TOM VANHEUVELEN AND JANE S. VANHEUVELEN

Department of Sociology, University of Illinois at Urbana-Champaign

Email: tvanheuv@illinois.edu, Email: jvh@illinois.edu

The (Economic) Development of Healthy Eating Habits

Gender, Nutrition, and Health Outcomes in 31 Countries

ABSTRACT This research examines how gender and economic development interrelate to predict healthy eating behaviors, and how all three interrelate to predict health outcomes. The consumption of fresh fruits and vegetables has been identified by international NGOS, policymakers, and health advocates as an important way to improve health outcomes. However, attempts to change population diets often take highly individualistic approaches, which may overlook structural factors that influence access to and availability of healthy food options, and systematic differences in the propensity to enact health behaviors among populations with similar levels of access and availability. In response, we examine nationally representative data from 31 middle- and high-income countries from the health module of the 2011 International Social Survey Programme. Following analyses from multilevel gamma and linear regression models, we draw two main conclusions. First, women, but not men, tend to eat fresh fruits and vegetables more frequently in more developed countries. Second, there is substantial heterogeneity in health differences between men and women, depending on individual eating behaviors and national development context. We conclude by discussing the academic and policy implications for health and development of our findings regarding the effect of structural factors on eating behaviors and health outcomes. KEYWORDS health, development, comparative historical research, food consumption, health lifestyles

INTRODUCTION

Improvement in nutrition, particularly consumption of nutritionally dense fruits and vegetables, represents one of the major health and development challenges of the twenty-first century (Lang and Heasman 2015; WHO 2014). In 2010, inadequate consumption of fresh fruits and vegetables accounted for nearly 7 million deaths worldwide (Lim et al. 2013) and has been identified as one of the top 10 global risk factors for mortality (WHO 2006), with risk pronounced in low- and middle-income countries. Economic development and health are inextricably linked (Noy 2011; Stroud, Anglewicz, and VanLandigham 2016; WHO 2014), and while the causal effects are debated, existing research on food, development, and health finds that economic development generates greater access to and availability of a wide diversity of types of food (Drewnowski and Popkin 1997; Popkin 2006; VanHeuvelen and VanHeuvelen 2017).

Thus, it should be unsurprising that policymakers have implemented reforms to increase consumption of fresh fruits and vegetables in countries such as the United States, Brazil, and

Hungary, and that international organizations have pushed for increased consumption of fresh fruits and vegetables as a central, cost-effective method to improve both economic development and public health (WHO 2014). Yet the ease and success of such nutrition reforms likely vary, not only across countries at different stages of development, but also within countries, as research suggests that some individuals are more likely than others to partake in healthy eating behaviors, even with similar access to and availability of nutritionally dense foods (Cockerham 2005). Specifically, scholars in this tradition identify gender as an important structural variable that distinguishes different health lifestyles. These complications imply substantial heterogeneity in who might partake in, and perhaps even benefit from, healthy eating behaviors at both the individual level, via anchors of healthy lifestyle behaviors (Cockerham 2000, 2005), and the country level, via economic development's tight coupling with food access and availability (Drewnowski and Popkin 1997).

In the current research, we examine the relationship between gender, healthy eating behaviors, and health outcomes across a variety of countries through a synthesis of two theoretical frameworks: the nutrition transition model (Drewnowski and Popkin 1997) and health lifestyle theory (Cockerham 2005). The former emphasizes that macro-level variation in economic development tightly couples with access to and availability of a wide diversity of foods, implying that individuals in more economically developed countries can more easily incorporate fresh fruits and vegetables into their diet. The latter offers a micro-level framework to explain variation of health behaviors among individuals with different social identities, roles, and expectations (such as men and women) who have a similar set of food choices. Combined, health lifestyle theory provides a theoretical foundation for focusing on gender-based differences in the decision to eat nutritionally dense foods, and the nutrition transition model provides expectations for where gender-based decisions should be particularly consequential.

We use data from the 2011 wave of the International Social Survey Programme (ISSP), which includes nationally representative samples of individuals from 31 countries across a wide range of development, from middle-income—the Philippines, China, and Bulgaria, for example—to high-income—the United States, Germany, and Norway. Using mixed-effects random intercept and random coefficient gamma regression models, we examine how the frequency of healthy eating behaviors varies by gender and economic development. In doing so, our study seeks to unpack the relationship between gender, economic development, and healthy eating behavior.

LITERATURE REVIEW
The Health Benefits of Fruits and Vegetables

The importance of consuming nutritionally dense foods, particularly fresh fruits and vegetables, for an individual's health is well established and plays a central role both in global health research and in policy interventions aimed at improving public health (Dallongeville et al. 2010; Van Duyn and Pivonka 2000). Healthy diets that include fresh fruits and vegetables and minimize energy-dense foods are associated with improvements across a variety of health outcomes, including obesity, cardiovascular disease, diabetes, and cancer (Cannuscio 2014; Darmon and Drewnowski 2008; Otero et al. 2015). Therefore, health scholars identify diet,

alongside other major health behaviors—frequent exercise, moderated alcohol consumption, and refraining from tobacco use, for example—as an effective method for individuals to improve health outcomes (Pampel, Krueger, and Denny 2010).

In addition to individual-level health, fresh fruit and vegetable consumption plays a central role in global health. Overall, global diets tend to be relatively unhealthy; global consumption of fresh fruits and vegetables falls short by as much as 50 percent of goals set by the World Health Organization (FAO 2015a). This shortfall has important consequences, as inadequate consumption of fresh fruits and vegetables is responsible for upwards of 3 percent of all deaths worldwide, with risks particularly concentrated in middle- and low-income nations (WHO 2009). High-income countries have also become increasingly focused on raising the share of nutritionally dense foods such as fruits and vegetables in response to rising obesity rates (An 2015).

In total, it is unsurprising that policymakers, public health advocates, and intergovernmental organizations have undertaken a wide variety of public campaigns and policy initiatives to increase the consumption of fresh fruits and vegetables as a cost-effective method of improving public health (An 2015; Drewnowski and Darmon 2005; Sturm and Hattori 2015; WHO 2014, 2016). Positive health outcomes, such as those routinely measured using self-rated health scores, should be detected among groups that frequently consume fresh fruits and vegetables.

Access, Availability, and Development

Often, healthy food consumption is presented as an individual choice (Saguy and Almeling 2008), yet the decision to consume a healthy diet is not entirely in the control of an individual. Cross-national research demonstrates that food consumption choices are made within a broader developmental context of food availability and access. Briefly, *availability* refers to the simple presence of food choices for local populations. *Access* refers to the affordability of available food choices. The nutrition transition model helps explain the macro-level linkage between economic development and local diet (Drewnowski and Popkin 1997; FAO 2015a, 2015b; Popkin and Gordon-Larsen 2004).

The nutrition transition model highlights the fact that changes in the composition of local diets are partially symptomatic of changes in the causes and consequences of economic development—technological change, incorporation into global trade patterns, employment change across economic sectors, fertility change, educational attainment, and growth in affluence, for example (Alderson and Nielsen 2002). Changes in economic development also lead to shifts in local dietary options in countries at different stages of economic development. Simply put, scholars in this tradition note that an individual's dietary choices must be understood as subsumed under a broader development context that provides different food options to different populations.

Long-term changes in development have shrunk between-country differences in diet composition, as more countries have gained greater access to energy-dense "Western diets" (Drewnowski and Popkin 1997; Popkin 2006; Popkin, Adair, and Ng 2012; VanHeuvelen and VanHeuvelen 2017). However, substantial differences in food options exist between countries, primarily through (1) the relative cost of food, which is generally more expensive

relative to income in less affluent countries, and (2) the local availability of types of food, with a greater diversity of food choices in more affluent countries. The nutrition transition model suggests that healthy eating options might be difficult to incorporate into the diets of individuals in less developed countries, not only because it is hard for these foods to compete with the immediate gratification of fatty and sugary foods, but also because of the greater difficulties regarding access and availability of nutritionally dense foods in such countries (Drewnowski and Darmon 2005; Miller et al. 2016; Wiggins et al 2015).[1]

Gender and Health Lifestyles

At the same time, not all individuals are equally likely to engage in healthy eating behaviors when given similar food options, and medical sociologists have developed the theory of *health lifestyles* to understand why different groups make different health behavior choices in similar structural circumstances. Building on a Weberian definition of lifestyles, health lifestyles are "collective patterns of health-related behavior based on choices from options available to people according to their life chances" (Cockerham 2005:55). This theory offers a useful way to understand how individual *life choices* are made within a broader structure of *life chances*, the combination of which results in observed health behaviors and health outcomes. According to Weber, life chances are primarily influenced by economic class and cultural status, but Cockerham (2005) extends theoretical consideration to other social structures and identities, such as living conditions, race, ethnicity, age, and gender.

Although health lifestyle theory points to a variety of social identities potentially salient for health behaviors and health outcomes, we focus specifically on gender. Cockerham (2005) identifies gender as an important structural variable that differentiates participation in overall healthier lifestyles, including healthy diets. Most theoretical development and empirical research in the health lifestyles tradition identifies women as choosing healthier diets compared to men (Beardsworth et al. 2002; Cockerham 2005; Cockerham, Hinote, and Abbott 2006; Cockerham et al. 1988; Rappoport et al. 1993). Explanations for this gender-based variation in health behaviors include differences in socialization, societal norms, and perceptions of socially acceptable behaviors faced by men and women regarding health behaviors and physical appearance (see Beardsworth et al. 2002 for an overview). For instance, studies show gender differences in the way men and women perceive ideal body size, with greater expectations for women to maintain smaller body sizes (Fallon and Rozin 1985). Differences in ideal body shape translate into attitudes to body weight and dietary choices, with women being more likely to select healthier foods, including fresh fruits and vegetables and diets high in fiber, compared to men, in part as an effort to control weight gain and achieve their ideal body size (Rolls, Fedoroff, and Guthrie 1991; Wardle et al. 2004).

Women's greater participation in healthy eating behaviors may also be explained by gender differences in health beliefs and attitudes to healthy eating. For example, Wardle et al. (2004) found that women's stronger beliefs in the importance of healthy eating explained nearly half of the difference in the dietary choices made between men and women. Similarly, such food choices and attitudes may be partially based in the social roles that men and women are expected to perform in relation to food consumption, as women tend to

bear the responsibility of preparing their family's meals (Allen and Sachs 2006). This responsibility may well expose women to more information about nutrition, which then influences their health beliefs and individual food choices (Wardle et al. 2004).

While health lifestyles research consistently finds women to have healthier diets than men, it has largely been limited to developed countries. Of course, the fundamental link between development and gender equality is well established, and gender equality has been highlighted as one of the core Sustainable Development Goals by the United Nations (UNDP 2017). Beyond health beliefs, body shape ideals, and family responsibility, women in less developed nations may also lack power and control over the economic resources by which food is bought and brought into the household, limiting their food choice. Furthermore, in less developed contexts, women may devote resources to providing food for their families while undernourishing themselves (World Food Programme 2017). Empirically, gender equality is highly correlated with development (Klasen 2002). Therefore, understanding health lifestyles in countries across the economic development spectrum is of particular importance, as women's social roles and economic autonomy may differ across development levels.

Development Context through a Gendered Lens

The health lifestyles literature provides expectations for gender variation in the enactment of healthy behaviors that can be extended to the country level. Specifically, scholars have focused on the interplay between gendered health lifestyles and *living conditions*, or "a category of structural variables" that relate to the overall quality and level of development of the particular social context where people live (Cockerham 2005:59). Living conditions are typically conceptualized as individual-level socioeconomic differences, given that most health lifestyle research examines single countries. Examples include geographical variation in access to "basic utilities" and "grocery stores" (59), as exemplified by the "food deserts" literature in the United States (Adams, Ulrich, and Coleman 2010). Similarly, some research suggests that gender lifestyles are filtered through social class, as both men and women in higher socioeconomic positions have access to economic resources that allow them to engage in healthier behaviors unavailable to others (Cockerham 2005; Link and Phelan 1995). These findings would suggest that gender differences in health lifestyles tend to be larger at higher socioeconomic positions, which provide greater resources for women to enact their choices. Simply put, while women tend to perform healthier lifestyles than men, such decisions are made in relation to a broader socioeconomic context.

As suggested in the above section, these examples can be extended straightforwardly to the country level. We argue that variation in affluence at the country level should interact significantly with the manifestation of gender-based lifestyles. Given that the nutrition transition model points to country-level economic development as an important source of local dietary diversity, food access, and food availability, it is logical to consider country-level economic development as a broadly shared *living condition* with a direct linkage to food consumption behavior, as defined in the health lifestyles literature. Insofar as gender-based lifestyles are subsumed under living conditions, it is logical to consider living conditions as not only a class-based within-country phenomenon but also a between-country development phenomenon.

Of course, most health lifestyles research focuses on a single country. One exception is the study of Cockerham, Hinote, and Abbott (2006). Although they did not focus on economic development, they examined how gendered differences in health lifestyles in four former Soviet countries were influenced by levels of distress associated with macro-level social change. Given that gendered social roles as measured through gender equity are tightly coupled with overall levels of development (Klasen 2002), we draw motivation from Cockerham, Hinote, and Abbott to consider how gender differences in health lifestyles might systematically vary across country-level living conditions.[2]

We argue that the synthesis of health lifestyles research with the nutrition transition model provides a useful approach for understanding how both health behaviors and subsequent health outcomes are influenced by a complex relationship between individual agency and country-level structural factors (Cockerham 2005). This approach bridges the healthy eating research in medical sociology and the global policy discussion of healthy food consumption. Whereas health lifestyle theory emphasizes individual agency more than other theories in medical sociology, it provides greater attention to structural constraints compared to the individual-level orientation of many international discussions of global health by policymakers and international (non)governmental organizations. Such individualistic policy recommendations persist despite the strong association between health behaviors and social structures (Delormier, Frohlich, and Potvin 2009).

Expectations

Based on the above discussion, we develop the following expectations for the current research. First, we follow previous health lifestyles research and anticipate that women will eat healthily more frequently than men. We expect to find this gender difference for the total sample, and within each country. Second, based on both health lifestyle theory and the nutrition transition model, we anticipate that individuals in more economically developed countries will eat healthily more frequently than individuals in less developed countries. This expectation is based on the greater availability of healthy food options highlighted by the nutrition transition, and mirrored by the importance of living conditions in the health lifestyles literature. Third, we anticipate that economic development and gender associations with healthy eating will interact. We expect that although both men and women will take advantage of the greater access to and availability of healthy foods in more developed countries, women will do so more than men. Finally, we anticipate that the interrelationship between gender, economic development, and healthy eating will translate into significant differences in health outcomes. We expect women to have more positive health outcomes than men, insofar as women partake in healthy eating behaviors more frequently than men.

DATA

We examine 31 countries with available data from the 2011 ISSP's health module. The ISSP provides standardized and nationally representative survey data. Our study's total sample size is 44,017. Descriptive statistics are listed in Table 1.

	Mean	Std. dev.	Min.	Max.
TABLE 1. Descriptive statistics				
Dependent variables[1]				
Self-rated health				
Healthy eating days per week	4.89	2.42	0	7
Main independent variables				
Female	0.55	0.50	0	1
GDP per capita (USD thousands)	24.29	17.95	1.44	65.90
Health behavior and status control variables				
Number of cigarettes smoked per week	20.48	47.62	0	420
Former smoker	0.22	0.42	0	1
Alcohol consumed days per week	0.46	1.17	0	7
Exercise days per week	2.15	2.47	0	7
Has a chronic condition, long-standing illness, or disability	0.31	0.46	0	1
How frequently in last four weeks have you:				
Had difficulties with work or household activities because of health problems	2.02	1.17	1	5
Had bodily aches and pains	2.45	1.22	1	5
Felt unhappy and depressed	2.10	1.09	1	5
Lost confidence in self	1.81	1.02	1	5
Felt you could not overcome your problems	1.86	1.04	1	5
Sociodemographic control variables				
Relative income	0.00	0.74	−2.1	3
Imputed income	0.20	0.40	0	1
Age in years	47.61	17.03	15	99
Education in years	11.80	4.53	0	35
Marital status				
Married or in partnership	0.59		0	1
Separated or divorced	0.08		0	1
Widowed	0.08		0	1
Never married	0.24		0	1
Occupational status				
Employed	0.55		0	1
Unemployed	0.07		0	1
Student	0.06		0	1
Permanently sick or disabled	0.03		0	1
Retired	0.18		0	1
Other	0.11		0	1

	Mean	Std. dev.	Min.	Max.
Urban status				
Farm	0.04		0	1
Country village	0.30		0	1
Town / small city	0.22		0	1
Suburbs	0.14		0	1
Big city	0.29		0	1
Country educational attainment	12.06	7.10	0.32	30.04
Country energy supply adequacy	131.9	10.4	111	155

TABLE 1. Descriptive statistics (*continued*)

Observations: 44,017

[1]Countries in sample: Australia, Belgium, Bulgaria, Chile, China, Croatia, Czech Republic, Denmark, Finland, France, Germany, Israel, Italy, Japan, South Korea, Lithuania, Netherlands, Norway, Philippines, Poland, Portugal, Russia, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Turkey, Great Britain, United States.

Variables of Interest

Respondents are asked to rate their general health (1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent). Self-rated health (SRH) has been routinely used in cross-national and single-country studies as a validated, general, and comparable measure of morbidity and mortality.[3] Given that research shows healthy eating to improve a wide range of health outcomes, SRH provides an ideal opportunity to measure these diverse influences.

We examine variation in SRH along two key individual-level variables, gender (female = 1) and healthy eating behaviors, and one country-level variable, GDP per capita. For healthy eating behavior, respondents are asked how often they eat fresh fruits or vegetables (1 = never, 2 = once a month or less, 3 = several times a month, 4 = several times a week, 5 = daily). We transform this variable to correspond to the equivalent number of days per week: 0, 0.23, 0.92, 3.49, or 7. We test this decision against the original scaling as well as entering the variable as a series of distinct categories, which yield the same results. The association between healthy eating, gender, and health outcomes should be affected by unobserved heterogeneity stemming from a variety of other health behaviors and statuses. We control for all additional health items in the ISSP: *frequency of smoking*, whether the respondent *formerly smoked*, *frequency of heavy alcohol consumption*, *frequency of exercise*, whether the respondent has a *chronic condition, long-standing illness, or disability*, and how often in the past four weeks the respondent (a) had difficulties with work or household activities because of *health problems*, (b) had *bodily aches and pain*, (c) felt *unhappy and depressed*, (d) *lost confidence* in themselves, and (e) felt they *could not overcome their problems* (1 = never, 2 = seldom, 3 = sometimes, 4 = often, 5 = very often).[4] Of course, these measures do not exhaust all possible sources of unobserved heterogeneity, and so we do not attempt to make strong causal claims. Yet these controls help minimize concerns that our results are unduly driven by unobserved heterogeneity.

At the country level, we include the natural log of *GDP per capita* from the World Bank (2012). In sensitivity analyses, we found logged GDP per capita to be highly correlated with

indicators of food access and availability ($\rho = 0.90$) and the gender inequality index ($\rho = 0.92$). In our cross-sectional sample, economic development, nutritional diversity, and gender empowerment are tightly coupled.[5]

Control Variables

We include six sociodemographic controls: *relative household income*,[6] *age* in years and its squared term, *marital status* (married, divorced/separated, widowed, never married), *occupational status* (employed, unemployed, student, retired, disabled, other), *residential status* (ranging from rural to urban), and *education* in years and its squared term. At the country level, we control for tertiary educational attainment (World Bank 2012) and calorie availability (FAO 2015b).

METHODS

We use a multilevel modeling strategy, with individuals, i, nested within countries, j (Wooldridge 2010). We use mixed-effects regression models for SRH and include random coefficients for key variables—healthy eating and the interaction term between healthy eating and relative income. Random coefficients add a country-specific error term to individual-level coefficients, allowing individual-level coefficients to vary in magnitude across countries. This model takes the basic form:

$$Y_{ij} = \beta_{0j} + \beta_{1j}X_{ij} + \varepsilon_{ij}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01}W_j + \mu_{0j}$$

$$\beta_{1j} = \gamma_{10} + \mu_{1j}$$

The first equation is a simple linear regression with a single predictor. The second equation distinguishes an overall (γ_{00}) and a country-specific (μ_{0j}) intercept, and includes a country-level regression coefficient for GDP per capita (γ_{01}). The random coefficient for specific individual-level coefficients is included in the third equation, which differentiates the overall (γ_{10}) and country-specific (μ_{1j}) components of the coefficient. Our interaction models add a coefficient of GDP per capita ($\gamma_{11}W_j$) to this equation. This cross-level interaction enables the modeling of systematic associations between country-level and individual-level effects through cross-level interactions.

We model SRH with multilevel linear regression models. Because SRH includes five ordered categories, we also tested results using a multilevel ordered logistic regression model, reaching the same conclusions. We use a mixed-effects gamma regression model with a log link when predicting frequency of healthy eating.[7]

RESULTS

Table 2 shows regression results of the first step of our analyses: examining variation in the frequency of healthy eating by gender and country-level economic development. We estimate multilevel gamma regression models with log link functions predicting the number of healthy eating days per week.[8] The first model shows results for gender and economic

	(1)	(2)	(3)	(4)
Female	0.118[***]	0.130[***]	0.161[***]	−0.419[***]
	(0.007)	(0.015)	(0.015)	(0.115)
Logged GDP per capita	0.0907[***]	0.113[***]	0.037	0.029
	(0.025)	(0.030)	(0.031)	(0.030)
Female × logged GDP per capita				0.059[***]
				(0.012)
Controls?	No	No	Yes	Yes
Random effects				
var(constant)	0.017	0.021	0.017	0.016
	(0.004)	(0.006)	(0.004)	(0.004)
var(female)		0.005	0.005	0.002
		(0.002)	(0.002)	(0.001)
N	44,017	44,017	44,017	44,017

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

Notes: See Table 1 for list of controls. Standard errors in parentheses. Results from mixed-effects gamma regression models with log link.

development without any individual-level controls. The second model adds a random coefficient for gender. The third model adds individual-level controls. The fourth model adds a cross-level interaction between gender and economic development.

We observe that women tend to eat healthily more frequently than men—overall, 13 percent more frequently ($e^{0.118} - 1$). However, the significant variation of the random coefficient in Models 2, 3, and 4 illustrates that the magnitude of this gender gap differs across countries. Sensitivity analyses show that women eat healthily more frequently than men in all 31 countries, with the gap ranging from 2–4 percent in South Africa and China to 24 percent in Norway, Sweden, and Finland.[9]

How do gendered eating patterns differ across economic development? People in more developed countries tend to eat healthily more frequently compared to less developed countries ($\beta = 0.0907$, $p < 0.05$, two-tailed test). Individuals in the sample's most developed country, Norway, are predicted to eat healthily 41 percent more frequently than individuals in the sample's least developed country, the Philippines ($e^{0.051(11.095-7.271)} - 1$). These findings replicate descriptive patterns found in previous research (VanHeuvelen and VanHeuelen 2017).

How do gender and economic development interrelate regarding healthy eating behavior? Model 4, which includes an interaction between gender and logged GDP, reveals a statistically significant association between gender and logged GDP per capita. Women tend to eat healthily more frequently than men, and this gap is larger in more developed countries. In Model 4, the sign of the main female coefficient is negative. However, the main
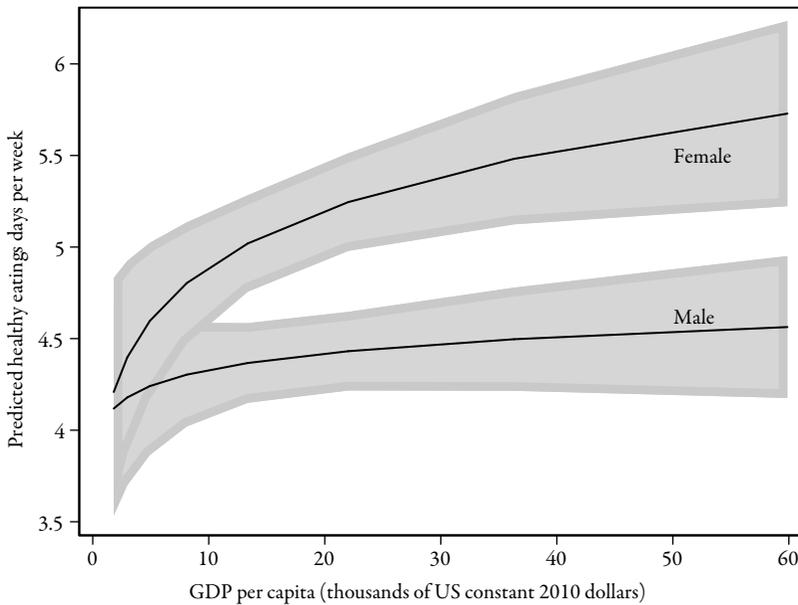
FIGURE 1. Predicted frequency of healthy eating, by economic development and gender

Notes: Predicted values following Model 4 of Table 2. Shaded areas represent 95% confidence interval surrounding predicted values.

coefficient represents the gender contrast at a logged GDP value of 0, while sample values for logged GDP per capita range from 7.271 to 11.095. Thus, the variation of the female coefficient ranges from about 0.009 (−0.420 + 7.271 × 0.059) to 0.234 (−0.420 + 11.095 × 0.0589). Notably, the main term for logged GDP loses significance with the addition of the gender interaction, suggesting a substantive difference in healthy eating frequency between men and women along countries' development spectrum. We illustrate this contrast in Figure 1, which shows the predicted male and female frequency of healthy eating across levels of GDP per capita following Model 4.[10] Predicted values are computed by averaging across the observed values of all other variables.[11]

We observe that, on average, male healthy eating frequency does not change with GDP per capita. Although the mean predicted frequency of healthy eating increases from 4.09 to 4.58 per week moving from the least developed (Philippines, Bulgaria) to the most developed (Norway, United States, Denmark) countries in the sample, a test of the magnitude of this difference cannot distinguish it from zero ($p = 0.318$, two-tailed test). In total, we find no evidence that male healthy eating habits vary across levels of development.

In contrast to the unchanging results for men, we observe more frequent healthy eating among women in more developed countries, compared to less developed countries. The predicted frequency for women increases from 4.12 in the sample's least developed countries to 5.77 in the most developed countries. The difference is statistically significant ($p < 0.01$, two-tailed test). We similarly examined gender contrasts in frequency of healthy eating following the cross-level interaction, finding the gender difference to be positive and

significant in 29 countries, though it was statistically insignificant in the two least developed countries in our sample. These gender differences provide an important caveat in the relationship we observe between economic development and healthy eating behaviors: *The overall positive association between economic development and the frequency of healthy eating is restricted to women*.

We now turn to how gender, healthy eating, and economic development interrelate to influence self-rated health. We use linear mixed-effects regression models to predict SRH. The following results include all control variables, as well as healthy eating frequency as an independent variable.

In this step of the analyses, we are ultimately interested in how gender, healthy eating behaviors, and economic development interrelate to predict SRH. A straightforward approach is to estimate a three-way interaction between gender, healthy eating frequency, and economic development, with random coefficients included for gender, healthy eating frequency, and the interaction between these variables. However, this is a complex modeling strategy and might not provide the optimal fit to the data. Therefore, we first assess fit statistics for regression models, building from simple (no interactions and no random coefficients) to complex (three-way interaction with random coefficients for gender, healthy eating, and the interaction between the two). We assessed two fit statistics across these models: BIC and AIC (see Table A1 in the appendix). A comparison between AIC and BIC leads to contrasting conclusions. AIC suggests that a regression model with a three-way interaction between gender, healthy eating, and logged GDP per capita is preferred over other models. However, BIC statistics prefer a simpler model which only includes an interaction between gender and healthy eating. Coefficients for both these models are included in the appendix (Table A2) and discussed briefly here. The model preferred by BIC produces a negative main gender coefficient, that is, women have lower SRH than men (−0.05, $p < 0.05$); a positive main healthy eating coefficient, that is, individuals who eat healthy foods more frequently have higher SRH (0.02, $p < 0.001$); and a positive gender-by-healthy-eating interaction, that is, women who never eat healthily have lower SRH than men, while women who eat healthily daily have higher SRH than men (0.011, $p < 0.001$). These results are suggestive of meaningful variation across country contexts. In descriptive sensitivity analyses, we found a simple positive association between the proportion of women who eat healthy foods daily and economic development, which suggests that the most positive health associations between gender and healthy eating—frequent healthy eating by women—are concentrated in highly developed countries. Therefore, we next turn to the associations from the three-way interaction model preferred by AIC fit statistics.

Three-way interactions involving a country-level continuous variable and a continuous individual-level variable involve substantial complexity, which makes straightforward interpretation difficult. To simplify the presentation of results, we include contrasts of combinations of gender and healthy eating across levels of economic development in Table 3, and visualizations of contrasts in Figure 2. Table 3 shows the linear combination of regression coefficients following a regression model with a three-way interaction. Economic development is set at specific values, as are either levels of healthy eating (right panels) or for men and women (left panels).[12] These values are combined

TABLE 3. Associations from three-way interaction models, self-rated health on gender-by-healthy eating-by-economic development, and controls

Logged GDP per capita	Female						Frequency of eating healthy					
	Overall		Never eats healthy		Eats healthy daily		Overall		Male		Female	
7.5	−0.094**	(0.033)	−0.180***	(0.048)	−0.057	(0.038)	0.008	(0.008)	−0.001	(0.009)	0.016	(0.009)
8	−0.073**	(0.027)	−0.150***	(0.039)	−0.040	(0.031)	0.012	(0.007)	0.003	(0.008)	0.019**	(0.007)
8.5	−0.053*	(0.022)	−0.121***	(0.031)	−0.023	(0.025)	0.016**	(0.005)	0.008	(0.006)	0.022***	(0.006)
9	−0.032	(0.017)	−0.092***	(0.024)	−0.007	(0.019)	0.019***	(0.004)	0.013**	(0.005)	0.025***	(0.005)
9.5	−0.012	(0.014)	−0.063*	(0.020)	0.010	(0.016)	0.023***	(0.003)	0.017***	(0.004)	0.028***	(0.004)
10	0.009	(0.013)	−0.033	(0.022)	0.027	(0.015)	0.027***	(0.003)	0.022***	(0.004)	0.031***	(0.004)
10.5	0.029	(0.015)	−0.004	(0.027)	0.043*	(0.017)	0.030***	(0.004)	0.027***	(0.004)	0.034***	(0.005)
11	0.050*	(0.020)	0.025	(0.034)	0.060**	(0.022)	0.034***	(0.005)	0.031***	(0.006)	0.036***	(0.006)

*p < 0.05, **p < 0.01, ***p < 0.001
Notes: N = 44,017. Standard errors in parentheses.

to result in development-gender-eating-specific coefficients. For example, the female coefficient for never eats healthy (−0.180) shows the gap in SRH between men and women with healthy eating values set to 0 days per week, in the sample's least developed country, the Philippines. This coefficient is the result of the linear combination of main and interaction terms with healthy eating set at 0, and logged GDP set at 7.5. The gender gap in SRH ranges from about −0.1 for women in the Philippines to 0.05 for women in Norway ("Overall" column, far left). That is, for the overall patterns of gender and SRH, we observe a reversal across economic development: women have worse SRH than men in the sample's least developed countries, with this gap narrowing and reversing among the most affluent countries, all else equal.

How does the pattern of SRH gaps between men and women vary across individuals with different dietary habits? In the next two columns of results, we present gender contrasts for SRH among individuals who *never* eat healthily, and among individuals who eat healthy foods *daily*. For individuals who never eat healthily, we observe a gender gap that, when statistically significant, ranges from twice to six times the magnitude of the overall association. In the sample's less developed countries (Philippines through the Czech Republic), women have worse predicted SRH, with contrasts ranging from −0.18 to −0.06. In the sample's most developed countries, the gender gap closes. While we observe a positive coefficient in the most developed country (Norway), it is statistically insignificant. In total, among unhealthy eaters, we observe a substantially larger gender gap in the least developed countries, with the gap converging in the sample's most developed countries.

How do gender patterns vary among frequent healthy eaters? Among healthy eaters, women tend to be as healthy as men, or healthier. That is, we observe a positive coefficient in the sample's most developed countries that increases with economic development (from Australia to Norway). The positive coefficient grows from 0.04 to 0.06 among the most developed countries in the sample. In total, we observe opposite associations between gender, economic development, and SRH depending on the dietary behaviors of individuals. Among unhealthy eaters, we observe a large, but closing, gender gap along economic development, with women catching up to men. Among healthy eaters, we observe a smaller gap opening up along economic development, with women outpacing men in more highly developed countries.

How do healthy eating associations vary across economic development, and across genders? We observe an increasing positive association between frequency of healthy eating, economic development, and SRH. Put simply, the health benefits of healthy eating are largest in the sample's most developed countries. A statistically significant positive overall association does not emerge until a logged GDP per capita of 8.5 (Bulgaria's value). Then the positive coefficient grows by 113 percent along economic development, from 0.016 to 0.034. We conclude that healthy eating is most advantageous for SRH in the sample's most developed countries, those with the greatest access to and availability of a wide variety of food choices.

How do healthy eating associations with SRH vary by gender? In contrast to the gender differences discussed above, we observe generally comparable associations between men and women. Overall, we observe slightly larger associations for healthy eating among women than among men. The relative advantage for female healthy eating is largest in the less developed countries. For example, women's coefficient for healthy eating is five times that of
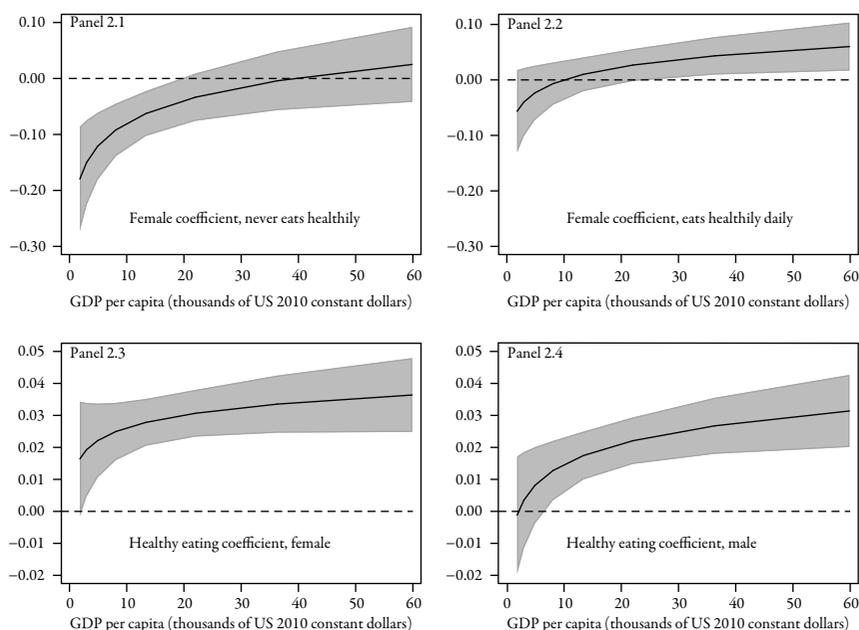
FIGURE 2. Visualization of coefficients from self-rated health on three-way interaction between gender, healthy eating, and development

Note: Visualization of coefficients from Table 3. All regression models include controls. Outcome variable is five-category self-rated health.

men in the second-lowest value of logged GDP per capita displayed. Of course, this large relative difference reflects largely similar absolute differences (Figure 2, bottom row). In contrast, the female coefficient is only 16 percent larger than the male coefficient in the most developed countries. Of course, this shrinking of the relative difference in healthy eating coefficients is the inverse of the growing absolute magnitude of healthy eating. These patterns suggest that the minor gender differences in the association between healthy eating and SRH are secondary to the positive association between healthy eating's effect on SRH and economic development. In total, we observe variation of healthy eating's association with SRH along economic development, and, to a lesser degree, between men and women.

We visualize the results from Table 3 in Figures 2 and 3. The top panels of Figure 2 show the gender coefficient across GDP per capita among those who never (2.1) and daily (2.2) eat fresh fruits and vegetables. The top row illustrates the lower female SRH among those who never eat healthily in lower-income countries, and the convergence of SRH between men and women who never eat healthily in middle- and high-income countries. Similarly, panel 2.2 highlights the modest emergence of higher SRH for women who eat healthily daily in high-income countries, compared to men who eat healthily daily in high-income countries. The bottom row similarly shows healthy eating coefficients for women (panel 2.3) and men (2.4). As discussed above, panels 2.3 and 2.4 illustrate the emergence of a positive coefficient for healthy eating among men in slightly higher-income countries than women, and illustrates the relative convergence of healthy eating effects between men and women in higher-income countries.
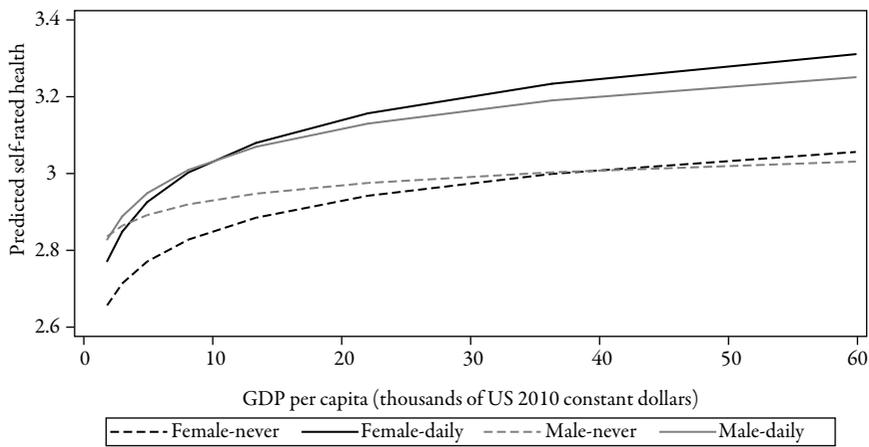
FIGURE 3. Predicted values of self-rated health following three-way interaction between gender, healthy eating, and development

Note: Predicted values following regression model from Table 3. All controls included. Outcome is self-rated health. "Never" refers to healthy eating set at 0. "Daily" refers to healthy eating set at 7.

Figure 3 visualizes predicted SRH values for men and women who never and daily eat healthily, across levels of GDP per capita. In the lowest-income countries in our sample, there is little difference between men who never or frequently eat healthily and healthily eating women, while women who never eat healthily have lower SRH. Across development, the predicted level of SRH for never-healthily-eating women converges, and slightly exceeds, male levels, while healthily eating men and women consistently have higher predicted SRH. Across development, a slight positive gap in predicted SRH emerges for healthily eating women compared to healthily eating men.

CONCLUSION

While fresh fruit and vegetable consumption has been highlighted as a cost-effective method of improving both public health and economic development (WHO 2014), it is unknown how dietary choices might be influenced by gender-based health lifestyles, or how these health lifestyles might systematically vary across countries with different development-based access and availability for a wide variety of food choices. We have therefore examined the interrelationship between these factors in this research.

We draw two main conclusions. First, women consistently eat nutritionally dense fresh fruits and vegetables more frequently than men, which generalizes expectations from health lifestyle theory beyond the high-income countries in which it is typically applied. However, this gap is most pronounced in the more highly developed countries, suggesting that women are more likely to use the greater access to and availability of food options brought by development to eat healthily.

This result has implications for both health lifestyle theory and the nutrition transition model. Our result is the first to extend and confirm health lifestyle expectations of gender-based eating habits beyond affluent countries and studies of a small number of countries. Given similar food access and availability, women tend to choose healthy food options more

frequently than men. Furthermore, our results confirm expectations that gender-based differences are largely subsumed under broader constraints of living conditions. Although this interaction is frequently used to develop theoretical arguments, it is less frequently tested. Our results suggest that such living conditions as development context are crucial for future studies of health lifestyles.

Our findings also highlight an intriguing gender-based mechanism of the nutrition transition model. Most research in this tradition takes a wholly macro-level view of the relationship between economic development and change in population diet. An implicit assumption is that whole populations are equally likely to benefit from, and take part in, changes in food access and availability wrought by economic development. This is not what we find. Whereas Norwegian and Filipino men eat healthily at similar rates, women tend to eat healthily more frequently in more developed countries. Simply put, these findings imply a development-independent health lifestyle for men, and a development-dependent set of health lifestyles for women. Future research that examines longitudinal shifts in gender, eating behaviors, and development is needed. As future waves of ISSP health module data become available, the results from this study should be replicated to test whether the key findings hold.

Our second main conclusion is that gender, healthy eating frequency, and economic development interrelate to predict self-rated health. We find a reversal in the association between gender and SRH across countries, with women having lower predicted SRH in less developed countries and higher SRH in more developed countries. These associations occur among individuals with different dietary habits: we observe a closing in the negative association along economic development among individuals who never eat healthily, and an opening of the positive association along economic development among individuals who eat healthily daily. Furthermore, we find that eating healthily has a larger positive effect in more developed countries, and that this positive healthy-eating effect is slightly larger for women. In total, our findings highlight the importance of the interrelationship between economic development, healthy eating behaviors, and gender for health outcomes.

This finding has significant implications for policies geared at improving local dietary habits. Improvement in diets in less developed countries might have an ancillary benefit of closing gender gaps in health. Interestingly, our results also suggest that policies aimed at increasing local development might also improve the effectiveness of individual-level health behaviors. Of course, our results cannot point to the direct mechanism linking variation in health outcomes across countries at different levels of economic development. Diet might also be connected to health knowledge, or to access to more (or better) health resources. Greater consumption of healthy foods might correlate to greater economic independence, or else might signal geographical locations in more prosperous areas. Future research is needed to disentangle the mechanisms of this finding.

An important limitation of this study is that it focuses on only one health behavior: healthy eating. Much work in the nutrition transition model examines the implementation of a variety of health behaviors. We focused specifically on diet because of the special role diet plays in international policies and social movements to improve public health (FAO 2015a; Lang and Heasman 2015; Miller et al. 2016; WHO 2006, 2015). However, our results

reveal the insights that can be gained by applying health lifestyle theory in a cross-national comparative context. Future work on gender and health lifestyles could use this comparative framework to understand how gender variation in health lifestyles depends on local social context.

The literature on development and heath highlights a second important limitation of this study. Noy (2011) and Noy and McManus (2015) illustrate the important regional heterogeneity in the relationship between health systems and economic development. Similarly, Burroway (2017) highlights the multiple pathways by which the multidimensional system of development can influence local health outcomes. Such heterogeneity is beyond the scope of the current study, yet provides a promising avenue for future research. As future waves of ISSP health data become available, we suspect that such insights can be successfully applied to the cross-national study of healthy eating, health lifestyles, and development.

Our results highlight the heterogeneity of dietary choices, and ensuing health consequences, across economic development and between men and women, with the combination presenting potential challenges for policymakers who focus primarily on implementing policies aimed at increased consumption of fresh fruits and vegetables (WHO 2014). First, if our conclusions hold up to future empirical scrutiny, then policymakers who hope to observe similar health benefits from increased healthy eating independent of a population's development context are likely to be disappointed. Our results suggest that the optimal methods to improve population health will need to incorporate both improvements in the nutritional quality of local diets and improvements in local economic well-being. Ignoring the latter might lead to underwhelming health results from the former.

Second, our results highlight the need to consider the gendered nature of improving nutrition. Our results show two distinct trends of improved nutrition with development. Many international organizations (governmental and nongovernmental) have examined the link between gender and nutrition, focusing on increasing access to proper nutrition for the world's most vulnerable women. Our results suggest that women are likely to take advantage of opening opportunities for greater food choice, but that a remaining challenge is to determine how to motivate men to do so as well. Future research on policy interventions would do well to determine effective methods to improve men's eating decisions.

In total, nutrition is one of many health behaviors that individuals undertake that influence their health and aggregate into patterns of population-level health inequalities. Our study illustrates how seemingly personal decisions of whether to eat nutritionally dense fruits and vegetables are simultaneously influenced by the development context in which the individual resides and by gender-based health lifestyles. Our study suggests that healthy eating behaviors are a promising avenue for understanding the reciprocal link between individual decision-making and broader patterns of development in generating health outcomes. ▪

TABLE A1. BIC and AIC of regression models predicting self-rated health

Model[1,2]	BIC	AIC
(1)	145,009.5	144,956.4
(2)	145,000.3	144,938.3
(3)	103,618.4	103,305.4
(4)	**103,529.4**	103,199.01
(5)	103,620.0	103,298.4
(6)	**103,529.6**	103,190.7
(7)	103,533.9	103,186.2
(8)	103,535.8	103,188.1
(9)	103,546.7	**103,176.1**

Note: Models in bold have lowest fit statistics.

[1]Model descriptions: (1) Baseline model: no interactions or random coefficients, no controls. (2) Gender-by-healthy-eating interaction, no controls. (3) Baseline model + controls. (4) Baseline + random coefficients. (5) Gender-by-healthy-eating interactions, no random coefficients. (6) Gender-by-healthy-eating interaction, random coefficients. (7) Gender-by-healthy-eating interactions, random coefficients for main and interaction terms. (8) GDP-by-gender and GDP-by-healthy-eating interactions, random coefficients for both. (9) Three-way-interaction, random coefficients for all individual-level coefficients.

[2]Controls include all variables listed in Table 1. Models vary in their interactions between logged GDP per capita, gender, and healthy eating frequency.

TABLE A2. Preferred models from Table A1, predicting self-rated health from linear mixed-effects regression models

	(M1)	(M2)
Individual-level variables		
Female	−0.050*	−0.618**
	(−2.34)	(−3.16)
Freq. healthy eating	0.020***	−0.071
	(5.21)	(−1.93)
Female × freq. healthy eating	0.011**	0.045
	(3.22)	(1.45)
Country-level variables		
Logged GDP per capita	0.077*	0.056
	(2.26)	(1.35)
ln GDP × female		0.059**
		(2.90)
ln GDP × freq. healthy eating		0.009*
		(2.49)

(continued)

TABLE A2. Preferred models from Table A1, predicting self-rated health from linear mixed-effects regression models (*continued*)

	(M1)	(M2)
ln GDP × female × freq. healthy eating		−0.004
		(−1.13)
Controls?	Yes	Yes
Random component		
Var(female)	0.004	0.0005
Var(freq. healthy eating)	0.0003	0.0002
Var(female × freq. healthy eating)		0.0001
Observations	44,017	44,017
Model preferred by:	BIC	AIC

*p < 0.05, **p < 0.01, ***p < 0.001
Z-statistics in parentheses.

REFERENCES

Adams, Anthony Troy, Monika J. Ulrich, and Amanda Coleman. 2010. "Food Deserts." *Journal of Applied Social Science* 4(2):58–62.

Alderson, Arthur S., and Francois Nielsen. 2002. "Globalization and the Great U-Turn: Income Inequality Trends in 16 OECD Countries." *American Journal of Sociology* 107:1244–99.

Allen, P., and C. Sachs. 2012. "Women and Food Chains: The Gendered Politics of Food." Pp. 23–40 in *Taking Food Public: Redefining Foodways in a Changing World*, edited by Psyche Williams-Forson and Carole Counihan. New York: Routledge Press.

Altman, Claire E., Jennier Van Hook, and Marianne Hillemeier. 2016. "What Does Self-Rated Health Mean? Changes and Variations in the Association of Obesity with Objective and Subjective Components of Self-Rated Health." *Journal of Health and Social Behavior* 57(1):39–58.

An, R. 2015. "Nationwide Expansion of a Financial Incentive Program on Fruit and Vegetable Purchases among Supplemental Nutrition Assistance Program Participants: A Cost-Effectiveness Analysis." *Social Science & Medicine* 147:80–88.

Beardsworth, Alan, Alan Bryman, Teresa Keil, Jackie Goode, Cheryl Haslam, and Emma Lancashire. 2002. "Women, Men and Food: The Significance of Gender for Nutritional Attitudes and Choices." *British Food Journal* 104(7):470–91.

Burroway, R. 2017. "Political Economy, Capability Development, and Fundamental Cause: Integrating Perspectives on Child Health in Developing Countries." *Journal of World-Systems Research* 23 (1):62.

Cannuscio, C. C., A. Hillier, A. Karpyn, and K. Glanz. 2014. "The Social Dynamics of Healthy Food Shopping and Store Choice in an Urban Environment." *Social Science & Medicine* 122:13–20.

Cockerham, William C. 2000. "Health Lifestyles in Russia." *Social Science & Medicine* 51(9):1313–24.

Cockerham, W. C. 2005. "Health Lifestyle Theory and the Convergence of Agency and Structure." *Journal of Health and Social Behavior* 46(1):51–67.

Cockerham, W. C., B. P. Hinote, and P. Abbott. 2006. "Psychological Distress, Gender, and Health Lifestyles in Belarus, Kazakhstan, Russia, and Ukraine." *Social Science & Medicine* 63(9):2381–94.

Cockerham, William C., Gerhard Kunz, and Guenther Lueschen. 1988. "On Concern with Appearance, Health Beliefs, and Eating Habits: A Reappraisal Comparing Americans and West Germans." *Journal of Health and Social Behavior* 29(3):265–69.

Cohn, S. 2017. "The Determinants of the Division of Labor between Men and Women in Paid Employment in the Global North and South." *Sociology of Development* 3(1):1–23.

Darmon, N., and A. Drewnowski. 2008. "Does Social Class Predict Diet Quality?" *American Journal of Clinical Nutrition* 87(5):1107–17.

Dallongeville, J., L. Dauchet, O. de Mouzon, V. Réquillart, and L. G. Soler. 2010. "Increasing Fruit and Vegetable Consumption: A Cost-Effectiveness Analysis of Public Policies." *European Journal of Public Health* 21(1):69–73.

Delormier, Treena, Katherine L. Frohlich, and Louise Potvin. 2009. "Food and Eating as Social Practice: Understanding Eating Patterns as Social Phenomena and Implications for Public Health." *Sociology of Health & Illness* 31(2):215–28.

Drewnowski, A., and N. Darmon. 2005. "The Economics of Obesity: Dietary Energy Density and Energy Cost." *American Journal of Clinical Nutrition* 82(1):265S–273S.

Drewnowski, A., and B. M. Popkin. 1997. "The Nutrition Transition: New Trends in the Global Diet." *Nutrition Reviews* 55(2):31–43.

Fallon, A. E., and P. Rozin. 1985. "Sex Differences in Perceptions of Desirable Body Shape." *Journal of Abnormal Psychology* 94(1):102.

FAO. 2015a. *Promotion of Fruit and Vegetables for Health: Report of the Pacific Regional Workshop*. Food and Agriculture Organization of the United Nations.

FAO. 2015b. *The State of Food Insecurity in the World 2015: The Multiple Dimensions of Food Security*. FAO, Rome.

Klasen, S. 2002. "Low Schooling for Girls, Slower Growth for All? Cross-Country Evidence on the Effect of Gender Inequality in Education on Economic Development." *World Bank Economic Review* 16(3):345–73.

Lang, T., and M. Heasman. 2015. *Food Wars: The Global Battle for Mouths, Minds and Markets*. New York: Routledge.

Lim, S. S., et al. 2013. "A Comparative Risk Assessment of Burden of Disease and Injury Attributable to 67 Risk Factors and Risk Factor Clusters in 21 Regions, 1990–2010: A Systematic Analysis for the Global Burden of Disease Study 2010." *The Lancet* 380(9859):2224–60.

Link, B. G., and J. Phelan. 1995. "Social Conditions as Fundamental Causes of Disease." *Journal of Health and Social Behavior* (1995) Extra Issue: 80–94.

Miller, V., et al. 2016. "Availability, Affordability, and Consumption of Fruits and Vegetables in 18 Countries across Income Levels: Findings from the Prospective Urban Rural Epidemiology (PURE) study." *Lancet Global Health* 4(10):695–703.

Noy, S. 2011. "New Contexts, Different Patterns? A Comparative Analysis of Social Spending and Government Health Expenditure in Latin America and the OECD." *International Journal of Comparative Sociology* 52(3):215–44.

Noy, S., and P. A. McManus. 2015. "Modernization, Globalization, Trends, and Convergence in Health Expenditure in Latin America and the Caribbean." *Sociology of Development* 1(2):321–46.

Otero, G., G. Pechlaner, G. Liberman, and E. Gurcan. 2015. "The Neoliberal Diet and Inequality in the United States." *Social Science & Medicine* 142:47–55.

Pampel, F. C., P. M. Krueger, and J. T. Denney. 2010. "Socioeconomic Disparities in Health Behaviors." *Annual Review of Sociology* 36:349.

Popkin, B. M. 2006. "Global Nutrition Dynamics: The World Is Shifting Rapidly toward a Diet Linked with Noncommunicable Diseases." *American Journal of Clinical Nutrition* 84(2):289–98.

Popkin, B. M., L. S. Adair, and S. W. Ng. 2012. "Global Nutrition Transition and the Pandemic of Obesity in Developing Countries." *Nutrition Reviews* 70(1):3–21.

Popkin, B. M., and P. Gordon-Larsen. 2004. "The Nutrition Transition: Worldwide Obesity Dynamics and Their Determinants." *International Journal of Obesity* 28:S2–S9.

Rappoport, L., G. R. Peters, R. Downey, T. McCann, and L. Huff-Corzine. 1993. "Gender and Age Differences in Food Cognition." *Appetite* 20(1):33–52.

Rolls, B. J., I. C. Fedoroff, and J. F. Guthrie. 1991. "Gender Differences in Eating Behavior and Body Weight Regulation." *Health Psychology* 10(2):133.

Saguy, A. C., and R. Almeling. 2008. "Fat in the Fire? Science, the News Media, and the 'Obesity Epidemic'." *Sociological Forum* 23(1):53–83.

Stroud, J., P. Anglewicz, and M. VanLandingham. 2016. "Development, Demographic Processes, and Public Health." In *The Sociology of Development Handbook*, edited by G. Hooks. Oakland: University of California Press.

Sturm, R., and A. Hattori. 2015. "Diet and Obesity in Los Angeles County 2007–2012: Is There a Measurable Effect of the 2008 'Fast-Food Ban'?" *Social Science & Medicine* 133:205–11.

UNDP. 2017. "United Nations Sustainable Development Goals" (http://www.undp.org/content/undp/en/home/sustainable-development-goals.html).

Van Duyn, M. A. S., and E. Pivonka. 2000. "Overview of the Health Benefits of Fruit and Vegetable Consumption for the Dietetics Professional: Selected Literature." *Journal of the American Dietetic Association* 100(12):1511–21.

VanHeuvleen, Jane, and Tom VanHeuvelen. 2017. "Rich Foods: The Cross-National Effects of Healthy Eating on Health Outcomes." *Advances in Medical Sociology* 18:27–58.

Wardle, J., A. M. Haase, A. Steptoe, M. Nillapun, K. Jonwutiwes, and F. Bellisie. 2004. "Gender Differences in Food Choice: The Contribution of Health Beliefs and Dieting." *Annals of Behavioral Medicine* 27(2):107–16.

WHO. 2006. *Global Strategy on Diet, Physical Activity and Health: A Framework to Monitor and Evaluate Implementation*. World Health Organization.

WHO. 2009. *Global Health Risks: Mortality and Burden of Disease Attributable to Selected Major Risks*. World Health Organization.

WHO. 2014. *Global Status Report on Noncommunicable Diseases 2014: Attaining the Nine Global Noncommunicable Diseases Targets; A Shared Responsibility*. Geneva: World Health Organization.

WHO. 2016. "Obesity: Data and Statistics" (http://www.euro.who.int/en/health-topics/noncommunicable-diseases/obesity/data-and-statistics).

Wiggins, S., et al. 2015. "The Rising Cost of a Healthy Diet: Changing Relative Prices of Foods in High-Income and Emerging Economies." Overseas Development Institute, London.

Wooldridge, J. M. 2010. *Econometric Analysis of Cross Section and Panel Data*. 2nd ed. Cambridge, MA: MIT Press.

World Food Programme. 2017. "Women and Hunger: 10 Facts" (https://www.wfp.org/our-work/preventing-hunger/focus-women/women-hunger-facts).

World Bank. 2012. *World Development Indicators 2012*. World Bank Publications.

World Bank. 2016. "Joint Child Malnutrition Estimates" (http://data.worldbank.org/child-malnutrition).

NOTES

The articles in this special issue on global health and development are Noy (2019); Harris and White (2019); Sommer, Shandra, Restivo, and Reed (2019); Jafflin (2019); Angotti, McKay, and Robinson (2019); and VanHeuvelen and VanHeuvelen (2019).

Thanks to Roy Sablosky for his thoughtful and careful editorial assistance.

1. Of course, economic development is also tightly coupled with several other conditions that could be conducive to healthy lifestyles: lower gender inequality, greater educational attainment for both men and women, less strenuous working conditions, and greater female economic independence, for example (Cohn 2017). Economic development thus provides a variety of mechanisms that allow gender-based variation in health lifestyles. Yet across these different processes, we argue that the provision of a wide diversity of food choices remains crucial for how food choices vary across countries.

2. Typically, health lifestyles behavior examines a wide variety of health behaviors. We focus specifically on healthy eating for two reasons. First, dietary choice might be a particularly important

health behavior to understand, given the resonance of, and attention given to, dietary choice. Second, we simplify the focus on health behavior to examine variation in patterns of living conditions across a wide variety of countries (Cockerham 2005).

3. Though see Altman, Van Hook, and Hillemeier (2016) for a critique.

4. Individual-level information on caloric consumption is not available in the ISSP. We replicated all results with a categorical measure of BMI. All results are the same.

5. Tests using a squared term for GDP do not improve model fit. We also replicated analyses with a composite measure of food access and availability drawn from the FAO. The correlation of this measure and logged GDP is 0.91.

6. Household income is standardized separately by country. We topcode household income at three standard deviations and impute missing values at zero. Results are the same if missing values are dropped instead.

7. We tested for multicollinearity by examining variance influence function statistics for all independent variables. All such statistics are at or below 2. We also replicated the results excluding potential outlying and overly influential observations. The main results are substantively identical.

8. We estimate these models due to the skewed nature of the frequency of healthy eating. We also estimate linear and ordered logistic regression models and reach similar conclusions.

9. This positive association is statistically insignificant in the two least developed countries in our sample when using Model 4.

10. We converted logged GDP per capita to GDP per capita for ease of interpretation. The untransformed version illustrates a flat association between lnGDPpc and healthy eating frequency for men, and a simple linear positive association for women. Results are identical if gender is also interacted with all control variables.

11. Interactions in nonlinear regression models can be problematic for a variety of reasons. We therefore replicated the findings from Table 2 in three ways. First, we re-estimated the results treating the frequency of healthy eating as a continuous variable and used linear regression models. Second, we interacted gender with GDP per capita and all other independent variables included in regression models. Third, we computed average marginal effects for gender across GDP per capita values following the fully interactive model. We draw the same conclusions across these sensitivity tests.

12. Coefficients in Table 3 are computed by the linear combination of coefficients estimated from a multilevel regression model and specific values of GDP and either gender or healthy eating.