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Social influence of adult children on parental health behavior among South Asian immigrants: findings from the MASALA (Mediators of Atherosclerosis in South Asians Living in America) study

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ABSTRACT

Objectives: Examine the social influence of adult children on the cardiovascular-related health behaviors of older South Asian (SA) immigrants to inform lifestyle interventions.

Design: This mixed-methods study used data from an ancillary study of social networks (2014–2018) in the Mediators of Atherosclerosis in South Asians Living in America cohort. Phase 1 was a quantitative analysis of self-reported diet and physical activity among SA adults ($n = 448$, mean age = 58 years, SD 8.4) who named at least one adult child to their social network. The Alternative Healthy Eating Index (AHEI) was used to measure parents' diet; higher numbers indicate a healthier diet (range 0–110). Phase 2 was a thematic content analysis of in-depth qualitative interviews from a subsample of these parents ($n = 23$, mean age = 55, SD 7.6).

Results: Parents with an adult child in their network who consumed uncooked vegetables daily had mean parental AHEI score 1.5 points higher (adjusted p -value = 0.03) than those who had a child in the network who ate uncooked vegetables less often. When at least one adult child in their network ate fresh fruit daily compared to less frequently or when at least one child ate non-SA food daily compared to less frequently, mean parental AHEI scores were higher by 2.0 (adjusted p -value = 0.01) and 1.6 (adjusted p -value = 0.03) points respectively. Parents with an adult child in their network who exercised at least weekly were more likely to meet guideline-recommended physical activity levels than parents with children who exercised less often (76% v. 56%, adjusted p -value = 0.02). Adult children provided social support and were seen as 'role models' for healthy behavior, especially when adopting Western health behaviors.

Conclusion: Positive role modeling and support from adult children were important facilitators of healthy behavior change in older SA immigrants and can inform health behavior interventions for SA adults.

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KEYWORDS

Social network; social influence; South Asian; MASALA; lifestyle intervention; intergenerational

Introduction

The benefits of social support on health have been widely acknowledged—higher levels of support have been linked with better physical and mental health (Berkman, Leo-Summers, and Horwitz 1992; Cohen 2004; Falk et al. 1992; Uchino 2004). Though a variety of relationship types and minority groups have been studied, very few studies have examined how social support influences the health of South Asians in the United States, an ethnic group with high levels of chronic diseases such as type 2 diabetes, hypertension, and heart disease (Kanaya et al. 2010; Jose et al. 2014; Joshi et al. 2007; Palaniappan, Wang, and Fortmann 2004; Talegawkar et al. 2017). Prior studies of social support in Asian Americans, which often aggregated all Asian Americans together, used both qualitative approaches and social network analyses to show that Asian Americans had family- and friend-centered social networks, relied on these networks for information about health, and had better physical and mental health if they had higher levels of support (Jang, Yoon, and Park 2018; Kim, Kreps, and Shin 2015; Rollock and Priscilla Lui 2016; You et al. 2018). There have been few studies about social support and health in the South Asian subgroup of Asian Americans. The present study examined the role of adult children as an important source of social support and social influence on middle-age and older South Asian adults' health behaviors and fills a critical gap in research on social support and minority health.

In 2017, there were 5.4 million South Asians in the United States and the ethnic group grew by 40% between 2010 and 2017 (SAALT 2019). South Asians face unique health challenges—a higher risk of cardiovascular disease, type 2 diabetes, and heart disease than non-Hispanic Whites and other Asian ethnic groups (Kanaya et al. 2010; Jose et al. 2014; Joshi et al. 2007; Palaniappan, Wang, and Fortmann 2004; Talegawkar et al. 2017). Prior data from the MASALA Study (Kandula et al. 2018) used egocentric social network analysis to show that South Asian social networks were highly family-centered, and that middle-aged and older South Asians with more family members in their network were more likely to have discussions about health with their network. Approximately 80% of participants said they could rely on adult children for social support, compared to 94% who said that about their spouses, and 66% who said they could rely on siblings, friends, or other relatives. These preliminary data suggested that adult children play a vital role in their parents' lives, but almost no research has been done on the social influence of adult children on older South Asians.

In other ethnic groups, social network members influence health through provision of both social support and social influence. In the field of epidemiology, the relationship between social support and health has been extensively studied, and there are consistent findings that higher levels of social support improved mental and physical health, and decreased mortality (Berkman, Leo-Summers, and Horwitz 1992; Cohen 2004; Falk et al. 1992; Rosengren et al. 1993; Uchino 2004). In one meta-analysis of 122 studies, higher levels of social support and family cohesiveness were associated with increased adherence to medication regimens (DiMatteo 2004). Conversely, in a study using multivariate analysis, lower levels of social support negatively influenced chronic disease outcomes (Angerer et al. 2000).

In addition to social support, a separate but connected entity—social influence—must be considered when planning behavioral interventions. While social support is the actual

support provided or the perception that one is receiving support, social influence is the *effect* of social relationships on behavior, thoughts, or emotions, and it operates via social support, role modeling or companionship. Thus, social support can lead to social influence on health-related behaviors (e.g. smoking, exercise or diet), but other forms of influence can also affect behavior even without direct provision of social support. For example, in a study of over 2,500 participants and a mean follow-up of 7.3 years, when members of a social network were less active and more sedentary, overall health worsened and mortality increased, an effect that may have been mediated through role modeling (Brummett et al. 2005).

Leveraging social networks in health behavior interventions requires identifying network members who have influence over specific behaviors (Latkin and Knowlton 2015). *Familism*, in which the needs of the family are more important than the needs of the individual, has been identified as a prominent cultural value in South Asian culture across both focus group and other qualitative fields of research, so family members may be especially salient for behavior change (Lamb 2009; Mukherjea et al. 2013). Despite this, little research has been done on social networks and health in this ethnic group. Further, as individuals in the U.S. live longer and the aging population grows, the role of adult children on their parents' health merits in-depth study and clarification.

Looking specifically at the relationship between adult children and their parents, several quantitative studies have identified three main factors that influence the provision of support; 1) filial obligation, 2) reciprocity of social support, and 3) the 'spill-over effect' of healthy behaviors (Lorca and Ponce 2015; Thomas 2009; Torssander 2013; Yahirun, Sheehan, and Hayward 2017). Filial obligation was defined as the provision of support out of obligation or duty—often thought to be influenced by societal norms (Lorca and Ponce 2015; Thomas 2009). Reciprocity was defined as the give and take between two individuals in a relationship, such that adult children who received more support from their parents were more likely to return that support as well. The 'spill-over effect' posited that when adult children take part in healthy behaviors, their parents imitate or adopt those behaviors as well (Torssander 2013; Yahirun, Sheehan, and Hayward 2017).

Despite these theories of social influence, the effect of support from adult children on parental health has been indeterminate—some research has shown a negative effect on psychological well-being (Reczek and Zhang 2016), while other research has shown increased parental longevity and improved health (Friedman and Mare 2010; Torssander 2013). The form of social support offered and the reciprocity of support appeared to be essential in mediating adult children's influence on their parents' health. Studies showed that emotional support from adult children was more beneficial than informational support, and that providing support to adult children rather than receiving it improved subjective well-being (Lang and Schütze 2002; Reczek and Zhang 2016; Thomas 2009). Further, the 'spill-over effect' of healthy behaviors from adult children to parents mediated improved parental longevity and health through changes in exercise and smoking habits—especially in relationships where adult children had higher levels of education and more health-related knowledge than their parents (Friedman and Mare 2010; Torssander 2013; Yahirun, Sheehan, and Hayward 2017). Few have studied the role of adult children on the health of aging ethnic minorities, including South Asians, who have unique social and cultural contexts that influence the parent-child relationship.

One community-based dialogue showed that older South Asian immigrants were less independent, had lost part of their extended social network upon immigrating to America, relied on family members most when they were uncomfortable with English, and viewed their health in the context of family-based discussions (Puar and Kalayil 2019). A small qualitative study utilizing semi-structured interviews (Sharma and Kemp 2012) examined 10 older South Asians and the role their adult children played in their health, focusing on filial piety, which they defined as the ‘long-term bonds of intergenerational reciprocity and affection, in which juniors provide care for their senior parents in old age. Sharma and Kemp studied the provision of emotional and instrumental (help with bathing, eating, and other activities of daily living) support; the traditional sense of filial piety was modified to accommodate for American values, but the underlying principle of filial piety persisted. They highlighted the reciprocity of support—parents helped their children with cooking or childcare and, in return, received financial support, emotional support, companionship or assistance with health issues. However, Sharma and Kemp did not study other forms of social support or evaluate social influence on concrete parental health behaviors such as diet and exercise.

We hypothesized that the role of adult children in their parents’ diet and exercise may be magnified by the unique position of adult children in the context of immigration (See Figure 1 for conceptual model). Upon immigration, older South Asians lose extended social networks and many face language barriers, resulting in an increased reliance on the nuclear family. In this context, children may be important sources of support and advice. Further, the adult children who were born in the U.S. or immigrated as children may be uniquely situated to provide new information about Western cultural attitudes and health norms in a way that social network members of the same age and acculturation level (spouses, siblings) cannot. This study aimed to understand the role and influence of adult children on the diet and exercise behaviors of older South Asian immigrants in the context of culture and immigration, specifically addressing 1) the ‘spill-over effect’ of

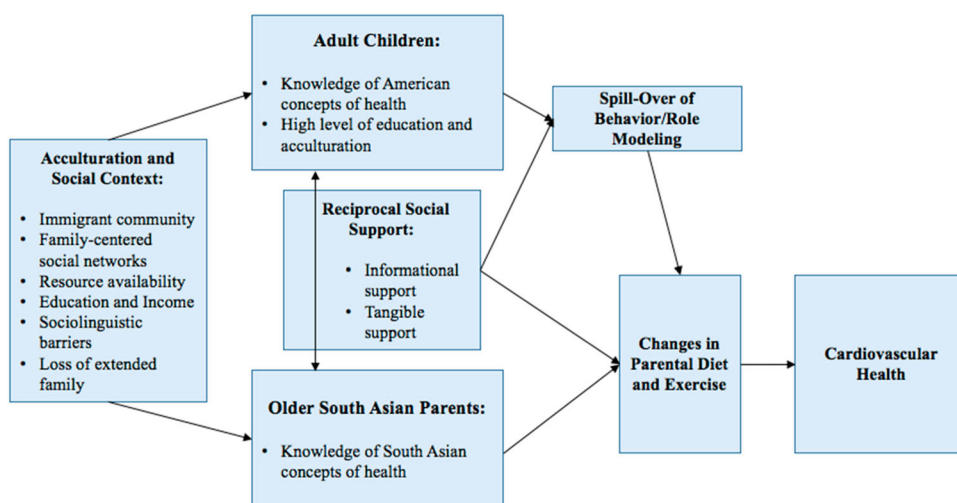


Figure 1. Conceptual Model of Impact of Adult Children on Diet and Exercise in South Asians.

healthy behaviors from adult children to their parents and 2) the reciprocity of social support between parent and child.

Methods

Study design

This mixed-methods study used a sequential explanatory design with two phases (Dominguez and Hollstein 2014). In Phase 1, a quantitative questionnaire elicited information about the MASALA participants' (the parents') social networks. In Phase 2, semi-structured interviews with a subset of parents obtained more detailed information about the social network and the parent-child relationship. Quantitative and qualitative data were then integrated, a key component of mixed-methods studies, which allowed for greater understanding and generalizability of findings from either type of data alone (Dominguez and Hollstein 2014).

Participants

The Mediators of Atherosclerosis in South Asians Living in America (MASALA) Study is a community-based cohort of 906 South Asians (individuals from India, Pakistan, Bangladesh, Nepal, and Sri Lanka) living in the San Francisco Bay Area and seven census tracts close to Chicago, IL (age range 40–84 y, 46% women, 98% foreign-born). All participants were free of clinically-evident cardiovascular disease (e.g. heart attack, stroke, at baseline). Details regarding recruitment and baseline measurements such as education, income, age, marital status, birthplace, number of years living in the U.S., and religion were collected on all participants and have been described previously (Kanaya et al. 2013).

Phase 1—quantitative

Participant sample

From 2014–2018, MASALA study participants were re-enrolled for an ancillary mixed-methods study of social networks. A total of 771 participants completed the quantitative egocentric network questionnaire. Phase 1 data were derived from the 448 participants who named an adult child to their social network in the quantitative questionnaire. The 448 participants who named adult children to their network were termed 'parents' for this study.

Data collection

Social network characteristics were obtained on parents using a standard egocentric approach in which the parent reported information on all their personal network members. A name generator that has been used by the General Social Survey (McPherson, Smith-Lovin, and Brashears 2006, years 1985 and 2004) as well as the National Social Life, Health, and Aging Project (Cornwell et al. 2009) was used to identify important network members. Parents were asked to name up to 10 people with whom they could discuss 'important matters.' This was followed by questions designed to collect detailed information about the first five network members who were listed. Specifically, parents were

asked to characterize the type of relationship, the sociodemographic characteristics of network members (including age, education, number of years living in the U.S., and birth-place), the strength of the relationship (through emotional closeness and frequency of contact), the functions of network members, the discussion topics between participant and network member, and the frequency of communication between network members. The children were not contacted for participation in the study.

Limiting the responses to five network members is a typical approach to reduce burden and still elicit information about key individuals who influence parents' health. Network measurements have been reported previously, and included size, composition, organizational affiliations, social support functions, and network members' behaviors (Kandula et al. 2018).

Measures

Social network exposure: The social network exposure for the quantitative analysis was operationalized as having a child in the personal social network who a) exercised daily/weekly compared to having a child in the network who did not exercise at least daily/weekly and b) having a child in the network who ate certain foods daily compared to a child who did not eat those foods daily.

A conceptual model illustrating how adult children influence their parents' health in the context of South Asian culture and the immigrant experience was used to drive the selection of outcomes and analyses (see [Figure 1](#)).

Outcomes—parental diet and exercise: The outcomes of interest included parental diet and parental exercise.

To measure diet, we used the Alternative Healthy Eating Index (AHEI), which includes 11 food components with scores ranging from 0 to 10 for each component, as a measure of diet quality. Dietary assessment was based on intake reported by parents on the validated Study of Health Assessment and Risk in Ethnic Groups (SHARE) Food Frequency Questionnaire, an instrument developed for South Asians in North America (Kelemen et al. 2003). AHEI scores were modeled on a continuous scale, and could range from 0 to 110, with higher AHEI scores indicating a higher quality diet (Chiuve et al. 2012).

Exercise was measured by self-report with the Cross-Cultural Activity Participation Study (Ainsworth et al. 1999). This study looked at self-reported exercise such as walking, dancing, sports, and swimming. Survey responses were used to calculate metabolic (MET)-minutes per week (with one MET defined as the energy consumed while sitting quietly). National guidelines in the U.S. recommend a minimum of 500–1000 MET-minutes per week of exercise (Nelson et al. 2007; “Appendix 1 - 2008 Physical Activity Guidelines - Health.Gov” 2008), and parents were further categorized as meeting or not meeting exercise recommendations (≥ 500 MET minutes per week).

Covariates. Information on participant age, gender, study site, education level, income category and Traditional Cultural Beliefs Scale Score were collected at the baseline study visit (2010–2013) as previously described (Kanaya et al. 2013) and were included as covariates in regression analyses. Adjustments were made for age and gender because both affect exercise and diet independently from the parent–child dyad. The Chicago and San Francisco study sites also differ in health-related behaviors including diet and exercise.

Education level and income category were included as covariates to control for the effect of socioeconomic status on exercise and diet. The Traditional Cultural Beliefs Scale is a previously validated scale ranging from 0 to 28 with lower scores reflecting stronger South Asian traditional cultural beliefs and higher scores reflecting weaker cultural beliefs. It was used as a covariate in this study to account for the effect of acculturation on diet and exercise.

Analyses

Bivariate associations of lifestyle behaviors with network exposures were examined and descriptive statistics (means and proportions) were calculated for variables of interest, including parent characteristics, social network characteristics and child characteristics.

We used multivariable linear regression to examine the association between having a child in the social network who ate certain foods at least daily (ie: uncooked vegetables, fresh fruit, non-South Asian food) with parental AHEI scores.

Similarly, we used multivariable logistic regression to examine whether having a child in the social network who exercised regularly (daily or daily/weekly) was associated with meeting exercise recommendations.

T-tests were used to compare continuous measures, and Chi-squared or Fisher's exact tests were used to compare categorical variables. All statistical tests were performed using two-sided tests with $\alpha = 0.05$ and were conducted using SAS, version 9.4 (SAS Institute; Cary, NC).

Phase 2—qualitative

Participant sample

Of the original 771 participants who completed the quantitative egocentric network questionnaire, 43 participants completed additional, in-depth interviews to provide context and perspectives on their social networks and health. Participants were chosen to ensure adequate representation of men and women, various age groups, and small and large social networks. Phase 2 data were derived from the 23 participants who both named an adult child to their personal social network and completed an in-depth interview (see [Figure 2](#)). These 23 participants are a subset of the 448 parents analyzed in Phase 1, and are also termed 'parents' in this study.

Data collection

Interviewers used a semi-structured interview guide that was developed by the research team using literature on the social and interpersonal processes that shape diet, exercise and health. Questions were designed to elicit information about health-related social support and social influence from network members and how those factors related to participants' health behaviors. All interviews were conducted in English, Hindi or Urdu by trained interviewers. First, participants were asked to discuss their general relationship with each member of the network and how these individuals influenced their health and behaviors. Next, they were asked about the types of social support they received from each network member. Finally, they were asked about network members' health behaviors and who they considered to be most important in maintaining their family's health.

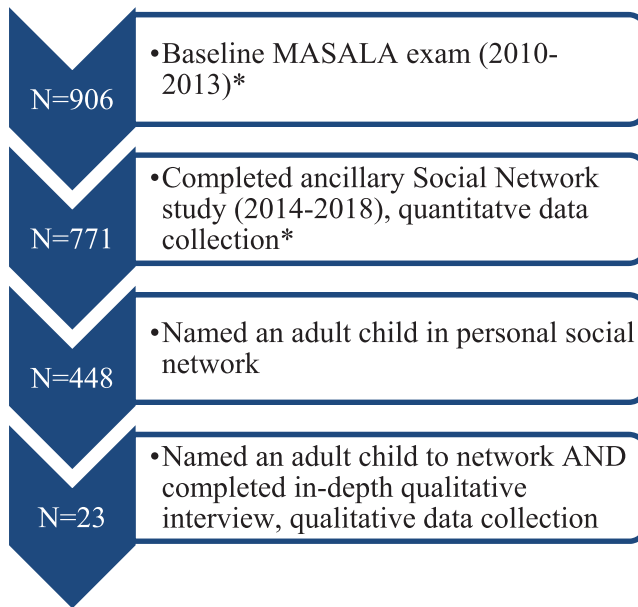


Figure 2. Diagram of Quantitative and Qualitative Data Collection.

Data analysis

Qualitative interviews were conducted, recorded, translated, and transcribed. Codes were created following the thematic analysis framework, with at least two co-authors (AR, SD, MM, AP-T, SM, or NK) coding each interview in NVivo (QSR International). Discrepancies were resolved by discussion and consensus among members of the research team. Codes were cross-referenced using the matrix feature in NVivo to identify major themes in the context of a conceptual model illustrating how adult children influence their parents' health within the South Asian immigrant experience (see [Figure 1](#)). Themes were then confirmed in the full context of each interview, and finalized through discussion among the research team (primarily AR, SD and NK).

Results

Sample characteristics

Parents ($n = 448$) averaged 58 years old (SD 8.43), 48% were women, 89% were married, and 88% obtained a bachelor's degree or higher. The majority (91%) were born in South Asia, and 62% had lived in the US for greater than 25 years. Social networks had a high proportion of family (81%) and South Asians (92%). Compared to parents who named adult children to their social networks but did not complete in depth interviews ($n = 425$), those who did complete in depth interviews ($n = 23$) had similar demographic characteristics (See [Table 1](#)).

Children ($n = 720$) averaged 32 years old (SD 9), 48% were women, 91% spent more than half their life in the U.S., and 85% obtained a bachelor's degree or higher. The proportion of children who were female was significantly higher for the group of parents who

Table 1. Demographic characteristics of South Asian parents (participants who named at least one adult child to their social network), MASALA Study 2014–2018.

Characteristic		All parents (<i>N</i> = 448)	Parents who did <i>not</i> complete the qualitative interview (<i>N</i> = 425)	Parents who <i>completed</i> in-depth interview (<i>N</i> = 23)	<i>P</i> - value		
		<i>N</i> (%) or Mean (SD)	<i>N</i> (%) or Mean (SD)	<i>N</i> (%) or Mean (SD)			
Age, years; Mean (SD)		58.22 (8.43)	58.39 (8.45)	55.22 (SD 7.66)	0.08		
Women, <i>N</i> (%)		215 (48%)	202 (48%)	13 (57%)	0.40		
Education	< Bachelor's Degree	55 (12%)	51 (12%)	4 (17%)	0.65		
	Bachelor's Degree	125 (28%)	120 (28%)	5 (22%)			
	> Bachelor's Degree	268 (60%)	254 (60%)	14 (61%)			
Family Income	< \$75k	118 (26%)	112 (26%)	6 (26%)	0.45		
	\$75–100k	42 (9%)	42 (10%)	0 (0%)			
	> 100k	273 (61%)	257 (61%)	16 (70%)			
	Unknown	15 (3%)	14 (3%)	1 (4%)			
Married, <i>N</i> (%)		398 (89%)	375 (88%)	23 (100%)	0.08		
Years lived in the US*	< 15 years	62 (14%)	58 (14%)	4 (17%)	0.84		
	15–25 years	110 (25%)	104 (25%)	6 (26%)			
	> 25 years	276 (62%)	263 (62%)	13 (57%)			
Percent of life in US, <i>N</i> (%)**	< 50%	251 (56%)	238 (56%)	13 (57%)	0.96		
	> = 50%	197 (44%)	187 (44%)	10 (43%)			
Birthplace, <i>N</i> (%)	India	394 (88%)	372 (87.5%)	22 (96%)	0.85		
	Pakistan	12 (3%)	11 (2.6%)	1 (4%)			
	Bangladesh	1 (0.2%)	1 (0.2%)	0			
	Nepal	1 (0.2%)	1 (0.2%)	0			
	Sri Lanka	3 (0.7%)	3 (0.7%)	0			
	Other	34 (8%)	34 (7.6%)	0			
	United States	3 (0.7%)	3 (0.7%)	0			
	Network Parameters**		5.81 (2.48)	5.81 (2.50)		5.91 (SD 2.17)	0.33
	Network size; Mean (SD)		0.81 (0.21)	0.81 (0.21)		0.78 (SD 0.22)	0.50
Proportion relatives; Mean (SD)		0.92 (0.19)	0.92 (0.19)	0.92 (SD 0.15)	0.89		
Proportion South Asian; Mean (SD)		0.57 (0.23)	0.57 (0.23)	0.52 (SD 0.30)	0.30		
Proportion female; Mean (SD)		4.53 (0.45)	4.52 (0.46)	4.58 (0.42)	0.54		
Closeness to alters; Mean (SD)							

*For those born outside of US in total cohort.

**Network parameters included: size; proportion of network made up of related individuals, South Asians, and women; and closeness to alters (parents rated closeness to each network member on scale 1–5).

completed qualitative interviews ($n = 34$, 65%) compared to those that did not ($n = 686$, 47%), but otherwise were demographically similar (See Table 2).

Phase 1 findings—quantitative data

Among MASALA participants who named children to their network, the mean AHEI score was 74.3 (SD 7.0). Quantitative data is summarized in Table 3. Parents with at least one adult child in the network who ate non-South Asian food daily had higher AHEI scores compared to parents whose children did not eat non-SA food daily (mean AHEI score 75.3 versus 73.4, 95% CI 0.2–2.9). Similarly, parents with at least one adult

Table 2. Demographic characteristics of adult children (named to social networks by parents), MASALA Study 2014–2018.

Characteristic	All adult children named to social network (N = 720)	Adult children named to social network who did <i>not</i> complete the qualitative interview (N = 686)	Adult children named to social network <i>and</i> discussed during in-depth interviews (N = 34)	p-value
	N (%) or Mean (SD)	N (%) or Mean (SD)	N (%) or Mean (SD)	
Age, years; Mean (SD)	32 (SD 9)	33 (SD 9)	30 (SD 7)	0.20
Female, N (%)	345 (48%)	323 (47%)	22 (65%)	0.04
Education*				
< Bachelor's Degree	97 (14)	103 (14%)	6 (17%)	0.29
Bachelor's Degree	249 (37)	257 (36%)	8 (24%)	
> Bachelor's Degree	332 (49)	352 (49%)	20 (59%)	
U.S. born	398 (58)	417 (58%)	19 (56%)	0.81
Years Living in US				
< 15 years	49 (7)	51 (7%)	2 (6%)	0.96
15–25 years	254 (37)	267 (37%)	13 (38%)	
> 25 years	383 (56)	402 (56%)	19 (56%)	
Percent of life in the U.S.				
> = 50%	618 (90%)	652 (91%)	34 (100%)	0.05
< 50%	68 (10%)	68 (9%)	0 (0%)	
Current Location				0.54
U.S.	662 (97%)	696 (97%)	34 (100%)	
South Asia	4 (1%)	4 (1%)	0 (0%)	
Other country	20 (3%)	20 (3%)	0 (0%)	

*Missing for 8 children in total cohort.

child in the network who ate uncooked vegetables daily had higher AHEI scores than parents whose children did not eat uncooked vegetables daily (mean AHEI score 75.2 versus 73.4, 95% CI 0.2–2.8). Finally, parents with at least one adult child in the network who ate fresh fruits daily had higher AHEI scores than parents whose children did not eat fresh fruits daily (mean AHEI score 74.8 versus 73.0, 95% CI 0.5–3.5). There were no significant differences between parental AHEI scores based on whether their children ate South Asian food or cooked vegetables daily. The data also did not demonstrate differences in parental AHEI scores based on adult children's daily consumption of unhealthy foods, including processed foods, sugar-sweetened beverages and diet drinks, though the prevalence of these behaviors was low among the children.

Among parents with any adult child in the network who exercised daily or weekly, 76% of parents met exercise recommendations of ≥ 500 MET-minutes/week, compared to 58% who had an adult child in the network who did not exercise at least weekly (OR 2.1, 95% CI 1.1–4.0).

Phase 2 findings—qualitative data

Three major themes were identified from interview data: 1) adult children provided various forms of social support to parents, 2) social influence manifested as the 'spill-over effect,' and 3) social support was reciprocal between parent and child. These major themes, as well as number of parents to voice each theme, are listed in Table 4.

Social support

Parents identified four major forms of social support that their adult children provided for them: emotional, informational, companionship, and instrumental support (see Table 4).

Table 3. Mean parental AHEI and children's dietary and exercise behaviors.

Network member who eats ...	Raw Scores by Group			Unadjusted Model		Adjusted Model [†]	
	Number of parents whose adult child meets behavior, N (%)	Mean AHEI score for parents whose child meets behavior (SD)	Mean AHEI Score for parents whose child does not meet behavior (SD)	Linear Regression Modeling AHEI Score			
				Beta	95% CI	Beta	95% CI
South Asian Food Daily	183 (41%)	73.6 (6.2)	74.7 (7.4)	-1.1	(-2.4, 0.3)	-0.7	(-2.2, 0.8)
Non-South Asian Food Daily	205 (46%)	75.3 (7.0)	73.4 (6.8)	1.9	(0.6, 3.2)**	1.6	(0.2, 2.9)*
Raw Vegetables Daily	222 (50%)	75.1 (6.5)	73.4 (7.3)	1.7	(0.4, 3.0)*	1.5	(0.2, 2.8)*
Cooked Vegetables Daily	331 (74%)	74.6 (6.7)	73.5 (7.7)	1.1	(-0.4, 2.6)	0.9	(-0.6, 2.5)
Fresh Fruit Daily	314 (70%)	74.8 (6.4)	72.9 (8.1)	1.9	(0.5, 3.3)**	2.0	(0.5, 3.5)**
Diet Drinks Daily	58 (13%)	72.8 (7.2)	74.5 (6.9)	-0.9	(-4.2, 2.4)	-0.1	(-3.4, 3.2)
Sugar Sweetened Beverages Daily	18 (4%)	73.4 (9.1)	74.3 (6.9)	-1.7	(-3.7, 0.2)	-1.2	(-3.2, 0.8)
Processed or Packaged Food Daily	9 (2%)	74.1 (7.3)	74.3 (7.0)	-0.2	(-4.8, 4.5)	-1.4	(-6.0, 3.2)
<i>Network member who ...</i>	<i>Number of parents whose child meets behavior, N (%)</i>	<i>Parent meets exercise recommendations and has child who meets behavior N (%)</i>	<i>Parent meets exercise recommendations but their child does not meet behavior N (%)</i>	<i>Logistic Regression Modeling Probability of Ego Meeting Exercise Requirements</i>			
Exercises Daily or Weekly	395 (88)	301 (76)	30 (58)	Odds ratio	95% CI	Odds ratio	95% CI
				2.4	(1.3, 4.3)***	2.1	(1.1, 4.0)*

[†]Adjusted for parental age, gender, study site, education level, income, Traditional Cultural Beliefs Scale Score

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Social support was defined as the actual support provided or the perception that one received support.

Parents strongly relied on their adult children for emotional support, and specifically for advice. HR, a 49 year-old woman, described that she went to her son, who was into 'positivity and emotional health' for advice when she was having a hard time relating to her sisters-in-law: 'He taught me some good ways of socially interacting, like the American ways ... and these things from him helped me really become a good person.' She described how her son's perspective helped her deal with relationship problems more effectively. More than half of parents felt that their children were able to provide them with emotional support when they were faced with other difficult relationship issues or health problems.

In addition to relying on their adult children for emotional support, parents also identified adult children as a significant source of information about health. Among other things, their adult children taught them about the nutritional content of different foods, label reading, portion control, and techniques to reduce or replace unhealthy snacks. Parents often identified children as a primary source of information about health (see [Table 4](#)).

Parents noted that their children would not only teach them about healthy behaviors, but also engaged in these behaviors alongside them, providing companionship that parents felt helped them practice healthier habits (see [Table 4](#)). Others felt their adult children would even hold them accountable if they wanted to change their behavior. SS, a 42 year-old woman, explained: 'I know that [if] I were to say I was going to do something ... [my son would] remind me every day, I know he would do it.'

Finally, parents described receiving instrumental support from adult children, which was defined as physical assistance or any other forms of tangible support. Most often, children helped their parents navigate the health system or provided financial support, but they also helped parents keep track of medications, make screening appointments, and research medical issues (see [Table 4](#)). Less commonly, children did household chores for their parents.

Of note, parents identified few negative influences on *health* behaviors from their children. Most negative influences described were in regard to worry about children's relationships or success, conflict between traditionally South Asian and Western values, children living away from home, or issues with in-laws.

Social influence manifested as the 'spill-over effect'

The 'spill-over effect' was confirmed in these South Asian parent-child relationships, but it was also magnified by parental acceptance of informational support from their adult children. Parents valued the informational support from their adult children, which appeared to promote healthy changes in parental behavior. Parents attributed this to acculturation and education, which increased exposure to ideas about health and wellness that were very different from traditional SA norms.

Nearly 75% of parents saw their children as role models for healthy behavior (see [Table 4](#)). They observed their children living in healthier ways, and often identified their children as sources of inspiration when they were trying to change their behavior, especially for dietary changes. SS, a 42 year-old woman, describes how she views her son as a role model: 'He has given up sugar for the past, I would say, four years. I think "He's a kid, so much younger than me, and he's able to do it.'" Because children were seen as role

Table 4. Major themes related to social support and influence in the South Asian parent-adult child relationship, MASALA Study 2014–2018.

Major Theme	Number of Parents Voicing Theme (% of total)	Illustrative Quote
Forms of Social Support		
Emotional Support	14 (61%)	‘Even when she was younger [she] was always wise, but kind of gives me matter of fact, good advice.’ –SA, a 56 year old woman.
Informational Support	13 (57%)	‘My son tells me, in the morning to eat a big breakfast and not to [eat] any snacks in between and just if you’re eating, eat some vegetable snack or fruit snack because cookies also have lots of carbs and things, lot of sugar.’ –EA, a 56 year old woman.
Companionship and Accountability	13 (57%)	‘Back when I was in a better routine of going for a jog and I used to go with [my daughter] we used to do it a lot more frequently because we would kind of encourage each other to go. And you know sometimes I would be in the mood to go or sometimes she would be in the mood to go ... it’s easier you know, because then you have company.’ –TS, a 44 year old woman.
Instrumental Support	12 (52%)	‘If I have a headache or, like right now I have shoulder pain and so, I told her and she will suggest ‘Go to this doctor,’ or she will do some research and tell me ‘You just call this number,’ and sometimes she takes appointment for me, also.’ –MS, a 59 year old man.
Social Influence		
Children as Role Models	17 (74%)	‘He’s so much that he will not eat carb because body building, you know, so no <i>naans*</i> , no <i>puris**</i> in our house now ... my sons inspire me towards good health’ –HR, a 49 year old woman.
Introduction to Western Behaviors	13 (57%)	‘My wife and I, we are very much Indian food based. From her we learned ... we had salad, and soup and one baked dish. It was fine and we enjoyed it very much. So that way she is helping us to keep that option.’ –JA, a 68 year old man.
Reciprocity of Support		
Children Receive Instrumental Support	18 (78%)	‘Even though they both have full-time nannies sometimes in the evening [my daughter] needs more help so the reason I’m not looking for a new job, at least not until February, is that I just want to help her.’ –SA, a 56 year old woman.
Parent Role Models Health	11 (48%)	‘He’s put on some weight, right, so now I, you know, he started with three miles and I want him to go up ... so I kind of work with him’ –NV, a 46 year old man.
Parents Provide Health Information	9 (39%)	‘With my kids, I do push them, I do tell them, you know, eat healthy or take your meds if you need to, work out if possible.’ –RR, a 55 year old woman.

*South Asian baked flatbread.

**South Asian deep-fried flatbread.

models for healthy behaviors, parents were willing to accept health-related information and to imitate or adopt the behaviors they saw their children participating in.

Parental acceptance of adult children’s informational support was strengthened by parental belief that some of the Western health behaviors their children had adopted were healthier than traditional South Asian behaviors. Nearly sixty percent of parents said their children had adopted Western health behaviors and consequently introduced those ideas to their parents (see Table 4). NR, a 51 year old woman, described how she was unfamiliar with healthy Western dietary options, but once her son joined the track team in high school, he would come home with information from his coach about healthy foods that the whole family would then adopt. A 66 year old woman, LR, described

how the process of acculturation led to new health information: ‘I was not aware I was overweight and I was not familiar with the American culture, so she was the one and my son who made us familiar with all the foods.’ In fact, NR, whose son influenced the family diet through his track coach, also described the children of South Asian immigrants as more ‘health conscious.’ She contrasted this with her own parents, saying ‘it’s a cultural difference ... and I think a combination of attitude and plus the plentifulness of moving to this country was not good for that [older] generation.’ She described her own generation as culturally ‘in between’ her parents’ and her children’s generations.

Reciprocity of support

In addition to the unique role of adult children in the South Asian immigrant community, the support provided by children to their parents was accepted due to the reciprocity of social support in the child–parent dyad.

Parents provided many forms of support for their children, including instrumental and informational support (see Table 4). NK, a 58 year old woman, noted that she enjoyed preparing food for her son, commenting ‘If I don’t do it, I’ll be unhappy.’

Parents also identified themselves as role models for healthy behaviors for their children in addition to seeing their children as role models (see Table 4). MS, a 59 year old man, echoed a common theme among parents that he worked hard to keep his children from eating processed, packaged foods and to promote healthy fresh foods. This concept was referred to in the context of Western culture’s reliance on packaged foods, and he implied that by promoting fresh food consumption, he was also reinforcing South Asian concepts of healthy eating. The reciprocity of support and the perception of both themselves and their children as role models indicated a give-and-take relationship in which parents were more able to accept health-related information from their children because they too could provide valuable information about health, rooted in South Asian culture, to their children.

Discussion and integration of findings

This is one of the few studies that examined the role of specific social network members on health in South Asian immigrants in the U.S. Our mixed-methods data suggested that adult children are an important influence on parental health behaviors and that underlying mechanisms include social support and ‘spill-over’ of healthy behavior.

In Phase 1, the quantitative data suggested that parents with adult children who consumed specific foods and exercised regularly had higher diet quality and were more likely to meet exercise recommendations those whose children did not. Although these findings are consistent with findings in other populations (Higgs and Thomas 2016), the reasons for these differences have not been elucidated, and the specific ways adult children influenced these behaviors merited further exploration. Interview data illuminated the possible reasons for these associations with three main findings: first, adult children provided various forms of health-related social support; second, healthy behaviors from adult children were found to ‘spill-over’ to their parents; and third, social support between parents and children was reciprocal. Integration of the findings supported the hypothesis that adult children of older South Asian immigrants are in a unique situation to influence their parents due to their position within immigrant families in the U.S., where they serve

as credible sources of informational support and role models of certain healthy behaviors adopted as part of the acculturation process.

We found that parents with an adult child in the network who consumed non-South Asian food, raw vegetables, or fresh fruit daily had higher diet quality than parents who had a child in the network that did not consume these foods as frequently. When children consumed South Asian food or cooked vegetables daily, there was no association with healthier parental diet. Parental diet was also unaffected by children's consumption of sugary beverages, diet drinks or processed foods, which was also supported by qualitative data; packaged and processed foods were likely not accepted by parents due to parental emphasis and role modeling of South Asian norms about healthy food, such as eating fresh foods rather than processed foods. The combined effects of 'spill-over,' children's and parents' education, and acculturation may explain why children's consumption of healthy non-South Asian food (raw vegetables and fresh fruit) was associated with improved parental diet when other aspects of non-South Asian diet (packaged foods) were not.

Children introduced their parents to Western concepts of health and then provided companionship and accountability in changing what both parent and child thought were unhealthy dietary behaviors. These acculturative processes and reciprocal role modeling may explain how South Asian immigrant parents used new health information, brought to them by their adult children, and integrated it with their own concepts of a healthy lifestyle that were based in South Asian cultural norms.

Another important finding that can be explained by the combined processes of acculturation and role modeling was older South Asians' acceptance of children's informational support. Prior findings from non-immigrant populations suggested that informational support from adult children had negative effects on parental health and well-being (Lang and Schütze 2002; Reczek and Zhang 2016; Thomas 2009), but we found the opposite to be true. The adult children's unique ability to introduce Western ideas of health and wellness to their parents may have made it easier for parents to accept information from children. This is especially true in the setting of immigration, in which children are exposed to more Western health concepts than their parents through higher education and in which parents rely heavily on the nuclear family and actively take up Western cultural behaviors. However, another major factor in this acceptance was reciprocity of support—parents provided support to their adult children and also influenced their health, suggesting a give-and-take relationship in which information from adult children may have been more readily accepted and incorporated.

Limitations and strengths

Limitations of this study included the cross-sectional quantitative design, which limited causal inference and focused on data collected only from the parents without data collected directly from the children, which could have altered Phase 1 findings. We also evaluated several different network exposures, which raises the issue of multiple exposures (Patel and Ioannidis 2014). Although our choice of exposures was based on an *a priori* conceptual model and hypotheses, it is possible that significant associations were due to chance, and there is a need to replicate these findings. Further, only data on adult children, not children less than 18 years of age, was included, which may have altered the impact of

children on their parents' health behaviors in Phase 2. Finally, the MASALA Study population was from only two geographic areas in the U.S., participants had a high socioeconomic status, and were largely of Indian origin, which does not represent the heterogeneity of the South Asian community in the U.S.

Despite these limitations, this study used a theoretically-informed mixed-methods design in a relatively large sample, with established measures of diet and physical activity and in-depth semi-structured interviews. We also selected covariates that were potential confounders, including those variables that were potential causes of the exposure or outcome or both, and those that may have captured unmeasured common causes of the exposure and the outcome. Though the findings may not be generalizable to all South Asians, our findings reflect the general demographics of South Asian immigrants in the U.S., where Indians comprise the largest subset of the South Asian community (over 80%), followed by Pakistanis, Bangladeshis, Nepali, and Sri Lankans (SAALT 2019). Our findings provide rich, empiric evidence of how adult children influence the health of middle- and older-aged South Asians in the U.S., and can inform health promotion strategies in this population.

Conclusion

Integration of the quantitative and qualitative data from this study showed that adult children in South Asian families influenced their parents' diet and exercise by providing social support, introducing Western concepts of health, holding their parents accountable for behavioral change, and by acting as role models for healthy behavior. Our data support the idea that for older South Asian immigrants, adult children provide trustworthy and acceptable sources of health information that influences parental exercise and diet. Given that the South Asian immigrant community is at high risk of morbidity and mortality from cardiovascular risk factors and diseases that can be prevented and partially treated by lifestyle modification, future prevention efforts in this community should consider incorporating adult children to help implement and sustain healthy behavior change.

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