dementia was 3.6 times higher.<sup>41</sup>



Kaiser Permanente researchers are also contributing to knowledge about a host of newly emerging risks, such as the link between obesity and dementia, including Alzheimer’s disease.<sup>41-43</sup> Other risks associated with obesity that our researchers have investigated include depression or social isolation;<sup>11</sup> experiences of bias and bullying;<sup>11,44</sup> and quality of life and physical functioning.<sup>30,45,46</sup>

Obesity can also affect the treatment of other conditions. Kaiser Permanente researchers have described uncertainty in correct dosing of certain medications in obese people, such as chemotherapies<sup>47</sup> or heparin.<sup>48</sup> Women with obesity may also be less likely to complete recommended gynecologic cancer screening<sup>49</sup> and mammography.<sup>50,51</sup>

## Improving Patient Outcomes

### What strategies are effective in preventing obesity?

Preventing obesity is a critical strategy to curb the growth in the absolute numbers of people who are overweight and obese globally, which are projected to reach 2.16 billion and 1.12 billion respectively by 2030.<sup>52</sup> A nutritious diet and adequate physical activity are beneficial for people in all weight groups and contribute to obesity prevention. Researchers have also linked sleep adequacy with obesity, suggesting another behavioral factor in preventing obesity.<sup>19,20</sup>

Our researchers have contributed to the growing evidence around methods to encourage behavior maintenance and weight maintenance, irrespective of weight status.<sup>53-57</sup> Kaiser Permanente physicians and researchers have implemented “Exercise as a Vital Sign” within the organization’s electronic health record system, which incorporates physical activity questions into every routine outpatient visit and prompts clinicians to offer brief counseling to maintain healthy behaviors and modify unhealthy ones.<sup>58-62</sup> However, there are many barriers to consistently screening for physical activity and delivering the brief intervention,<sup>62</sup> and further work is needed to improve consistent follow-through.

One special population in which weight control is of heightened importance is pregnant women. Excessive weight gain during pregnancy is associated with gestational diabetes (and related health risks for both mother and child) and persistent weight concerns for the mother after pregnancy.<sup>63,64</sup> Our researchers have also found that high gestational weight gain (and maternal hyperglycemia) is associated with childhood overweight and obesity.<sup>65-67</sup> Among women who are already overweight



or obese, Kaiser Permanente researchers have studied interventions designed for weight loss before becoming pregnant,<sup>68</sup> as well as dietary interventions during pregnancy to limit gestational weight gain.<sup>69</sup>

## How does early identification of obesity affect outcomes?

Routine screening is used to identify people who are overweight or obese, and is recommended in children, adolescents, and adults based on the availability of effective treatments.<sup>11,70,71</sup> Early identification of unhealthy weight gain may have additional importance because there is evidence that the human body adapts to and defends its excess weight, counteracting calorie restrictions and other dietary changes.<sup>72,73</sup> Furthermore, after obesity has persisted for some time, biological adaptations are triggered that act on fat storage capacity and dopamine signaling (which helps control the brain's reward and pleasure centers), triggering food overconsumption.<sup>72</sup> As such, the treatment of obesity grows increasingly difficult the longer it has persisted.

## What are the key factors in effective treatment of people with obesity?

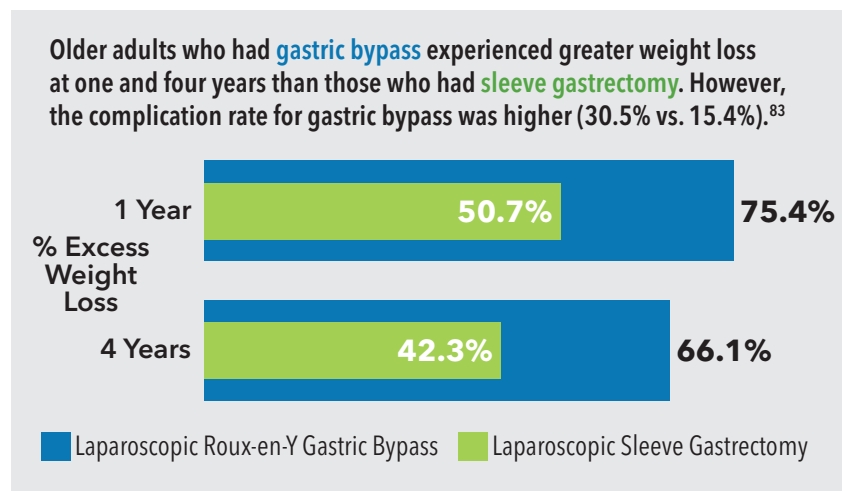
People who are overweight or obese can modify their behaviors, habits, and environment to improve their health in many ways. For people with obesity and other common co-occurring conditions, even a very modest amount of weight loss can have important health benefits. For example, studies have found that weight loss was associated with declines in stress and depression,<sup>74</sup> with improved blood pressure,<sup>75</sup> and with improvements in symptoms among obese adults with asthma.<sup>76</sup>

**Behavior Change.** For people who are overweight or obese, dietary changes are a key factor in weight loss.<sup>9,77-79</sup> In particular, adopting low-carbohydrate diets,<sup>78</sup> decreasing intake of other energy-dense foods,<sup>77</sup> and reducing consumption of liquid calories (such as from sugar-sweetened beverages)<sup>9</sup> can be effective dietary strategies. These changes can be combined with increased intake of fruits and vegetables,<sup>79</sup> low-fat dairy products,<sup>79</sup> and other foods low in energy density and containing more fiber.

Increasing physical activity – in combination with nutritional changes – can also contribute to weight loss and weight maintenance.<sup>80</sup> Moreover, physical activity is important for people with obesity even if it doesn't result in weight loss. Our researchers have shown that people who are both obese and active are healthier in terms of important cardiometabolic factors than those who are obese and inactive.<sup>81</sup>

Our researchers have studied a range of evidence-based behavioral interventions to address obesity – such as the Diabetes Prevention Program, Weight Watchers, and others<sup>82-84</sup> – and have concluded that there is strong support for the efficacy and effectiveness of such programs.<sup>85</sup> Some of the key behavior changes taught in these programs that are associated with maintaining a significant amount of weight loss over time include food and physical activity journaling; cooking most meals at home (not eating out); weighing one's self regularly (daily or every other day); and setting a baseline for physical activity that is 2 to 3 times more than the standard recommendation of 30 minutes per day/5 days per week.<sup>80,86-92</sup> Patients have also reported that social support is key for weight maintenance, leading to the recommendation that weight loss programs consider involving family and friends to support long-term success.<sup>88,93</sup>

**Surgical Approaches.** Weight-loss surgeries are an available complement to behavior-change approaches for treating obesity. For people with obesity and diabetes, our researchers have shown that bariatric surgery was associated with substantial weight loss compared to nonsurgical approaches, and also resulted in better odds of diabetes remission.<sup>94</sup> Kaiser Permanente researchers have described the comparative effectiveness and complication rates of various types of weight-loss surgeries, and described differences in outcomes according to procedure type, age at time of surgery, level of obesity before surgery, and other factors.<sup>95-97</sup> The benefits of bariatric surgery appear to be durable over time for many, but not all, patients.<sup>98,99</sup> However, there is evidence of differences between racial/ethnic groups in outcomes after bariatric surgery (such as resolution of metabolic syndrome and overall weight loss), and evidence that surgery is more effective for younger and less obese patients.<sup>100-102</sup>



**Children.** Screening and early intervention are particularly important in children, since obesity during childhood and adolescence is predictive of obesity as an adult.<sup>103</sup> Treatment of obesity in children differs from treatment in adults, because children are often reliant on others (parents, school environment, home environment) for their nutrition, access to or engagement in physical activity, and other factors.

Our researchers have conducted a number of studies testing models to improve physical activity and nutrition in schools,<sup>104-106</sup> developed an instrument for assessing the home environment,<sup>107</sup> tested phone counseling for parents of overweight children,<sup>108</sup> and created other parent-focused approaches.<sup>109</sup> Within the past decade, evidence to support effectiveness of behavioral interventions for weight management among children and adolescents has emerged, and routine screening for obesity in youth is now recommended.<sup>11,70</sup>

## Translating Research Into Policy and Practice

### How has Kaiser Permanente research on obesity contributed to changes in policy and practice?

Kaiser Permanente is a learning health care organization that works to systematically use research to inform and improve practice both within and outside of Kaiser Permanente. Research, clinical, and operational partners within Kaiser Permanente have tested a range of interventions to reduce the risk of obesity and improve outcomes for people with obesity. We have reviewed the evidence for intensive behavioral weight-loss counseling programs delivered in person and by telephone, and by a range of interventionists, such as primary care providers, dietitians, and medical

assistants.<sup>110-112</sup> We have implemented “Exercise as a Vital Sign”<sup>58-62</sup> in our electronic health record system, and continue to encourage clinicians to engage with patients of all weights to promote healthy habits. Kaiser Permanente has also invested in community health initiatives that promote obesity-prevention policies and environmental changes in the communities we serve.<sup>113-117</sup>

Our researchers have participated in studies assessing obesity prevention programs that involve work, school, and community-level environmental and policy changes such as healthier offerings in vending machines and cafeterias.<sup>113,114,118-122</sup> These studies have suggested that site-based interventions must be high-intensity to be effective at a population level.<sup>117</sup> However, these strategies offer a pathway for health plans to prevent obesity among their own employees.

Kaiser Permanente’s research on obesity since 2007 has been cited 100 times in consensus statements, clinical practice guidelines, and point-of-care decision aid tools for clinicians. Guidelines citing our research have been published by a wide range of entities, including the American Society for Metabolic and Bariatric Surgery, the American Association of Clinical Endocrinologists, and the American Heart Association. In addition, our researchers and clinician scientists have directly contributed as authors of guidelines for the management of overweight and obesity in adults,<sup>71</sup> routine assessment of physical activity in health care,<sup>62</sup> and screening for obesity in children and adolescents.<sup>11,70</sup>

### Top 10 most cited articles on obesity from Kaiser Permanente authors since 2007

Title	First Author	Year	References
Association analyses of 249,796 individuals reveal 18 new loci associated with body mass index	Speliotes, EK	2010	1,584
Global burden of obesity in 2005 and projections to 2030	Kelly, T	2008	1,102
Genetic studies of body mass index yield new insights for obesity biology	Locke, AE	2015	845
The obese without cardiometabolic risk factor clustering and the normal weight with cardiometabolic risk factor clustering: Prevalence and correlates of 2 phenotypes among the US population (NHANES 1999-2004)	Wildman, RP	2008	776
2013 AHA/ACC/TOS Guideline for the management of overweight and obesity in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and The Obesity Society	Jensen, MD	2014	458
Comparison of strategies for sustaining weight loss: the weight loss maintenance randomized controlled trial	Svetkey, LP	2008	409
Central obesity and increased risk of dementia more than three decades later	Whitmer, RA	2008	379
Childhood obesity and metabolic imprinting: the ongoing effects of maternal hyperglycemia	Hillier, TA	2007	371
New genetic loci link adipose and insulin biology to body fat distribution	Shungin, D	2015	305
Effectiveness of weight management interventions in children: a targeted systematic review for the USPSTF	Whitlock, EP	2010	297

Kaiser Permanente’s nearly 170 research scientists and more than 1,600 support staff are based at 8 regional research centers and 1 national center. There are currently more than 2,500 studies underway, including clinical trials. Since 2007 our research scientists have published more than 12,000 articles in peer reviewed journals. Kaiser Permanente currently serves more than 12 million members in 8 states and the District of Columbia.

This brief was written by Anna C. Davis, Nicholas P. Emptage, and Elizabeth A. McGlynn. It is available online from [share.kp.org/research/briefs](http://share.kp.org/research/briefs). The authors wish to thank the following researchers for their contributions to the development of this brief: David E. Arterburn and Deborah R. Young.

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