

## Supplementary Methods 1: Summary of questionnaire modules

Eight modules were assessed in the following sequence:

- (1) Demographic characteristics, household structure, and household migration history.
- (2) Dietary habits, measured in terms of the frequency of consumption of key nutritionally relevant food groups included in the Prime Diet Quality Score (PDQS)<sup>1</sup>, a holistic metric of diet quality designed for use in diverse populations that we operationalized as a screening instrument by adapting published guidance (**Methods S2**).
- (3) Drivers of food choice (evaluating the subjective importance of diverse considerations in food choice decisions and related perceptions and behaviors, adapting a constructionist food choice process model and framework for understanding internal and external domains of food environments)<sup>2,3</sup>.
- (4) Nutrition knowledge (evaluating participants' objective understanding of the relative nutritiousness of different food groups and application of nutrition knowledge in daily life, adapting FAO methodology)<sup>4</sup>.
- (5) International Physical Activity Questionnaire-Short Form (IPAQ-SF)<sup>5</sup> analyzed using an Excel-based system<sup>6</sup>.
- (6) Pittsburgh Sleep Quality Index (PSQI)<sup>7</sup> (higher scores indicate poorer sleep quality).
- (7) Generalized Anxiety Disorder 7-Item (GAD-7) Scale<sup>8</sup> (higher scores indicate a greater degree of generalized anxiety).
- (8) Fagerström Test for Nicotine Dependence<sup>9</sup> (higher scores indicate more intense physical addiction to nicotine).

The IPAQ, PSQI, GAD-7, and Fagerström Test have been extensively validated in diverse international contexts and all four of these instruments and metrics have been used in prior peer-reviewed studies in Mongolia and Kazakhstan based on a recent Google Scholar search). While the PDQS is a relatively new metric, it has also been widely applied and validated, including as part of research to develop the closely related Global Diet Quality Score (GDQS)<sup>10</sup> which involved analysis of over 65,000 adults in numerous world regions.

Reference periods over which different sets of questions were asked varied from “prior to migration”, “currently” or undefined, “past 2 weeks”, “past month”, to “past 3 months” to increase interpretability of questions and relevance of responses. Questions regarding dietary habits and nutrition knowledge were asked in reference to the past 3 months, such that the “combined” reference period for these questions across the four assessments ranged 12 months, i.e., from 3 months prior to migration to baseline (assessed at the baseline) to 6-9 months post-migration (assessed at 9 months).

An English version of the questionnaire used in this study is provided in **Methods S3**.

## References

1. Fung TT, Isanaka S, Hu FB *et al*. International food group-based diet quality and risk of coronary heart disease in men and women. *Am J Clin Nutr* 2018;107(1):120–9.
2. Sobal J, Bisogni CA. Constructing food choice decisions. *Annals of behavioral medicine*. 2009 Dec 1;38(suppl\_1):s37-46.
3. Turner C, Aggarwal A, Walls H *et al*. Concepts and critical perspectives for food environment research: a global framework with implications for action in low-and middle-income countries. *Glob food sec*. 2018 Sep 1;18:93-101.
4. Marias YF, Glasauer P. Guidelines for assessing nutrition-related knowledge, attitudes and practices. Food and Agriculture Organization of the United Nations (FAO). Rome FAO; 2014.
5. Craig C, Marshall A, Sjostrom M *et al*. International physical activity questionnaire-short form. *J Am Coll Health*. 2017;65(7):492-501.

6. Cheng HL. A simple, easy-to-use spreadsheet for automatic scoring of the International Physical Activity Questionnaire (IPAQ) Short Form. 2016. DOI: 10.13140/RG.2.2.21067.80165.
7. Buysse DJ, Reynolds CF 3rd, Monk TH *et al.* The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res.* 1989 May;28(2):193-213.
8. Spitzer RL, Kroenke K, Williams JB *et al.* A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med.* 2006 May 22;166(10):1092-7.
9. Heatherton TF, Kozlowski LT, Frecker RC *et al.* The Fagerström test for nicotine dependence: a revision of the Fagerström Tolerance Questionnaire. *Br J Addict.* 1991 Sep;86(9):1119-27.
10. Bromage S, Batis C, Bhupathiraju SN *et al.* Development and validation of a novel food-based Global Diet Quality Score (GDQS). *J Nutr.* 2021 Oct;151(Supplement\_2):75S-92S.

## Supplementary Methods 2: Operationalizing the PDQS metric for use as a dietary screener

The following methods were implemented in consultation with the developers of the PDQS and GDQS, with the understanding that it is appropriate to carefully adapt the design of these and other metrics of diet quality and dietary diversity, and the ways they are operationalized as dietary screening instruments, to suit the needs of different studies and contexts. Adaptations were also influenced by the fact that design and implementation of the current study occurred during a period in which the initial version of the PDQS<sup>1</sup> underwent iterative refinements which later led to the development of the first PDQS-based screening instrument<sup>2</sup> and the GDQS<sup>3</sup>.

*List of food groups:* To collectively operationalize PDQS food groups as a screening instrument, each group was described using local example foods (selected in consultation with dieticians in Ulaanbaatar and Almaty) adapting published guidance<sup>2</sup>. All of the food groups included in the most recent published version of the PDQS metric<sup>2</sup> were represented in the screener. The following adjustments were made for local interpretability (as informed by the pilot test) and in consultation with the developers of the PDQS and GDQS.

- Fried foods were restricted to those obtained outside the home and deep orange fruits and vegetables were combined into one food group (as has been done in original and subsequent versions of the PDQS, respectively)<sup>1,4</sup>.
- Sugar-sweetened beverages were expanded to include (non-homemade) fruit juice, considering evidence from large, prospective cohort studies on associations between consumption of fruit juice, weight gain, and incident type 2 diabetes which informed inclusion of fruit juice in the GDQS<sup>3</sup>.
- Low fat milk and dairy products (consumption of which were understood to be relatively low in both cities)<sup>5,6</sup> were excluded and replaced with any milk and dairy (mostly representing high fat milk and dairy, which is also included in GDQS)<sup>3</sup>.
- Some adjustments were also made to the names of food groups for local interpretability.

Game meat and shellfish (which are represented in the GDQS)<sup>3</sup> were not considered for inclusion in the screener because consensus on the importance of these foods to global diets and nutrition had not been reached by the GDQS development team until after implementation of the current study had begun. However, these foods were understood to be minor contributors to the diets of urban populations in landlocked Mongolia and Kazakhstan as informed by our prior research in Mongolia<sup>19</sup> and in consultation with the research team at the Kazakh Academy of Nutrition.

*Frequency response options:* The range of PDQS frequency response options was expanded (as has been done in other frequency-based PDQS screening instruments)<sup>2</sup> from 0-1 per week, 2-3 per week, and  $\geq 4$  per week to <1 per week, 1 per week, 2-4 per week, 5-7 per week, and >1 per day. This approach was more easily interpreted in the pilot test, and provided greater resolution for understanding consumption patterns and deriving exploratory diet patterns (which were objectives of particular interest in this study).

## References

1. Fung TT, Isanaka S, Hu FB *et al.* International food group-based diet quality and risk of coronary heart disease in men and women. *Am J Clin Nutr* 2018;107(1):120–9.
2. Kronsteiner-Gicevic S, Mou Y, Bromage S *et al.* Development of a Diet Quality Screener for Global Use: Evaluation in a Sample of US Women. *J Acad Nutr Diet*. 2021 May;121(5):854-871.e6.
3. Bromage S, Batis C, Bhupathiraju SN *et al.* Development and validation of a novel food-based Global Diet Quality Score (GDQS). *J Nutr*. 2021 Oct;151(Supplement\_2):75S-92S.
4. Gicevic S, Gaskins AJ, Fung TT *et al.* Demographic and socio-economic predictors of diet quality among adults in Bosnia and Herzegovina. *Public Health Nutr* 2019;22(17):3107–17.
5. Bromage S, Daria T, Lander RL *et al.* Diet and Nutrition Status of Mongolian Adults. *Nutrients*. 2020 May 22;12(5):1514.
6. Euromonitor International. Drinking Milk Products in Kazakhstan. Report code: ASDR-338877. London: Euromonitor; Oct 2020.

Supplementary Methods 3: English version of the questionnaire used in this study (8 pages)

I. Demographics

1. Today's date (DD/MM/YY) \_\_\_\_/\_\_\_\_/\_\_\_\_

2. Subject code \_\_\_\_\_

Baseline Questions (skip during follow-up visits)

3. Sex:  a. Male  b. Female    4. Date of birth (DD/MM/YY) \_\_\_\_/\_\_\_\_/\_\_\_\_    5. Ethnicity \_\_\_\_\_

6. Highest education level

- a. None     b. Primary school     c. Secondary school     d. Professional certificate  
 e. High school     f. University     g. Graduate degree     h. Postgraduate degree

7. Occupation prior to migration \_\_\_\_\_ 8. Dwelling prior to migration:  a. Ger  b. House  c. Apartment

9. When did you migrate to Ulaanbaatar/Almaty? (DD/MM/YY) \_\_\_\_/\_\_\_\_/\_\_\_\_

Where did you migrate from?    10. Aimag/Oblast: \_\_\_\_\_    11. Soum/Rayon: \_\_\_\_\_  
12.  a. Countryside/Rural village     b. Soum/Rayon center     c. Aimag/Oblast center

13. What was the purpose of your migration? \_\_\_\_\_

14. Had you lived in Ulaanbaatar/Almaty previously?  a. No     b. Yes

15. How long will you reside in Ulaanbaatar/Almaty?  a. Less than one year     b. One year or more

Who lived in your household prior to migration? (relationship to you and age in years)

- |                        |               |                        |               |
|------------------------|---------------|------------------------|---------------|
| 16. Relationship _____ | 17. Age _____ | 18. Relationship _____ | 19. Age _____ |
| 20. Relationship _____ | 21. Age _____ | 22. Relationship _____ | 23. Age _____ |
| 24. Relationship _____ | 25. Age _____ | 26. Relationship _____ | 27. Age _____ |
| 28. Relationship _____ | 29. Age _____ | 30. Relationship _____ | 31. Age _____ |

Who migrated with you to Ulaanbaatar/Almaty?

- |                        |               |                        |               |
|------------------------|---------------|------------------------|---------------|
| 32. Relationship _____ | 33. Age _____ | 34. Relationship _____ | 35. Age _____ |
| 36. Relationship _____ | 37. Age _____ | 38. Relationship _____ | 39. Age _____ |
| 40. Relationship _____ | 41. Age _____ | 42. Relationship _____ | 43. Age _____ |
| 44. Relationship _____ | 45. Age _____ | 46. Relationship _____ | 47. Age _____ |

Who do you currently live with in Ulaanbaatar/Almaty?

- |                        |               |                        |               |
|------------------------|---------------|------------------------|---------------|
| 48. Relationship _____ | 49. Age _____ | 50. Relationship _____ | 51. Age _____ |
| 52. Relationship _____ | 53. Age _____ | 54. Relationship _____ | 55. Age _____ |
| 56. Relationship _____ | 57. Age _____ | 58. Relationship _____ | 59. Age _____ |
| 60. Relationship _____ | 61. Age _____ | 62. Relationship _____ | 63. Age _____ |

Follow-up Questions (skip during baseline visit)

64. Current Height (cm) \_\_\_\_\_    65. Current Weight (kg) \_\_\_\_\_

66. What is your current occupation in Ulaanbaatar/Almaty? \_\_\_\_\_

67. Type of dwelling in Ulaanbaatar/Almaty:  a. Ger     b. House     c. Apartment

Who do you currently live with in Ulaanbaatar/Almaty? (relationship to you and age in years)

- |                        |               |                        |               |
|------------------------|---------------|------------------------|---------------|
| 68. Relationship _____ | 69. Age _____ | 70. Relationship _____ | 71. Age _____ |
| 72. Relationship _____ | 73. Age _____ | 74. Relationship _____ | 75. Age _____ |
| 76. Relationship _____ | 77. Age _____ | 78. Relationship _____ | 79. Age _____ |
| 80. Relationship _____ | 81. Age _____ | 82. Relationship _____ | 83. Age _____ |

## II. Dietary habits

1. Subject code \_\_\_\_\_ 2. Today's date (DD/MM/YY) \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_

How often, on average, have you used each food group **over the past 3 months**? Mark **one and only one** circle for each food group. For example: If you have usually eaten fish three times a week, please fill in "2-4 per week".

FOOD GROUP	A	B	C	D	E
	<1 per week	1 per week	2-4 per week	5-7 per week	>1 per day
3. RED MEAT. <i>Beef, sheep, goat, pig, horse, camel. Includes organs. Excludes processed meat.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. PROCESSED MEAT. <i>E.g. sausage, luncheon meat, bacon, pâté, chicken nuggets.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. POULTRY. <i>E.g. chicken, turkey, game birds. Excludes organs, chicken nuggets, lunch meat, pâté.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. FISH. <i>Includes canned, smoked, preserved fish. Excludes shellfish, other seafood.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. MILK & MILK PRODUCTS. <i>Includes liquid, soft, hard, powdered milk products. Excludes ice cream.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. EGGS. <i>Boiled eggs, fried eggs, poached eggs, scrambled eggs, omelets, raw yolks.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. FRIED FOODS OUTSIDE HOME. <i>E.g. fried fast food, street food, restaurant food eaten outside home.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. REFINED GRAINS & PRODUCTS. <i>White rice; refined grain porridge, bread, noodles, biscuits.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. POTATOES & OTHER WHITE TUBERS. <i>Includes mashed potatoes, potato salad, homemade fries.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. SWEETS & ICE CREAM. <i>E.g. candy, candy bar, chocolate, chocolate biscuit, wafer, cake, ice cream.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. SUGARY DRINKS. <i>Soda, juice, sweet tea, energy &amp; sports drinks. Excludes homemade juice, dairy.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. CITRUS FRUITS. <i>E.g. orange, lemon, mandarin, tangerine. Excludes juice, nectar, fruit sauce, jam.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. DEEP ORANGE FRUITS & VEGETABLES. <i>E.g. apricot, mango, pumpkin, carrot, carrot salad.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. OTHER FRUITS. <i>Includes dried &amp; preserved fruits, fruit salad. Excludes juice, nectar, fruit sauce, jam.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. DARK GREEN LEAFY VEGETABLES. <i>E.g. spinach, lettuce, collards, bok choy, arugula, seaweed.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. CRUCIFEROUS VEGETABLES. <i>E.g. broccoli, cabbage, cabbage salad, kimchi, radish.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. OTHER VEGETABLES. <i>E.g. pepper, onion, cucumber, tomato, beetroot, eggplant. Excludes legumes.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. LEGUMES. <i>Beans, peas, lentils. Includes bean products (e.g. tofu). Excludes nuts and seeds.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. NUTS & SEEDS. <i>E.g. sunflower seeds, pine nuts, peanuts, pistachios. Includes peanut butter.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. WHOLE GRAINS & PRODUCTS. <i>Brown rice, millet; whole grain cereal, porridge, bread, noodles.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. LIQUID OILS. <i>Liquid vegetable oils for cooking &amp; eating raw. E.g. sunflower oil, vegetable oil, olive oil.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### III. Drivers of food choice

1. Subject code \_\_\_\_\_ 2. Today's date (DD/MM/YY) \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_

Compared with **unhealthy** foods, **healthy** foods are generally...

- |  |   |   |   |
|--|---|---|---|
| <b>3.</b><br>a. <input type="radio"/> Much less expensive<br>b. <input type="radio"/> Less expensive<br>c. <input type="radio"/> The same price<br>d. <input type="radio"/> More expensive<br>e. <input type="radio"/> Much more expensive | <b>4.</b><br>a. <input type="radio"/> Much less available<br>b. <input type="radio"/> Less available<br>c. <input type="radio"/> Equally available<br>d. <input type="radio"/> More available<br>e. <input type="radio"/> Much more available | <b>5.</b><br>a. <input type="radio"/> Much less tasty<br>b. <input type="radio"/> Less tasty<br>c. <input type="radio"/> Equally tasty<br>d. <input type="radio"/> Tastier<br>e. <input type="radio"/> Much tastier | <b>6.</b><br>a. <input type="radio"/> Much harder to cook<br>b. <input type="radio"/> Harder to cook<br>c. <input type="radio"/> Same difficulty<br>d. <input type="radio"/> Easier to cook<br>e. <input type="radio"/> Much easier to cook |
|--|---|---|---|

For each statement, indicate whether you "Strongly Disagree", "Disagree", are "Neutral", "Agree", or "Strongly Agree".

	a. Strongly Disagree	b. Disagree	c. Neutral	d. Agree	e. Strongly Agree
7. "I care about eating healthy foods."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. "My nutrition knowledge helps me to make healthier food choices."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. "I pay attention to nutrition information on food packaging."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. "I am capable of cooking healthy foods."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. "I eat worse when I am stressed, depressed, or tired."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Describe the influence that each has had on your food choices **over the past 3 months** as: "None", "Weak", "Moderate", "Strong", or "Very Strong".

	a. None	b. Weak	c. Moderate	d. Strong	e. Very Strong
12. The price of food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. The availability of food where you live	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. The taste of food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. The time, effort, or skill required to cook food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. The nutritive quality of food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. Public advisories, TV, radio, or web programs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. Information from medical professionals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. Food safety concerns	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20. Compared with foods cooked **at home**, foods **from outside** are generally...  
 Much Less Healthy    Less Healthy    Equally Healthy    Healthier    Much Healthier

21. Overall, **over the past 3 months**, food advertising has influenced me to eat...  
 Much Less Healthy    Less Healthy    No Influence    Healthier    Much Healthier

For each statement, indicate whether you "Strongly Disagree", "Disagree", are "Neutral", "Agree", or "Strongly Agree".

"My diet influences my..."

	a. Strongly Disagree	b. Disagree	c. Neutral	d. Agree	e. Strongly Agree
22. Health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. Physical fitness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. Physical appearance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25. Bodyweight	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26. Household members' diets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## IV. Nutrition knowledge

1. Subject code \_\_\_\_\_ 2. Today's date (DD/MM/YY) \_\_\_\_/\_\_\_\_/\_\_\_\_

Over the past **3 months**...

3. ...how would you describe your diet overall?

- a.  Very Healthy
- b.  Healthy
- c.  Average
- d.  Unhealthy
- e.  Very Unhealthy

4. ...how would you describe your nutrition knowledge?

- a.  Well Informed
- b.  Informed
- c.  Average
- d.  Uninformed
- e.  Very Uninformed

5. ...how frequently has your household cooked its meals?

- a.  All Meal
- b.  Most Meals
- c.  Some Meals
- d.  Few Meals
- e.  No Meals

6. ...how would you characterize your own cooking skills?

- a.  Very Skilled
- b.  Skilled
- c.  Average
- d.  Poor
- e.  Very Poor

7. ...how often has your household eaten together

- a.  All Meal
- b.  Most Meals
- c.  Some Meals
- d.  Few Meals
- e.  No Meals
- f.  Not Applicable (single-person household)

8. ...how would you describe your bodyweight?

- a.  Overweight
- b.  Normal
- c.  Underweight

9. ...how would you describe your physical activity level?

- a.  High
- b.  Moderate
- c.  Low

Check which among the following pairs of foods is generally more nutritious for **healthy adults** to eat **habitually** (if you are unsure or don't know, check that option):

10. a.  Red Meat (mutton, beef, pork)  
 b.  Lean Meat (chicken, fish)  
 c.  Unsure

12. a.  Cooking Oils (sunflower seed oil, other oils)  
 b.  Cooking Fats (solid animal fats, butter)  
 c.  Unsure

11. a.  Whole Fat Milk and Dairy Products  
 b.  Reduced Fat Milk and Dairy Products  
 c.  Unsure

13. a.  Whole Grains (brown flour/bread/noodles/rice)  
 b.  Refined Grains (white flour/bread/noodles/rice)  
 c.  Unsure

Check whether it is generally more nutritious for **healthy adults** to eat more or less of each of the following foods **habitually** (if you are unsure or don't know, check that option):

	a. More	b. Less	c. Unsure
14. Salt and Salty Foods:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. Sugar and Sugary Foods/Drinks:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. Fruits and Vegetables:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. Nuts and Seeds:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. Processed and Fast Foods:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. Alcoholic Drinks:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>





**VI. Sleep quality** 1. Subject code \_\_\_\_\_ 2. Today's date (DD/MM/YY) \_\_\_\_/\_\_\_\_/\_\_\_\_

The following questions relate to your usual sleep habits during the **past month** only. Your answers should indicate the most accurate reply for the majority of days and nights in the **past month**. Please answer all questions.

During the **past month**...

- 3. When have you usually gone to bed? \_\_\_\_\_
- 4. How long (in minutes) has it taken you to fall asleep each night? \_\_\_\_\_
- 5. What time have you usually gotten up in the morning? \_\_\_\_\_
- 6. A. How many hours of actual sleep did you get at night? \_\_\_\_\_
- 7. How many hours were you in bed? \_\_\_\_\_

During the **past month**, how often have you had trouble sleeping because you

	a. Not during the past month	b. Less than once a week	c. Once or twice a week	d. Three or more times a week
8. Cannot get to sleep within 30 minutes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Wake up in the middle of the night or early morning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Have to get up to use the bathroom	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. Cannot breathe comfortably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. Cough or snore loudly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. Feel too cold	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. Feel too hot	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. Have bad dreams	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. Have pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. Other reason (s), please describe, including how often you have had trouble sleeping because of this reason (s):	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

18. During the **past month**, how often have you taken medicine (prescribed or "over the counter") to help you sleep?

- a.  Not during the past month
- b.  Less than once a week
- c.  Once or twice a week
- d.  Three or more times a week

19. During the **past month**, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

- a.  Not during the past month
- b.  Less than once a week
- c.  Once or twice a week
- d.  Three or more times a week

20. During the **past month**, how much of a problem has it been for you to keep up enthusiasm to get things done?

- a.  Not during the past month
- b.  Less than once a week
- c.  Once or twice a week
- d.  Three or more times a week

21. During the **past month**, how would you rate your sleep quality overall?

- a.  Very good
- b.  Fairly good
- c.  Fairly bad
- d.  Very bad

## VII. Generalized anxiety

1. Subject code \_\_\_\_\_ 2. Today's date (DD/MM/YY) \_\_\_\_/\_\_\_\_/\_\_\_\_

Over the past **2 weeks**, how often have you been bothered by the following problems?

	a. Not at all sure	b. Several days	c. Over half the days	d. Nearly every day
1. Feeling nervous, anxious, or on edge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Not being able to stop or control worrying	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Worrying too much about different things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Trouble relaxing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Being so restless that it's hard to sit still	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Becoming easily annoyed or irritable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Feeling afraid as if something awful might happen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## VIII. Nicotine dependence

1. Subject code \_\_\_\_\_ 2. Today's date (DD/MM/YY) \_\_\_\_/\_\_\_\_/\_\_\_\_

3. How soon after waking do you smoke your first cigarette?

- a.  Within 5 minutes
- b.  5-30 minutes
- c.  31-60 minutes

4. Do you find it difficult to refrain from smoking in places where it is forbidden? E.g. church, library, etc.

- a.  Yes
- b.  No

5. Which cigarette would you hate to give up?

- a.  The first in the morning
- b.  Any other

6. How many cigarettes a day do you smoke?

- a.  10 or less
- b.  11-20
- c.  21-30
- d.  31 or more

7. Do you smoke more frequently in the morning?

- a.  Yes
- b.  No

8. Do you smoke even if you are sick in bed most of the day?

- a.  Yes
- b.  No

#### Supplementary Methods 4: Approach for scoring the PDQS and PDQS sub-metrics

The dietary screener was used to score the PDQS metric by adapting scoring principles described in published guidance<sup>1</sup> to the range of consumption frequency options adapted for use in this study: healthy food groups were assigned 0, 1, 2, 3, or 4 points for responses of <1 per week, 1 per week, 2-4 per week, 5-7 per week, and >1 per day, respectively; scoring was reversed for unhealthy food groups; and the total score ranged from 0 to 80. “PDQS-healthy” and “PDQS-unhealthy” sub-metrics were also scored using only the healthy and unhealthy PDQS food groups, respectively, following principles for scoring the positive and negative sub-metrics of the related Global Diet Quality Score (GDQS)<sup>2</sup> (as with the GDQS sub-metrics, higher PDQS-healthy scores reflect higher consumption of healthy foods while higher PDQS-unhealthy scores reflect lower consumption of unhealthy foods).

The approach for classifying healthy and unhealthy PDQS food groups followed that which has been applied in published guidance<sup>1,3-5</sup>, with the exception of eggs. Eggs, which the PDQS has varyingly classified as a neutral or healthy food group<sup>1-5</sup>, were classified as a healthy group considering evolving evidence from large, prospective cohort studies on the relationship between egg consumption and health that informed inclusion of eggs in the GDQS<sup>2</sup>.

Further, despite updated evidence that informed reclassification of red meat and high-fat milk and dairy products from the PDQS (which considers these to be unhealthy and neutral dietary components, respectively, for adults)<sup>1</sup> to the GDQS (which considers both components to be unhealthy only when consumed in excessive amounts)<sup>2</sup>, we retained the classifications used in the PDQS, considering that:

- Red meat is consumed in extremely high amounts in the Mongolian and Kazakhstan general populations<sup>6,7</sup> and it was assumed that habitual consumption by most participants could be reasonably classified as excessive (defined according to the GDQS as >46 g/day).
- High-fat milk and dairy products are also consumed in large amounts in the general population of both countries<sup>6-8</sup>. However, despite having expanded the range of PDQS frequency response options, the maximum consumption frequency captured by the screening instrument developed for use in this study was >1 per day, while the GDQS defines excessive consumption of high fat milk and dairy as >734 g/day (roughly equivalent to >3 servings or milk equivalents). This reasonably precluded adapting the GDQS scoring approach for high fat milk and dairy products in this study.

The final approach for scoring the PDQS and PDQS sub-metrics in this study is summarized below:

Food groups	Point values associated with each frequency response					
	<1/wk	1/wk	2-4/wk	5-7/wk	>1/d	
<b>Healthy</b> food groups (included in the <b>PDQS</b> metric and <b>PDQS-healthy</b> sub-metric)	Citrus fruits	0	1	2	3	4
	Other fruits	0	1	2	3	4
	Dark green leafy vegetables	0	1	2	3	4
	Cruciferous vegetables	0	1	2	3	4
	Other vegetables	0	1	2	3	4
	Deep orange fruits and vegetables	0	1	2	3	4
	Legumes	0	1	2	3	4
	Nuts and seeds	0	1	2	3	4
	Whole grains and products	0	1	2	3	4
	Liquid oils	0	1	2	3	4
	Fish	0	1	2	3	4
	Poultry	0	1	2	3	4
	Eggs	0	1	2	3	4
<b>Unhealthy</b> food groups (including in the <b>PDQS</b> metric and <b>PDQS-unhealthy</b> sub-metric)	Red meat	4	3	2	1	0
	Processed meat	4	3	2	1	0
	Refined grains and products	4	3	2	1	0
	Sweets and ice cream	4	3	2	1	0
	Sugary drinks	4	3	2	1	0
	Potatoes and other white tubers	4	3	2	1	0
	Fried foods from outside home	4	3	2	1	0
Not scored	Milk and milk products	0	0	0	0	0

## References

1. Fung TT, Isanaka S, Hu FB *et al.* International food group-based diet quality and risk of coronary heart disease in men and women. *Am J Clin Nutr* 2018;107(1):120–9.
2. Bromage S, Batis C, Bhupathiraju SN *et al.* Development and validation of a novel food-based Global Diet Quality Score (GDQS). *J Nutr*. 2021 Oct;151(Supplement\_2):75S-92S.
3. Kronsteiner-Gicevic S, Mou Y, Bromage S *et al.* Development of a Diet Quality Screener for Global Use: Evaluation in a Sample of US Women. *J Acad Nutr Diet*. 2021 May;121(5):854-871.e6.
4. Gicevic S, Gaskins AJ, Fung TT *et al.* Demographic and socio-economic predictors of diet quality among adults in Bosnia and Herzegovina. *Public Health Nutr* 2019;22(17):3107–17.
5. Gicevic S, Tahirovic E, Bromage S *et al.* Diet quality and all-cause mortality among US adults, estimated from NHANES, 2003–2008. *Public Health Nutr* 2021;24(10):2777–872.
6. Bromage S, Daria T, Lander RL *et al.* Diet and Nutrition Status of Mongolian Adults. *Nutrients*. 2020 May 22;12(5):1514.
7. Jia M, Zhen L, Xiao Y. Changing Food Consumption and Nutrition Intake in Kazakhstan. *Nutrients*. 2022 Jan 13;14(2):326.
8. Euromonitor International. Drinking Milk Products in Kazakhstan. Report code: ASDR-338877. London: Euromonitor; Oct 2020.

## Supplementary Methods 5: R packages and functions used in this study

Derivation of exploratory diet patterns: *prcomp* function in the *stats* package<sup>1</sup>.

Extraction and visualization of results of pattern analysis: *fviz\_eig*, *get\_pca\_var*, and *get\_pca\_ind* functions in the *factoextra* package<sup>2</sup>.

Linear mixed-effects regression models for continuous outcomes and generalized linear mixed models for one binary outcome: *lmer* and *glmer* functions in the *lme4* package<sup>3</sup>.

Cumulative link mixed models for ordered categorical outcomes: *clmm* function in the *ordinal* package<sup>4</sup>.

## References

1. R Core Team. R: A language and environment for statistical computing. Vienna: R Foundation for Statistical Computing; 2022.
2. Kassambara A, Mundt F. *factoextra*: Extract and Visualize the Results of Multivariate Data Analyses. R package version 1.0.7. 2020.
3. Bates D, Maechler M, Bolker B *et al*. Fitting Linear Mixed-Effects Models Using lme4. *J Stat Softw*. 2015;67(1):1-48.
4. Christensen RHB. *ordinal* - Regression Models for Ordinal Data. R package version 2022. 2022.