While increasing numbers of health professionals seek to counsel their overweight and obese patients on weight loss, the recommendation to “eat less and move more” has proven largely ineffective (Benjamin, 2002; Wansink, Shimizu, & Camps, 2012). Instead of encouraging dieting, some health professionals are helping their patients understand how factors in their eating environments such as their homes may lead them to overeat, and how they can change these environments to help them effortlessly eat less (Escott-Stump, 2008; Miller & Rollnick, 2002). The long-term effectiveness of changing one’s eating environment, such as using smaller plates to downsize portions, could be examined through randomized controlled trials. Another approach to obtain useful insights might be to simply contrast the homes and kitchens of normal-weight individuals with those who are obese. Since more than half of household food budgets are composed of at home foods (Ayala et al., 2008), understanding how the home food environment interacts with overall health outcomes such as obesity might highlight overlooked intervention points that a health professional could easily ask an obese patient to consider (Wansink, 2014). Indeed, our primary research questions are to identify associations between characteristics of kitchen spaces, such as what foods are on the counter, and how these associations are distributed across males and females.

There is interesting precedent for such studies. Controlled observations of 213 non-Asian diners at all-you-can-eat Chinese buffets showed remarkable behavioral differences between obese diners (body mass index [BMI] > 30) and diners of normal weight (BMI < 25). Obese diners behaved in ways that made the buffet food more visible and convenient to them (Wansink & Payne, 2008). They sat 8 meters closer to the food and were 55% more likely to face the food and to use larger plates (Wansink, 2014). In contrast, normal-weight diners were more likely to use chopsticks than cutlery and to scout out the food instead of immediately picking up a plate and start serving themselves. Similarly, experimental field studies of visibility and convenience have shown dramatic differences in intake over short periods of time. For instance, office workers’ daily intake of chocolates dropped from 225 kcal to 100 kcal, a 56% decrease, when their candy dish was moved 2 meters away from their desks (Mackner, McGrath, & Stark, 2001).

While previous research has identified how an individual’s immediate environment strongly influences food decisions, little attention has been directed to understanding this phenomenon in...
A nationwide sample of 500 adult women with at least two children under the age of 18 living at home was recruited for a survey study. Cornell University’s Institutional Review Board approved of the study. This demographic was chosen as a target because women are, in general, more likely to be discontent with their current weight and at risk for weight gain (Slevec & Tiggemann, 2011). In addition, women still handle two thirds of household work, with cooking and cleaning taking the most time (Lachance-Grzela & Bouchard, 2010), making them more often than not the household’s nutrition gatekeeper (Wansink, 2006) and exposing them with greater frequency to the home food environment. The sample size of 500 was estimated to be sufficient to achieve a representative sample.

The survey was conducted online by a national panel service called e-Rewards to obtain an unbiased sample. In this service, people sign up to join a consumer panel by invitation from a sponsor company, complete surveys, and get rewarded with discounts on goods and services. Panel members were recruited “by-invitation-only” and remunerated with $4.00 in e-Rewards currency. No mention was made that the study involved weight. The survey was conducted on consecutive days from September 1 through 6, 2011.

The primary objective of this survey was to understand food behaviors at home and four questions related to kitchen environments. Thus, one of the secondary objectives was to gather preliminary data illustrating household kitchen spaces, primarily counter tops in this study, and how these spaces correlate with BMI. To collect the appropriate measures, respondents were asked yes/no questions about the presence of foods and appliances on their home kitchen counters. Specifically, they were asked if cookies, candy, packaged food (chips, crackers, pretzels, and cold cereal), a fruit bowl, a toaster, and/or a blender or food processor were located on their counter at the time when taking the survey. In addition, they were asked to report their weight and height, as well as the weight and height of their spouse (when applicable), which has been shown to be reasonably accurate (Jeffery & Rick, 2002). Spouses were assumed to be male. BMI scores were calculated based on weight and height reports. Respondents were required to fill in the full survey so there were no missing values in the analysis.

Of the 500 women surveyed, those with BMI less than 18 were excluded from the analysis due to being underweight or having misreported their height or weight. In addition, individuals in the underweight category have potential health challenges that are outside the scope of this study (Ahern, Bennett, & Hetherington, 2008). Analysis of variance was used to identify differences in BMI associated with the presence or absence of kitchen countertop items. The analyses were done separately for women and men.

**Study 2. The Syracuse Study: Kitchen Counter Correlates of Obesity**

Adults with at least one child under the age of 18 living at home in Syracuse, New York, were recruited to the in-home observational study through various methods. These methods included fliers, which were sent to schools, grocery stores, and public places such as the library, word-of-mouth by current participants, contacts by researchers in parking lots outside of large retail stores, and advertisements on radio stations. Cornell University’s Institutional Review Board approved of this study. Individuals from 210 households expressed their interest to take part in the study.

A representative member from each household filled out an enrollment form that asked for their address, e-mail, gender, age, height, household size, and what percentage of household meals they prepared. Once the initial enrollment was completed, trained field researchers established a time and date with the primary contact to visit the home and collect more specific household information. Standard household characteristics and participant information such as income, education, marital status, employment, ethnicity, height, and weight were collected. Recruitment and home visits were carried out between March and June 2011. Participants were compensated with gift cards for participating in the study.

A primary objective of this second study was to build on the preliminary results from Study 1 and collect more comprehensive and objective information about the household’s kitchen space, and not just the counter top. In other words, an inventory was taken of all the visible items in the kitchen, which included the counter top, table, and any other place where food may have been kept in the kitchen. Thus, the home visit described above also allowed researchers the opportunity to observe kitchen environments in order to collect reliable data for the kitchen-scape free of self-report bias. During the home visit, researchers recorded what food items and appliances were visible in the kitchen, but did not open cupboards, drawers, refrigerators, or move items on the countertops.
Specifically, researchers determined whether or not the following items were on the kitchen counter: fresh fruit, canned or dried fruit, fresh vegetables, regular or reduced fat snack crackers or chips, dry cereal, regular or diet soft drinks, candy, cookies and other baked goods (muffins, cake), clear and opaque food storage containers, toaster, and blender or food processor. In addition, respondents were asked if they usually purchased food in large-sized packages and if they had a cupboard where they kept their snacks. In comparison to Study 1, there were additional food items including soft drinks (regular and diet), fresh vegetables, and canned and dried fruit. Packaged foods (chips, crackers, pretzels, and cold cereal) were recorded under breakfast cereal or crackers/chips. In addition, researchers asked about specific behaviors: if the respondent usually purchases food in large-size packages, and if the respondent has a cupboard for snack items (87.1% vs. 73.1%; \( p < .05 \)).

To understand the relationship between the kitchen environment and BMI and weight outcomes of adult men and women in the households, two estimation techniques were employed. First, probit analysis with robust standard errors was used to estimate the probability that men and women of normal, overweight, and obese status responded affirmatively to keeping specific items in visible locations in their kitchens. Second, ordinary least squares analysis with robust standard errors was used to estimate the relationship between visible food items in the kitchen and weight for men and women. There were no missing values for kitchen characteristics. A total of 18 participants, however, did not report their weight or height, and these observations were omitted from the sample.

### Results

#### Study 1. Kitchen Counter Correlates of Obesity From a Nationwide Survey

The final sample contained 481 female respondents (mean age 38 years) and 408 spouses (mean age 41 years). The presence of a fruit bowl on the kitchen counter had a strong association with lower BMI among both women and men (25.5 vs. 26.8 for women, \( p < .05 \); 27.1 vs. 28.6 for men, \( p < .01 \); see Table 1). The presence of other items, when significant, was associated with higher BMI. Overall, effects of countertop items were slightly more pronounced among men. Packaged food was related to greater BMI among both sexes (25.6 vs. 27.3 for women, \( p < .05 \); marginally significant for men, 27.3 vs. 28.4, \( p < .1 \)), whereas the presence of cookies was associated with higher BMI only among men (27.3 vs. 28.6, \( p < .05 \)). In addition, men who had a toaster on their counter had a higher BMI than those with no toaster (27.8 vs. 26.6, \( p < .05 \)).

<table>
<thead>
<tr>
<th>What is visible on the counter?</th>
<th>Women</th>
<th>Men</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Present</td>
<td>Not present</td>
<td>Difference</td>
</tr>
<tr>
<td>Cookies</td>
<td>26.7 (6.2)</td>
<td>25.8 (6.0)</td>
<td>0.9</td>
</tr>
<tr>
<td>Candy</td>
<td>26.3 (5.2)</td>
<td>25.9 (6.1)</td>
<td>0.4</td>
</tr>
<tr>
<td>Packaged food</td>
<td>27.3 (7.5)</td>
<td>25.6 (5.6)</td>
<td>1.7*</td>
</tr>
<tr>
<td>Fruit bowl</td>
<td>25.5 (5.3)</td>
<td>26.8 (7.3)</td>
<td>−1.3*</td>
</tr>
</tbody>
</table>

Note. BMI = body mass index.

*The values for men are based on female respondents’ reports of their spouses’ height and weight.

#### Study 2. Kitchen Counter Correlates of Obesity in a Medium-Sized U.S. City

The final sample consisted of 300 participants (215 females, mean age 38.5 years). Overall, normal-weight participants were more likely than obese participants to have fresh fruit (52.7% vs. 37.4%; \( p < .05 \)) and less likely to have regular soda (7.5% vs. 17.4%; \( p < .01 \)) visible in their kitchens. Cookies and other baked goods such as cakes and muffins (21.5% vs. 33.3%; \( p < .1 \)) were marginally less likely to be visible in normal-weight participants’ kitchens.

Table 2 shows how these results were distributed across genders. Women of normal weight were the most likely (50.7%; \( p < .01 \)) to have fruit on the counter. Among men, having fresh fruit on the counter was not associated with BMI. Although regular soft drinks were rarely observed (probably because they were stored in the refrigerator), they were much less likely to be observed in normal-weight women’s kitchens than in obese women’s kitchens (4.3% vs. 14.1%; \( p < .01 \)). By contrast, normal-weight men were just as likely to have regular soft drinks on the counter as obese men. Keeping cookies and other baked treats visible was strongly correlated with high BMI but only with men (5.6% vs. 38.7%; \( p < .01 \)). The visibility of packaged food such as cereal, chips, or crackers had no significant association with BMI.

In addition to foods visible in the kitchen, certain behaviors were associated with lower BMI among women. Normal-weight women were more likely to have a designated cupboard for snack items (87.1% vs. 73.1%; \( p < .05 \)) and less...
<table>
<thead>
<tr>
<th></th>
<th>Women</th>
<th></th>
<th>z-Stat (percentage point difference between normal and obese)</th>
<th>Men</th>
<th></th>
<th>z-Stat (percentage point difference between normal and obese)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cookies (and baked goods)</td>
<td>26.1%</td>
<td>14.0%</td>
<td>28.6%</td>
<td>−0.33</td>
<td>5.6%</td>
<td>34.6%</td>
</tr>
<tr>
<td>Candy</td>
<td>22.1%</td>
<td>16.3%</td>
<td>14.3%</td>
<td>1.21</td>
<td>—</td>
<td>26.9%</td>
</tr>
<tr>
<td>Chips and crackers</td>
<td>34.8%</td>
<td>34.9%</td>
<td>43.6%</td>
<td>−1.09</td>
<td>27.8%</td>
<td>34.6%</td>
</tr>
<tr>
<td>Cereal</td>
<td>39.7%</td>
<td>32.6%</td>
<td>50.0%</td>
<td>−1.25</td>
<td>22.2%</td>
<td>26.9%</td>
</tr>
<tr>
<td>Regular soda</td>
<td>4.3%</td>
<td>11.6%</td>
<td>14.1%</td>
<td>−1.99**</td>
<td>16.7%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Diet soda</td>
<td>1.4%</td>
<td>9.3%</td>
<td>7.7%</td>
<td>−1.85</td>
<td>16.7%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Fresh fruit</td>
<td>50.7%</td>
<td>48.8%</td>
<td>32.1%</td>
<td>2.29**</td>
<td>55.6%</td>
<td>46.2%</td>
</tr>
<tr>
<td>Fresh vegetables</td>
<td>20.3%</td>
<td>25.6%</td>
<td>21.8%</td>
<td>−0.22</td>
<td>16.7%</td>
<td>38.5%</td>
</tr>
</tbody>
</table>

Note: These results were generated from generalized estimating equations that rely on the normal distribution to predict the difference in the likelihood of a specific kitchen characteristic or behavior between normal-weight and obese, and overweight and obese individuals.

*Variable omitted in estimation because it predicts a perfect negation of the probability in the “Obese” column.

*p < .01. ***p < .05.
likely to buy food in large-sized packages (40.0% vs. 64.1%; $p < .01$).

Table 3 reports the differences in kilograms for participants who had specific items visible in their kitchens versus those who did not. Women who kept regular or diet soft drinks on their counters or in other highly visible locations in the kitchen weighed 12 kg ($p < .05$) and 11.1 kg ($p < .05$) more than those who did not. Furthermore, keeping breakfast cereal on the counter was associated with an additional 9.4 kg ($p < .05$) in women. Although soft drinks and cereal were not associated with higher BMI in men, sweet treats appeared to have an effect. Candy on the counter was associated with almost 8 kg more in men ($p < 0.1$), but 10 kg less in women ($p < .01$). Finally, leaving fruit on the counter or in another visible kitchen location was weakly associated with 6.34 kg lower weight in women ($p < .10$).

**Discussion**

In keeping with earlier findings (Mackner et al., 2001; Silverstein et al., 2005), these results demonstrate that salience and convenience of a food can consistently increase its consumption (Wansink & Payne, 2008). Proximity and visibility of food have been shown to contribute to the quantity of food consumed at settings such as workplaces, cafeterias, and school lunchrooms (Mackner et al., 2001; Miller & Rollnick, 2002; Overby et al., 2007; Peters & Mennecke, 2011). These two studies suggest that the home is no different. While snacking can encourage weight gain in both women and men, the type of snack—fresh fruit versus chips—makes a big difference. It appears that convenience and salience of sweet snack foods in the kitchen encourage weight gain for men. Dried fruit or cookies are convenient snack foods and food storage containers on counter tops often store ready-to-eat foods. In contrast, having fresh fruit at hand is a signal of generally healthy eating habits and functions as a cue, or a trigger, to steer people toward healthier foods (Mayer-Davis et al., 2006).

Unique to this study is the systematic approach to taking an inventory of kitchen spaces and identifying key components that are most strongly associated with normal weight or overweight status (Wansink, 2014). Interestingly, the insights from this study are not focused on completely removing specific foods from the kitchen but rather rearranging the foods to promote healthy choices while leaving treats in the kitchen (though hidden) for occasional indulgences. The specific prescriptions, such as designating a cupboard for healthy snacks and replacing the cookies with a bowl of fruit, can easily be implemented. Furthermore, the results also highlight how the kitchen space influences food decisions differently for men and women.

These findings provide key insights health professionals can use in dietary counseling. In particular, these findings can be leveraged to diagnose any kitchen-scape (Sobal & Wansink, 2007) and provide clear and succinct suggestions...
for change. In addition, the reported behavioral differences between men and women provide evidence for implementing separate strategies. While we did not report any correlations for children, they are undoubtedly influenced by the food environment over which they likely have little control. Children are often at the mercy of their parents, at least in terms of what foods are visible in the kitchen and on counter tops and these findings can help improve the food environment for them too. Last, the prescribed changes cost very little to no money, often in contrast to many diet plans and other weight loss opportunities.

While the objective of this research is to identify systematic relationships between BMI and kitchen-scape, a direct extension deals with the potential for environments in food insecure households to encourage less healthful food decisions. For many households, the affordability of fresh fruit and other healthy foods is often a challenge (Cassady, Jetter, & Culp, 2007). Prior studies have shown a strong association between low income and high BMI (Just & Wansink, 2009). The absence of a fruit bowl in the kitchens of participants with high BMIs might be a signal of food insecurity, which cannot be solved by nutritional advice alone.

**Limitations and Future Research**

Our study combined a national survey and an in-home observational study to gather data that would be representative of a real population. Thus, weights and heights of respondents and their spouses in the national survey study were self-reported and may have been inaccurate, which is very likely in the cases in Study 1 when male weights and heights were reported by their female spouse or partner. In the in-home study, kitchen items were observed only during one home visit, which may not have represented the usual kitchen environment, especially if participants had chosen to conceal foods from the researchers. In addition, researchers did not open refrigerators or cupboards where easily accessible healthy foods could have been stored. Yet, when in a hurry, an individual is more prone to grab an easily accessible item in plain view.

The generalizability of the findings is limited due to the somewhat different measures of kitchen characteristics that were used in the two studies. Nevertheless, the findings of both studies point to the same direction and the discovered BMI differences are large enough to have practical significance, highlighting the importance of examining salience and convenience of foods in home environments. We point out that in our measures we did not collect information regarding the amount of foods left on the counter or visible in the kitchen, or open cupboards or refrigerators to identify easily accessible foods in these areas. While the focus of this study was to examine the “ready-to-go” foods in plain sight in the kitchen, such foods can also be stored in highly accessible areas in cupboards and refrigerators. While salience and convenience of food can influence one’s short-term intake of food, it is not clear as to whether people adjust to this over time. Existing studies have not been conclusive, partly due to measurement errors, self-reported weights, and methodological confounds (Silverstein et al., 2005; Virtanen et al., 2000). As a result, it is an open question whether or not a prescriptive solution based on modifying the visible and easily accessed foods in a kitchen is a viable long-term solution.

**Conclusion**

To our knowledge, this is the first study with a large sample size that observes correlations between factors in actual home food environments and BMI (Wansink, 2014). Observing home kitchens shows that salience and convenience of food items appear to make a difference. Normal-weight people surround themselves with fewer eating cues, buy food in smaller packages, store snack foods out of sight in a cupboard or drawer. What they choose to place on their kitchen counters is generally healthier. These small habits of arranging the personal food environment may lessen one’s tendency to overeat (Randecker et al., 1996). This has important implications for people who seek to accurately monitor and control their food intake. What is seen is more likely to be eaten. Hence, clearing kitchen counters of all foods except fresh fruit could be an easy change to make, could decrease daily consumption and increase awareness of eating habits.

The home food environment sets the model for children as well. Mothers are strong influences on their children’s eating habits, both as providers of food and as role models for eating behavior (Powers et al., 2002). Nutritional advice to parents could include not only the importance of role modeling but also the arrangement of the family’s kitchen to become slim by design (Wansink, 2014). Encouragingly, if visibility and availability increase the consumption of sweet treats, making healthier foods such as fruits and vegetables visible and easily accessible may also boost their intake (Wansink, 2010). Before parents or other caregivers can decide where to store healthful foods in the home, they need to decide to bring them into the home in the first place.

**Authors’ Note**

The funders played no role in the study other than financial support. The authors had complete access to the data and take full responsibility for the integrity of the data and accuracy of its analysis. Research and writing of this article took place while Andrew S. Hanks and Kirsiikka Kaipainen were at Cornell University.

**Declaration of Conflicting Interests**

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