Despite the significant attention and resources committed to the prevention and treatment of childhood obesity, the epidemic shows no sign of abating. Although all children are at risk for obesity, there are marked disparities by race/ethnicity, socioeconomic status, neighborhood, and access to health care. Any successful approach to addressing the overall burden of obesity must not rely solely on the healthcare system, but must include the implementation of policies that take into account the physical and social environment to change the eating and activity behaviors of children and their families. Examples of such policy efforts include the attempts to ban food marketing to children and their families. Examples of such policy efforts include the attempts to ban food marketing to children and to increase access to safe and appealing venues for exercise. Despite these important policy directions, efforts to sustain changes in behavior remain challenging, and the evidence about which interventions are most effective is still incomplete.

Social networks are groupings of interconnected 2-way relationships. Modern-day social networks typically rely on social media for communication. More specifically, the term social media refers to the use of Web-based and mobile technologies that are commonly used for interaction and communication within networks. Research underscores strong associations between participation in social networks and preventive health behavior. Recently, it was observed that obesity may spread across social networks, suggesting that these networks could be leveraged for prevention or treatment. The main purpose of this statement is to evaluate the role of social networks and social media in relation to childhood obesity. We build on a recent statement by the American Heart Association directed at the management of adult weight management strategies in the ambulatory setting that focused on the use of Internet-based and other related technologies. In this statement, we provide an overview of social networks and their relationship to health and obesity and describe social network--based interventions. In addition, we review specific intervention strategies for obesity that rely on various forms of social media. Finally, we suggest recommendations for future directions.

Overview of Social Networks
As groupings of interconnected relationships, social networks can be constructed by asking individuals, referred to as “egos,” to nominate contacts, referred to as “alters.” For example, a school-aged child (ie, ego) may be asked to nominate 5 best friends (ie, alters), creating ties between the ego and the alters. Both the directionality (eg, reciprocal versus unidirectional) and the strength of the relationships are...
important when considering social influence. Both strong and weak ties affect health, and their relative roles and importance in networks are subjects of current research.15 Strong ties (eg, family and friends) are characterized by emotional attachment, reciprocity, and time spent together,16 and often link people with similar characteristics, whereas weak ties (eg, acquaintances) tend to be more formal and organized by social rules and roles.15 Strong ties may be more important in relation to social support, whereas weak ties may serve as information conduits and may link individuals to other contacts and resources.15,16 Both strong and weak ties likely help to establish cultural norms.15,17

People tend to select friends with similar behaviors, interests, and appearances. Researchers must disentangle peer selection based on this similarity, known as homophily, from causal peer influences on an individual’s behaviors, known as induction.2,18 The environmental context is another important factor affecting social networks. Friends may exhibit similar behavior because they are subject to the same environmental constraints or social circumstances, such as neighborhood, school setting, or socioeconomic status.19

Pathways Linking Social Networks to Health
Social networks can influence health through numerous pathways. Alters may provide emotional support, instrumental support (financial or practical), informational support, or appraisal (decision-making) support.20 Social support, whether real or perceived, can buffer stress by enhancing coping skills.17 Although social support may buffer stress, social interactions can also be a source of stress, thereby negatively affecting health.17 Another pathway is social integration, which can increase access to health information and promote self-worth and self-care on the basis of societal norms and expectations.17 However, if cultural norms promote unhealthy behaviors, social integration could negatively affect health. For example, smoking was once a highly accepted and socially valued behavior that was more common in higher socioeconomic groups. Social norms have changed, and smoking is now considered a destructive behavior. Smoking is now more common in lower socioeconomic and disadvantaged populations and is likely implicated in social inequalities in health.21,22

A separate concept that is related to social networks is social capital. Social capital has been defined as the resources obtained by a group or an individual through a network of social relationships, as well as the number and quality of the relationships in the network.23 An alternative definition of social capital focuses on the trust, norms, and networks that social organizations provide that allow the facilitation of coordinated action to advance civil society, democratization, and political development.24 Thus, social networks may enhance health by contributing to social capital, and social capital can be thought of as a capital that resides between individuals, enabling them to access other resources or benefits.

Social Networks and Childhood Obesity
An analysis of the Framingham Heart Study, which included only adults, found that spouses, siblings, and friends were at greater risk for obesity if their alters were obese. Furthermore, the risk of obesity was increased for those contacts up to 3 ties away.12 Among children and adolescents, body mass index (BMI) is associated with school-based friendship clusters; school friends are significantly similar in terms of their BMI, with friends of the highest BMI appearing to be most similar. The frequency of fast food consumption clusters within groups of boys, as do body image concerns, dieting, and eating disorders among girls.19 The same is true for tobacco use in that peer pressure is a potent stimulus for smoking initiation.25 Additional longitudinal research is needed to clarify the degree to which these associations are due to induction, homophily, or environmental factors.19

Overweight youth are more likely to be socially isolated and marginalized.26–28 Social networks can also affect their body image. For example, adolescents are more likely to underestimate their own weight status when surrounded by obese peers.29 Obesity-related health behaviors are also associated with adolescent social networks, including participation in organized sports, fast food consumption, and computer/video game screen time.30 Social networks therefore may be critical in shaping young people’s eating behaviors and body weight and vice versa, and their role suggests the potential of social network–based health promotion interventions.

The Role of the Built Environment
The built environment may modify the extent to which social networks affect childhood obesity.31 The built environment encompasses the constructed and open spaces outside the family home, including commercial and noncommercial buildings, public open areas, such as parks playgrounds and green spaces, and road and transportation infrastructure.32 Features of the built environment such as unfavorable community design and poor transportation infrastructure are associated with decreased energy expenditure.33,34

Social capital can also be adversely affected by an environment that limits social connections, such as high-traffic areas and the presence of dense commercial areas.35,36 Combining social network analysis with environmental assessment can identify interventions for childhood obesity treatment or prevention.37 Interventions modifying the built environment may be more likely to be successful if such efforts are designed to enhance social networks. Specific improvements to the built environment could be designed to promote face-to-face contacts and to encourage the formation of social networks.39 Moreover, providing safe and appealing places for peer groups could extend social networks and promote the diffusion of healthy behaviors. For example, improving the condition of school fields, making them available for use outside of school hours, ensuring safe access, and providing supervision support the formation of social networks and involvement in structured physical activity both during and after school.30,35,40 Geocaching, an activity during which individuals or groups search for items described on Web sites using navigational tools, such as GPS tracking devices, also leverages social networks and the built environment to increase physical activity. Thus, participation
Interventions Targeting Existing Social Networks

All individuals are members of many diverse social networks. Strategies have been developed to identify opinion leaders within social networks (e.g., local celebrities, community observation, interviews). It is unclear, however, whether these opinion leaders could be recruited to develop strategies to affect childhood obesity within social networks. However, a cluster-randomized, controlled trial of a peer-led program based on these strategies was effective for tobacco prevention among adolescents.

The association between social networks and participation in structured physical activity suggests that there is opportunity to develop school-based interventions within physical education classes to target obesity. The Chefs Move to Schools initiative within First Lady Michelle Obama’s Let’s Move campaign encourages chefs to partner with schools to support the creation of healthy, affordable meals and to educate children on healthy cooking and eating. Because of budget constraints within schools, such interventions will need to be relatively inexpensive and easy to adopt. In addition, churches and other religious settings can serve as important environments for community-based participatory interventions. Such an effort has recently been established to develop a culturally appropriate faith-based obesity intervention examining diet, physical activity, and body image in black children, parents, and church leaders in the Sunday school setting. Future work will need to evaluate the effectiveness and sustainability of such interventions.

Many adolescents are part of virtual social networks defined by Internet use. Social network sites like Facebook represent natural points for intervention. Data from these sites have been used to assess the association between social networks and a variety of outcomes. However, we are unaware of studies that have developed interventions specifically within these social networks. Identifying and measuring outcomes would be difficult. The ethical issues involved in social media interventions are beyond the scope of this statement, and it is the responsibility of each researcher to give this topic careful consideration.

Interventions Based on the Purposeful Development of Social Networks

In addition to targeting existing social networks, future interventions could be based on the development of social networks purposefully developed to address obesity. In fact, this is the basis of the Weight Watchers program. Little is known about the effectiveness of these programs in children or adolescents or whether parental involvement has spillover beneficial effects for obesity prevention or treatment in their children. However, these programs are easily accessible and are now available over the Internet. Another example is the Weigh2Rock program (http://www.weigh2rock.com), which offers online health and weight loss education; an online support community of several thousand overweight kids, teens, and parents; and self-managed personal weight loss charts and goal setting, which may be viewed by a child’s healthcare provider.

Social Media: Internet-Based Strategies

Recent advances in technology provide new and emerging tools as interactive methods of intervention for the treatment and prevention of obesity. Nearly all (95%) adolescents 12 to 17 years of age have Internet access, and most are active in online social media. Internet-based programs and other electronic technologies have been used in both the treatment and prevention of overweight and obesity in youth. Benefits of the form of these interactive electronic interventions include their widespread availability in the school and home, popularity among youth, ability to engage and immerse participants, and ability to provide immediate tailored feedback. These technologies can also be used to provide specific content addressing healthy lifestyles with regard to diet and exercise. In addition, these technologies hold significant promise for application in the research setting because they are relatively inexpensive to scale up for broad implementation and can facilitate data collection.

Randomized Trials of Internet-Based Obesity Interventions

Several Internet-based randomized trials have been performed in overweight children and adolescents. An et al performed a systematic review of studies published in peer-reviewed journals that used randomized, controlled trials via the Internet and reported weight loss, BMI change, physical activity, and dietary intake as outcome variables. Studies were included only if the Internet intervention was directed toward study participants or their families, not solely toward healthcare providers. Eight studies were included. Studies were variable in their use of social media as the main agent of therapy or as an adjunct to other types of therapy, including nutrition and physical activity engagement.
Six of these studies suffered from small sample size (n=35–80), and 3 studies were from the same cohort of patients. Doyle et al and Celio et al demonstrated a reduction in BMI z scores in those receiving an interactive Internet-delivered cognitive behavioral program compared with those receiving usual care with basic information provided on nutrition and physical activity. Baranowski et al, however, did not show any significant difference in girls randomized to a monthly Internet intervention and those receiving no Internet intervention; however, both groups also attended a special 4-week summer day camp, and there was a significant difference in the baseline mean BMI between the Internet intervention group (21.1±4.4 kg/m²) and the control group (26.3±7.9 kg/m²). White et al and Williamson et al studied the same cohort, demonstrating that active family-based behavioral Internet interventions resulted in more loss of body weight and lower dietary fat intake than passive primary health education. The Internet-based interactive program included e-mail counseling on self-monitoring, problem solving, goal setting, and relapse prevention. Compared with a noninteractive program, greater efficacy was seen in the interactive program.

In 2 larger studies, Marks et al studied 359 adolescent girls and did not demonstrate any significant difference between subjects receiving intervention over the Internet and those receiving a print workbook, with both groups improving in the degree of physical activity, self-efficacy, and intentions. Haerens et al studied 2991 seventh and eighth graders, randomizing them to receive a computerized, tailored intervention either with or without parental involvement or to a control group with no intervention. In girls, the 1- and 2-year differences in BMI and BMI z score in the intervention with parents group were significant. There was a significant sex interaction with no positive intervention effect seen in boys.

Recently, a school-based, randomized, controlled trial in rural Louisiana was implemented within 14 schools using a student Web site, an Internet counselor Web site, and an Internet counseling process. The Internet intervention contained lessons on health eating and regular physical activity, and students communicated with a counselor through a chat room and e-mail. This study was focused on the prevention of weight gain.

In summary, findings from these studies have been mixed, with some finding improvement. Interpreting the effectiveness of these interventions and the role of social networks is challenging because of the small sample sizes, the variations in treatment provided to the intervention and control groups, the outcome measures, and the duration of follow-up. Furthermore, there was variable use of the Internet-based interventions, raising questions about the degree to which the interventions led to meaningful virtual social networks. Two other larger trials had similar limitations and had mixed results. Although some of these studies focused on the prevention of abnormal weight gain and the treatment of overweight and obesity, studies also need to be performed on the maintenance of appropriate weight once weight loss is achieved.

Of note, attrition rates affect the overall power of the studies. Log-on rates, which are measures of program use, are highly variable. E-mail reminders, financial incentives, and the provision of a Web master to help participants with technical difficulties can have positive effects on the log-on rate.

Social Media: E-Mail and Texting Interventions

Several studies have demonstrated the benefit of e-mail and texting interventions on weight loss in adolescents. However, these interventions do not necessarily work through social networks, especially if communication is not bidirectional. A school-based intervention incorporating physical activity monitoring with pedometers and e-mail support was successful in promoting physical activity and selected healthy eating behaviors in adolescent boys and girls. Lubans et al provided adolescents with an intervention incorporating pedometers and e-mail support on physical activity, sedentary behavior, and healthy eating. Among those in the intervention group, boys increased their step counts by 956±4107 steps per day and girls by 999±1999 steps per day. The intervention significantly decreased the number of energy-dense/low-nutrient snacks consumed by boys (P=0.043) and increased the amount of fruit consumed by girls (P=0.028). The intervention did not have a statistically significant effect on sedentary behavior.

Similarly, text messaging has also been used as a modality for intervention. Text messaging may be especially useful for self-monitoring because of the potential for providing both support and immediate feedback based on a patient’s specific goals. In a study to evaluate the use of sweetened beverages and amount of screen time and physical activity in adolescents, Shapiro et al randomized study participants to text messaging with feedback, paper diaries, or an unmonitored control group. Children randomized to the texting intervention had lower attrition (28%) than both the paper diary (61%) and control (50%) groups and significantly greater adherence to self-monitoring than the paper diary group (43% versus 19%: P<0.02). Seventy-two percent of the texting group completed the study versus 39% and 50% in the paper diary and control groups. From this study, children appear to prefer a technological, tailored, interactive program over a more traditional paper diary program, and when enrolled, those using texting had greater adherence and higher completion rates.

Other Social Media Technologies

Active video games enjoy widespread appeal to youth and have been demonstrated to increase energy expenditure and physical activity compared with sedentary video gaming. Several of these technologies also offer Internet connectivity, including Nintendo Wii Fit and Microsoft Kinect, and the ability to join an online gaming service that allows one to play games against other members in its online community with the use of an avatar. A recent study of the effects of the exergaming experience found that seeing the image of self
Role of the Clinician in Using Social Networks to Treat Adolescent Obesity

The American Academy of Pediatrics–endorsed 2007 recommendations from the Expert Committee on the Assessment, Prevention and Treatment of Child and Adolescent Overweight and Obesity make no mention of social networks. This is not surprising, given that the evidence gathered to that date was preliminary and that the recommendations focused on what primary care practitioners could do in their offices and clinics. In fact, although adolescents and their families are likely to recognize a problem with overweight, it is the primary care practitioner following the adolescent over time who has the growth data to quantify the magnitude of the problem accurately for the family. That same practitioner, who often is a trusted source of information on health issues, is also in a position to assess and affect the adolescent’s and family’s motivation to change.

It is for this reason that these recommendations cite motivation, particularly motivational interviewing, as part of the clinician’s role. A full discussion of motivational interviewing is beyond the scope of this review. Briefly, motivational interviewing takes into account readiness to change, uses neutral questions and reflective listening to explore the beliefs and values, and in so doing elicits motivation. As a next step, the clinician is in a position to work with the adolescent to create strategies to address the problem. The clinician could use motivational interviewing to work with the adolescent on diet and physical activity issues on a one-to-one basis. Although there is a lack of studies on the use of motivational interviewing with respect to social network or social media use, it would undoubtedly be a more efficient and possibly more effective use of the clinician’s time to direct the adolescent and family to a social networking resource on this topic. The clinician could then continue to serve as a resource to the adolescent and family by providing accurate information, advice, and monitoring of growth but defer the bulk of intervention to the social networking site. In addition, the clinician could reinforce the use of the social networking resource, which can be challenging to sustain over time. Motivational enhancement delivered through social media (typically facilitated online or through electronic communication by a counselor in a nonjudgmental manner) may be helpful in sustaining efforts in weight loss.

Future Directions for Clinicians, Policy Makers, and Researchers

The results of these several studies and ongoing initiatives support the promise and potential of social media and electronic technology as a viable component of weight management programs and underscore the need for additional research to optimize these technologies as effective delivery channels for youth. The Table lists the general steps and describes the key components to guide the development of interventions targeting social networks. In general, more evidence is needed to support specific strategies for incorporating...
collaborative approaches for weight management. Future work should address whether engagement within a social network either increases the effectiveness of these interventions or promotes greater sustainability. Most treatment is aimed at behavior changes, which include such elements as stimulus control, self-monitoring, goal setting, and rewards. Clinicians, policy makers, and researchers should consider flexible models for behavior change in adolescents that use social networks and social media and determine how the use of social networks and social media applies to each of these elements of behavior change.

Planning and training should be incorporated into collaborative approaches that involve physicians, nurses, or other providers. Potential collaboration with industry will require transparency to promote healthy behavior over promotional activity for a given product. In addition, electronic technology is constantly evolving and will require continual reevaluation over time. There is clearly a need for larger studies, particularly those that include technologically based interventions that enroll a diverse spectrum of overweight and obese adolescents in terms of sex, race, geographic location, and socioeconomic status. Large sample sizes are required to investigate whether different demographic characteristics modify the impact of social networks and social media on subsets of the population. There is also a need to investigate the specific features of technology-based interventions (eg, content, format, device) that make such interventions appealing to youth and successful in promoting healthy weight. However, it is the mere existence of the technology itself rather than any specific attribute of it that is important to recognize; those who are interested in public health or in providing medical care will likely see social media become a powerful and perhaps dominant communication tool of the 21st century.

Although social networks may be developed to bring about a desired behavior change, it will be important to harness the content of the relationships as they exist within a particular network to inform and direct interventions that are likely to be sustainable. The use of social media with interactive bidirectional interventions, coupled with parental involvement, appears to hold promise. The development of methods to ensure privacy protection and monitoring of outcomes should take priority. Initiating and sustaining behavior change in accordance with the values and goals of the members of that social network needs to be the goal toward empowering members of the community to use the strength of their social ties to choose pathways toward health promotion.

Disclosures

### Writing Group Disclosures

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*Significant.
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Approaches to the Prevention and Management of Childhood Obesity: The Role of Social Networks and the Use of Social Media and Related Electronic Technologies: A Scientific Statement From the American Heart Association

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