ARTICLE

Nutrition and Exercise Environment Available to Outpatients, Visitors, and Staff in Children's Hospitals in Canada and the United States

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Background: Children's hospitals should advocate for children's health by modeling optimum health environments.

Objectives: To determine whether children's hospitals provide optimum health environments and to identify associated factors.

Design: Telephone survey.

Setting: Canadian and US hospitals with accredited pediatric residency programs.

Participants: Food services directors or administrative dietitians.

Main Outcome Measures: Health environment grades as determined for 4 domains quantifying (1) the amount of less nutritious food sold at cafeterias (cafeteria grade), (2) the presence of fast food outlets (outlet grade), (3) the amount of nutritious food alternatives available (healthful alternative grade), and (4) the presence of patient obesity or employee exercise programs (program grade).

Results: The overall response rate was 87%. Compared with Canadian hospitals, US hospitals had more food outlets (89% vs 50%) and more snack/beverage vending machines (median, 16 vs 12) ($P=.001$ for both), despite equivalent consumer numbers. External companies managed more outlets at US vs Canadian hospitals (65% vs 14%; $P=.01$), and, generally, US hospitals recuperated more revenue from their outlets. Worst cafeteria grade was associated with US hospital location (odds ratio [OR], 8.9; 95% confidence interval [CI], 1.6-50; $P=.01$) and lower healthful alternative grade (OR, 0.016; 95% CI, 0.002-0.15; $P<.001$). Lower grade in any domain was related to whether hospitals received more revenue from noncafeteria food outlets (OR, 1.7; 95% CI, 1.06-2.72; $P=.03$) and the presence of more internally operated cafeterias (OR, 2.3 per cafeteria; 95% CI, 1.53-3.36; $P<.001$).

Conclusions: Children's hospitals provide suboptimal health environments. Reliance on revenue may be an important motivating factor encouraging the adoption of outlets that serve less nutritious food.

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THE INCREASING PREVALENCE of overweight and obesity in North American children is a serious public health concern. Children's hospitals are uniquely positioned to advocate for the improved general health of children and should, therefore, provide an environment that encourages the consumption of nutritious food and emphasizes physical activity. The objective of this study was to survey the food services and health programs available to visitors, outpatients, and staff in Canadian and US children's hospitals to determine whether an optimum nutrition and exercise environment is present and, if not, what factors are associated with the adoption and tolerance of less optimum environments.

METHODS

HOSPITALS AND THE SURVEY INSTRUMENT

All hospitals with pediatric residency programs accredited by either the Royal College of Physicians and Surgeons of Canada or the American Medical Association and with membership in the Canadian Association of Pediatric Health Centers or the National Association of Children's Hospitals and Related Institutions were eligible for the study (N=116). After obtaining ethics approval from The Hospital for Sick Children's Research Ethics Board, data were collected between June 1, 2004, and August 31, 2005. We obtained basic hospital demographic information, including the location of the hospital, the number of inpatient beds, the estimated number of outpatient clinic and day-surgery visits, the number of emergency de-

partment visits, and the number of staff members, by conducting telephone interviews with each hospital's appropriate public relations representative or from the public affairs report if it was accessible from institutional Internet-based resources.

Three of us (C.M.M., J.G.W., and J.G.) used a standardized closed-ended questionnaire and conducted telephone interviews with each hospital's food service director or administrative dietitian to obtain information regarding the food services available to outpatients, visitors, and staff members at each facility. In some cases, when it was not possible to conduct the interview by telephone, the appropriate contact person completed the questionnaire by hand and returned it to the investigators by fax. Data were obtained about the main cafeteria, other commercial and noncommercial food outlets, and vending machines in each hospital. For each main cafeteria and food service outlet, we requested information regarding the hours of operation, whether it was operated by an external company, whether all revenue was recuperated by the hospital, whether nutritional information was displayed or available on request, and the specific food choices available. We also collected data regarding the number of dietitians employed at each hospital, whether the hospital operated an obesity clinic or program for children, and whether an exercise program was available for hospital employees. Interviewees were also invited to make comments about what, if any, measures their hospital was taking to improve their current environment.

We made every attempt to avoid value judgments regarding food quality. The terms *good, suboptimal*, and *bad* pertaining to food were specifically avoided because of their inherent subjectivity and the lack of uniform agreement of their constituents. Instead, we used the terms *less nutritious, healthful,* and *not healthful* to describe food items that met the accepted criteria (defined in the following subsection). The criteria used in this study for the classification of food items as healthful or not healthful were formulated based on a synthesis of currently available nutritional guidelines.[1-3] For specific vendor items (eg, McDonald's, Burger King, or Starbucks coffee options), we determined, when available, the caloric content, number of calories from fat, *trans*-fat content, and saturated fat content of food items using nutritional information provided by the specific food outlets and restaurants.[4-7]

GRADING SYSTEM

The overall nutritional "health" of each hospital was measured by the responses in 4 separate domains: cafeteria grade, outlet grade, healthful alternative grade, and program grade. Cafeteria grade quantifies the number of food items of less nutritional value marketed in the cafeteria(s). To calculate cafeteria grade, a total grade was derived from the sum of less nutritional food items available in the cafeteria. Less nutritious food items included (1) nutrient-poor foods, such as candy bars, potato chips, and soda pop; (2) items containing 1 g or more of *trans*-fat; (3) foods in which more than 30% of the calories are derived from fat; (4) items that provided more than 33% of the recommended saturated fat per day, defined as 65 g for a 2000-cal/d diet; (5) processed foods made with hydrogenated oils or shortening, such as commercial baked goods, donuts, and cakes; and (6) fast food items, such as burgers and french fries. This total grade was then subdivided into an ordinal 4-level grade based on rank quartiles (1 = worst and 4 = best).

Outlet grade quantifies the proportion of fast food franchises and other noncafeteria food service outlets serving food items of less nutritional value in the hospital. To calculate outlet grade, a total grade was derived on the basis of the proportion of fast food franchises and other noncafeteria food service outlets serving food items of less nutritional value divided by the total number of outlets. This total grade was then subdivided into an ordinal 4-level grade (1 = worst and 4 = best). Quartile ranks could not be used because 68% of the hospitals had no outlets serving food items of suboptimal nutritional value and were assigned a grade of 4. To validate the grouping of different food outlets, such as Starbucks and fast food restaurants, together as serving food that is not healthful, we performed a comparative analysis of the nutritional content of 22 popular menu items (using nonfat milk for the drink options) to ensure that no significant differences existed among the outlets. For example, there was no significant difference between Starbucks and McDonald's with respect to either caloric content (median, 330 vs 345; $P = .72$) or saturated fat (median, 6 vs 3.8 g; $P = .47$). Both outlets provided high levels of saturated fat, with Starbucks drink options providing a slightly higher level of saturated fat despite the use of nonfat milk drink options in these comparisons. We included a domain score, the healthful alternative grade discussed in the following paragraph, into the analysis to improve the discrimination among outlets based on the number of healthful food options. This grade quantified the number of healthful alternative choices available at the outlets and provided each food outlet with a mechanism to achieve a higher nutritional score if they had comparatively more healthful options.

Healthful alternative grade quantifies the number of more optimal nutritious food items available in the hospital. To calculate this grade, a total grade was derived from the sum of the amount of nutritious food available in all food sources in the hospital. Healthful food items included the following: (1) nutrient-rich foods, such as fresh fruits, vegetables, and salad; (2) items containing 1 g or less of *trans*-fat; (3) fat-free (0.5 g of fat per serving) or low-fat (≤3 g of total fat per 100-g serving) items; (4) tuna, turkey, or vegetarian sandwiches; and (5) nonfried fish or poultry items. This total grade was then subdivided into an ordinal 4-level grade based on rank quartiles (1 = worst and 4 = best).

Program grade quantifies the availability of overweight and obesity programs for children and exercise programs for staff. Score assignment was as follows: obesity and exercise programs present = 4, obesity program only = 3, exercise program only = 2, and neither = 1.

DATA ANALYSIS

Data are presented as frequency, median (range), or mean ± SD as appropriate. Because some interviewees could not answer some questions, where there are missing data, the number of nonmissing values is given. Percentages, odds ratios (ORs), and estimates are presented with 95% confidence intervals (CIs). All the data analyses were performed using statistical software (SAS version 9; SAS Institute Inc, Cary, NC). Multivariable logistic regression models and multivariable linear regression models were constructed initially to explore the relationship between factors and the derived domain grades. However, because we expected important intrainstitutional correlation among the 4 domain grades (cafeteria, outlet, healthful alternative, and program grades), these grades were then treated as repeated measurements. Therefore, to accurately account for this correlation and the repeated nature of measurement, generalized estimating equations were used to identify factors associated with having a lower (worse) grade value. Independent correlation structures were used for the generalized estimating equation models, and the assumption of proportional odds was verified by cumulative logit plots.

RESULTS

HOSPITAL CHARACTERISTICS

There were 116 children's hospitals that met the inclusion criteria. Demographic data for all of the hospitals

Table 1. Demographic Characteristics of 116 Children's Hospitals

Variable	Value	No. Missing
Location, No.		0
Canada	12	
United States	104	
Completed survey, No. (%)	101 (87)	15
Inpatient beds, median (range), No.	175 (26-666)	4
Outpatient visits per day, median (range), No.	220 (3-1500)	55
ED visits per day, median (range), No.	130 (25-11 476)	58
Employees, median (range), No.	2200 (220-8500)	41
Dietitians, median (range), No.	9 (1-32)	32
Food resources		
Cafeterias in hospital, median (range), No.	1 (0-8)	1
Food outlets in hospital, median (range), No.	1 (0-6)	16
Hospitals with a noncafeteria food outlet, No. (%)	82 (81)	19
Snack/beverage vending machines, median, (range), No.	15 (0-235)	29
Types of food available in cafeteria, No. (%)		
Not healthful food choices (n = 114)		2
Chocolate/candy	105 (92)	
Pies/cake	90 (79)	
Potato chips	104 (91)	
Beef burgers/french fries	99 (87)	
Meat pizza	93 (82)	
Healthful food choices (n = 100)		16
Low-fat yogurt	96 (96)	
Fruits/vegetables	97 (97)	
Low-fat desserts	34 (34)	
Low-fat baked goods	46 (46)	
Salad	92 (92)	
Chicken/fish dishes	90 (90)	
Hospital programs for staff, No. (%) (n = 94)		24
Both obesity and exercise programs	16 (17)	
Obesity program only	25 (27)	
Exercise program only	29 (31)	
No obesity or exercise program	23 (25)	
Cafeteria revenue, No. (%) (n = 113)		3
All revenue recuperated	88 (78)	
Some revenue recuperated	12 (11)	
No revenue recuperated	12 (11)	
Food outlet revenue, No. (%) (n = 72)		45
All revenue recuperated	28 (39)	
Some revenue recuperated	21 (29)	
No revenue recuperated	23 (32)	

Abbreviation: ED, emergency department.

are given in **Table 1**. The response rate for conducting the interviews was 87% overall (n = 101) and was slightly better for Canadian vs US hospitals (100% vs 86%). Reasons for noncompletion of the interview were refusal to participate for 2 hospitals and inability to contact the person identified at the respective hospital for the remaining 13 hospitals.

FOOD RESOURCES

Of 99 hospitals with cafeterias, 82 (83%) had noncafeteria food service outlets as well. Although many hospitals had cafeterias that operated until 2 or 3 AM, food was also available for purchase on the hospital inpatient wards for 35 hospitals. Snack and beverage vending machines were present in all but 4 hospitals, with a median of 15 machines (ranging up to 235) per hospital. Less nutritious food choices predominated in hospital cafeterias, including 92% selling chocolates and candy; 79% selling pies, cakes, or other dessert items; 91% selling potato chips; 87% selling beef burgers and french fries; and 82% selling meat pizza (Table 1). In contrast, healthful alternatives, such as low-fat desserts or baked goods, were present in only 34% and 46% of hospitals, respectively. A total of 29 fast food franchise outlets were found in 24 hospitals, with 2 hospitals having more than 1 such outlet. Hospital cafeterias were externally operated in 54% of the hospitals, with 79% of the hospitals having their noncafeteria food service outlets operated by external management companies.

BEVERAGE CHOICES

Regular soft drinks were sold at all times in 99% of the hospital cafeterias and in 75% of the noncafeteria food service outlets. Regular fruit juice was sold in 99% of the cafeterias and in 81% of the noncafeteria outlets. In contrast, only 47% of the noncafeteria outlets sold skim milk, and 75% sold diet soft drinks. Coffee vendors, including Starbucks, were found in 69% of hospitals.

HOSPITAL PROGRAMS

Obesity programs for children and exercise programs for staff were both present in only 13 hospitals. An obesity or exercise program alone existed in 45 hospitals, and 19 hospitals had neither type of program. Information regarding programs was unavailable for 24 hospitals. Although several respondents mentioned health promotion initiatives that their hospitals were undertaking, these tended to be in hospitals that were combined adult and child facilities. Many respondents cited their hospital's increasing demands for revenue as a major factor limiting the availability and affordability of more nutritious alternatives.

REVENUE

All the revenue from the cafeterias was recuperated by 76 (78%) of 98 responding hospitals, and an additional 11 hospitals (11%) recuperated a percentage of the revenue from the sale of cafeteria items. Of 56 responding hospitals, 22 (39%) recuperated all of the revenue generated from the noncafeteria food service outlets, and an additional 16 (29%) recuperated a percentage of the revenue from outlet sales (Table 1).

DOMAIN GRADES

Distribution of the 4 domain grades is shown in the **Figure**. The cafeteria and healthful alternative grades were calculated for 98% of the hospitals (n = 99). The median total cafeteria score before conversion to a quartile grade was 10 (range, 1-14). Similarly, the median healthful alternative score was 19 (range, 4-40.5) before conver-

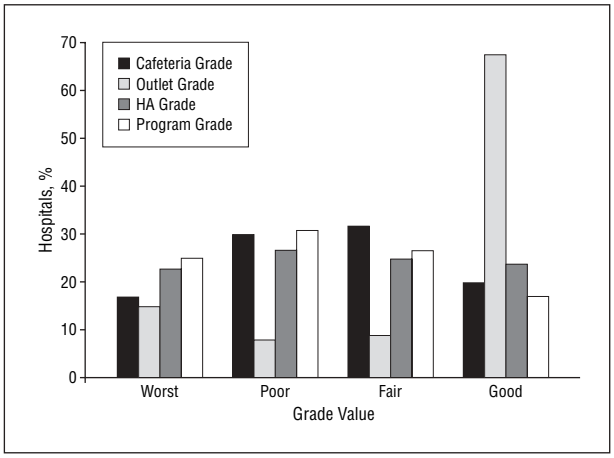

Figure. Distribution of the domain grades for hospitals. Ordinal grade assignment was based on rank quartile groups for the cafeteria and healthful alternative (HA) grades. For the outlet grade, however, there were 52 hospitals with no noncafeteria outlets serving predominantly less nutritious food, and, therefore, these hospitals all received a grade of good. Similarly, the program grade was assigned on the basis of other criteria, and so distributions could not be grouped according to rank quantiles.

sion to a quartile grade. Data to generate program and outlet grades were available for 76% of the hospitals (n=77). Of hospitals with available scores, only 8 had a final program grade of good, indicating the presence of both an obesity program for patients and an exercise program for staff. Although fast food franchise outlets were present in several of the large hospitals, 52 (68%) of the 77 hospitals received a final outlet grade of good, indicating that none of the noncafeteria food service outlets at that hospital sold predominantly food with suboptimal nutritional value.

Important differences existed between US and Canadian hospitals (**Table 2**). The US hospitals had significantly more noncafeteria food service outlets serving food of suboptimal nutritional value compared with the Canadian hospitals (89% vs 50%) and more snack and beverage vending machines than the Canadian hospitals (median, 16 vs 12; $P=.001$ for both), despite equivalent employee and patient numbers. Noncafeteria food service outlets in US hospitals were more likely to be managed by external companies (65%) than such outlets in Canadian hospitals (14%; $P=.01$), and, in general, US hospitals recuperated a greater proportion of the revenues generated from these outlets. Similarly, multivariable logistic regression analysis determined that US hospital location was independently associated with worst cafeteria grade (grade 1) (OR, 8.9; 95% CI, 1.6-50; $P=.01$; area under the curve, 0.85). Worst cafeteria grade was also inversely related to the healthful alternative grade (OR, 0.016; 95% CI, 0.002-0.15; $P<.001$; area under the curve, 0.85), indicating a marked imbalance for cafeterias selling the greatest proportion of items with suboptimal nutritional value. Lower program score tended to be positively correlated with increased number of noncafeteria food service outlets serving items of suboptimal nutritional value ($r=0.48$; $P=.07$), suggesting that hospitals with no exercise or obesity programs were most likely to have more outlets with suboptimal choices.

Table 2. Characteristics of US Hospitals vs Canadian Hospitals*

Variable	US Hospitals (n = 104)	Canadian Hospitals (n = 12)	*P* Value
Full-time employees, median (range), No.	2114 (300-8500)	2400 (220-6300)	.58
Inpatient beds, median (range), No.	186 (26-666)	144 (60-450)	.38
ED visits, median (range), No.	135 (25-11 476)	118 (39-185)	.55
Outpatient visits, median (range), No.	203 (3-1500)	289 (40-875)	.79
Dietitians, median (range), No.	8 (1-32)	11 (3-25)	.27
Cafeterias, median (range), No.	1 (0-8)	1 (1-3)	.33
Food outlets, %	89	50	.001
Beverage vending machines, median (range), No.	8 (0-215)	5 (0-10)	.004
Total vending machines, median (range), No.	16 (0-235)	12 (0-15)	<.001
Obesity program, %	50	27	.20
Exercise program, %	45	64	.26
All or some revenue recuperated from food outlets, %	70	50	.24
All or some revenue recuperated from cafeteria, %	87	100	.38
Externally operated cafeterias, %	37	17	.21
Externally operated food outlets, %	65	14	.01

Abbreviation: ED, emergency department.
*Values are based on the number of responders.

FACTORS ASSOCIATED WITH INCREASING DOMAIN GRADES

Independent factors associated with lower (worse) grades were sought. Hospitals receiving more revenue from noncafeteria food service outlets were more likely to have lower grade values compared with hospitals receiving no revenue from outlets (OR, 1.7; 95% CI, 1.06-2.72; $P=.03$). Domain grade was also significantly lower in hospitals with more internally operated cafeterias (OR, 2.3 per cafeteria; 95% CI, 1.53-3.36; $P<.001$).

COMMENT

We used a telephone interview with an 87% response rate to show that most university-affiliated pediatric hospitals in Canada and the United States provide a suboptimal nutrition and exercise environment for their patients, patients' families, and employees. Although several studies have investigated the quality and availability of food services provided to inpatients, we extended this analysis to outpatients, staff, and visitors. We also included the presence of obesity programs and staff exercise programs as a measure of the hospital's commitment to overall nutritional health. We found that no

children's hospitals received a "perfect" grade in all 4 domains. Although children's hospitals are in a unique position to advocate for the general health of children from a position of authority and example, especially in the face of a growing epidemic of childhood obesity, they seem to be failing.

The increasing prevalence of overweight and obesity in North American society continues to be a serious public health concern. Results of the 2004 Canadian Community Health Survey[8,9] show that 59% of Canadian adults 18 years or older and 26% of children and adolescents aged 2 to 17 years were overweight or obese. In the United States, results of the 1999-2002 National Health and Nutrition Examination Survey[10] revealed that 65% of American adults 20 years or older were overweight or obese, whereas 32% of children 6 to 19 years of age were at risk for overweight or were overweight.

Environmental factors that affect lifestyle and consequently dietary choices are among the many variables contributing to this epidemic. St. Onge et al[11] note that time limitations have become an important factor in determining the types of food consumed. The food industry has responded by increasing the number of convenience foods and prepared meals available to customers.[12] Several hospitals have recently integrated commercial food outlets into their food service systems in hopes of generating more sales, of which a variable proportion of revenue is often contributed back to the hospital. We have shown, in agreement with this trend, that most (85%) of the university-affiliated children's hospitals have either fast food franchise outlets or other outlets selling items of less nutritional value. These hospitals also prominently featured less nutritious food choices in their cafeterias while providing few healthier alternatives. The adverse effect of this unwholesome environment may be magnified because hospital staff, patients, and their families represent a relatively captive consumer market. This increased reliance on foods consumed away from home and the decreased expense associated with less nutritious convenience food, food advertising, marketing, and promotion have changed the way North Americans eat.[13] Between 1977 and 1995, the percentage of meals and snacks eaten at fast food restaurants increased by 200%, and in 1998, 46% of all US adults ate at a restaurant on any given day.[13] Lin et al[14] found that away-from-home foods are higher in fat and energy compared with foods prepared and eaten at home. Furthermore, increased fast food restaurant use has been associated with higher energy and fat intake among adolescents[15] and an increased prevalence of obesity.[16,17] Based on our nutritional analysis, an average meal at McDonald's, consisting of a Big Mac, medium french fries, and a medium shake, contains 1520 total calories and 22 g of saturated fat.

Although we cannot provide direct evidence that the amount of food of suboptimal nutritional value consumed is increased by the predominance of commercial food service outlets and unwholesome food choices, it is certainly a plausible conclusion that people eat what is readily available and least expensive. This notion is supported by previous studies[18-20] that explicitly demonstrate the influential role that the nutrition environment plays in the health and nutritional status of the public. Bell and Swinburn[18] found that school cafeteria users obtained significantly more energy from fast food, packaged snacks, desserts, chocolate, and confectionary than students who did not use the cafeteria. As Fitzgerald[20] and others[21-23] point out, food service outlets, such as cafeterias, restaurants, and supermarkets, can act as "windows of opportunity" to connect the public with nutrition messages and can act as environmental supports for continual lifestyle changes rather than reinforcing bad habits.

Economic reliance on revenue may be a key motivating factor encouraging the growth of outlets selling less nutritious food in North American children's hospitals, especially those in the United States. The US hospitals had significantly more noncafeteria food service outlets and snack or beverage vending machines than the Canadian hospitals, despite equivalent employee and patient numbers. Furthermore, our data determined that 78% of the hospitals recuperated at least a percentage of the revenues generated from these food outlets, with a greater proportion of US hospitals recuperating all of the revenue from food outlet sales compared with their Canadian counterparts. Hospitals in the United States also relied more on external companies to manage their food outlets. Increased dependence on external companies may directly encourage the sale of less nutritious items because these items are the least expensive to purchase, distribute, and store, therefore generating the best profit-loss ratio for external companies.

Consumption of sweetened beverages such as soft drinks also has been linked to childhood diabetes mellitus and obesity in North American children.[18,24-26] Of further concern is the finding that soft drinks may be displacing milk and fruit juice in the diets of children and adolescents, particularly because only 5% of 7- to 14-year-old children meet the national recommendations for servings of fruit and only 9% of children meet the recommendations for dairy.[21] Despite the clear evidence that sweetened beverages promote childhood disease, we found an alarmingly high number of soft drink vending machines at many children's hospitals, with only 2 hospitals having none. Gazibarich[27] notes that hospitals have the potential to be models for healthful environments, a mission that should be reflected in the food that is made available to patrons. In Australia, this mission was articulated by setting a target to increase the proportion of health service users, visitors, and employees who have access to catering services that supply a range of food consistent with good dietary guidelines.[27] However, North American literature has failed to reveal any similar objectives.

A limitation of this study concerns the use of self-report to measure the outcome variable: the overall nutrition environment of each children's hospital. Financial considerations obviously precluded the possibility of visiting every children's hospital and directly validating respondents' self-report. Although our overall response rate was excellent at 87%, we cannot assume that nonparticipants were similar to participants. However, the repeated nature of grade assessment and the intragrade correlation apparent from the exploratory analysis allowed the use of generalized estimating equations to amplify the sample size. In addition, we considered only variables with robust response rates to minimize the

introduction of bias. The lack of direct evidence that unwholesome hospital environments foster the choice of items of suboptimal nutritional value is another potential limitation.

In conclusion, children's hospitals frequently have available a plethora of unwholesome food and beverage choices, and these choices contribute to revenue in most of these hospitals. Economic reliance on this revenue may be a key motivating factor encouraging the growth of unwholesome food outlets in North American children's hospitals. Coupled with revenue dependence, increased corporate control over the food services at many children's hospitals also makes it difficult to ensure that more healthful foods are available and being marketed to outpatients and visitors. Political and legislative initiatives should be actively pursued by children's hospitals to eliminate environmental factors that foster excess caloric consumption and threaten the general health of children.

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Correction

Omission in *About the Cover*. In *About the Cover* for the photograph *Summer in Lee Neff's Garden* in the July issue of the ARCHIVES (2006;160:669), the photographer was mistakenly omitted. The photographer was John Neff, MD.