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Meal skipping among adolescents in the Philippines: prevalence, associated factors, and associations with dietary, mental health, and health risk behavioural outcomes

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Abstract

Background Meal skipping is poorly understood among adolescents in Southeast Asia. The study aimed to investigate the type of and any meal skipping prevalence, its associated factors (sociodemographic and protective) and associations between meal skipping types and dietary, mental, and various health risk behaviour outcomes among school adolescents in the Philippines.

Method The 2019 Philippines Global School-based Student Health Survey (GSHS), a nationally representative survey of teenagers aged 11 to 18 (mean age 13.8 years, Standard Deviation-SD = 1.5) that used a multistage sampling technique, provided the study's data. In order to determine the variables associated with meal skipping (breakfast, lunch, dinner, any meal) and associations of meal skipping with six dietary indicators, four mental health indicators, and ten health risk behaviours, the study used bivariate and multivariable multinomial and binary logistic regression analysis.

Results The past-month prevalence of most skipping breakfast was 37.1%, most skipping lunch 20.1%, most skipping dinner 10.8%, and any meal skipping 68.1%. Most of the students (89.1%) reported having been exposed to healthy eating classes in school, and 51.7% said that they cannot buy soft drinks in school. Female sex, older adolescents, lower socioeconomic status, not being religious, no school truancy, low or no peer and/or parental support were associated with meal (breakfast, lunch, and/or dinner) skipping. Exposure to skipping breakfast, lunch, dinner, or any meal increased the odds of low vegetable, soft drink, and fast-food intake, overweight, obesity, suicidal ideation, plan, attempt, psychological distress, sedentary behaviour, alcohol use, drug use, physical injury, poor hand, and oral hygiene, and not always wearing a seatbelt.

Conclusion Almost seven in 10 adolescents skipped any meal in the past month. Sociodemographic and protective factors were associated with meal skipping. Exposure to meal skipping was associated with 15 out of 17 dietary, mental health, and other health risk behaviour outcomes. In order to lower various adverse health outcomes in

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adolescents, the results thus showed how important it is to improve in a regular meal pattern, particularly meal frequency and meal skipping. Interventions incorporating parental and peer engagement could be strengthened alongside school health education to effectively address meal skipping behaviours.

Keywords Meal skipping, Dietary, Mental health, Health risk behaviour, Adolescents

Introduction

In the Philippines, there is a significant rise in non-communicable diseases (NCDs) like cancer, cardiovascular disease, diabetes, and chronic respiratory diseases, which are now considered the leading cause of death (68%) in the country, with a growing concern about the increasing prevalence of mental health issues alongside this trend; primarily attributed to factors like unhealthy diets, physical inactivity, tobacco use, and alcohol consumption [1–3]. There are several detrimental health effects of eating infrequently [4, 5]. In particular, skipping breakfast is associated with cardiometabolic risk factors, heart disease, and type 2 diabetes [6–8]. Skipping meals appears to be common among adolescence, a period when longer lasting dietary behaviours are formed [9, 10]. In a systematic review, most (30 of 39) studies found that between 10% and 30% of children and adolescents from 33 countries skipped breakfast [7]. A review of teenage girls in low- and middle-income countries (LMICs) found that 40.3% reported skipping breakfast (defined as not eating breakfast every day), with 27.6% of girls in South Asia exhibiting this behaviour [9]. Among school-aged adolescents in Ningbo, China, 12.2% skipped breakfast (< 6 days/week) [11]. The percentages of skipping (0–4 days/week) breakfast, lunch, and dinner among Iranian children and adolescents were 13.8%, 6.8%, and 7.5%, respectively [10]. In comparison to breakfast (7.5% and 4.8%) or lunch (9.3% and 6.3% weekends and weekdays, respectively), dinner was skipped (no meal in a 2-day 24-hour recall) more frequently (25% weekends and 23% weekdays) in a small sample of Indonesian teenagers [12], and among adolescents in the Philippines, 1.8% were breakfast skippers (< 50 kcals of energy consumed) [13]. Most previous studies among adolescents have focused only on skipping breakfast, while more information is needed on skipping lunch or dinner, or any meal, in particular in the Philippines.

The 2012 curriculum guide on health for Grade 1 to Grade 10 learners in the Philippines includes the promotion of "good eating habits – eating regular meals, especially breakfast, eating fruits and vegetables – avoiding soft drinks and junk diet" [14]. The 2017 "Philippines Policy and Guidelines on Healthy Food and Beverage Choices in Schools" includes "make available healthier food and beverage choices among the learners; introduce a system of categorizing locally available foods and drinks in accordance with geographical, cultural, and religious orientations; and provide guidance in the selling and marketing of foods and beverages in schools, including the purchasing of foods for school feeding." [15]. However, it is unclear, if dietary education for adolescents in the Philippine's school system has an impact on meal skipping prevalence, associated factors and associations with dietary, mental health and health risk behaviour outcomes among adolescents in the Philippines, which led to this study.

Factors associated with meal skipping (mostly breakfast skipping) may include sociodemographic factors, such as being female, older adolescents, low family socioeconomic status [16–19], and protective factors, such as being religious or religiosity [20], and having peer and/or parental support [21].

Meal skipping among adolescents is associated with various adverse health outcomes, including dietary, mental health and health risk behaviour outcomes. Dietary outcomes of meal skipping among adolescents include skipping breakfast with obesity in cross-sectional but not cohort studies [22]. For instance, the Health Behaviour in School-aged Children (HBSC) study conducted in Italy found that skipping breakfast every day was linked to overweight, including obesity [23], and adolescent girls in Indonesia who skipped dinner had higher chances of being overweight or obese [12]. An increased risk of low fruit and vegetable intake was seen in older female adolescents with irregular breakfast habits [24], and skipping main meals was linked to low fruit and vegetable intake [25]. Low frequency of fruit and vegetable intake was found to be significantly correlated with irregular breakfast, lunch, and/or evening meal consumption [5, 17, 26, 27]. Skipping breakfast has been linked to increased intake of sugary or soft drinks, sweets, and fast food [28].

Mental health outcomes associated with meal skipping among adolescents may include stress, depressive mood, and suicidal ideation [29]. Skipping lunch and breakfast was linked to higher chances of low self-esteem [30], and skipping breakfast was prospectively linked to emotional or behavioural issues in adolescents [31]. Furthermore, skipping breakfast increased mental distress [32–34], depressive mood [32, 35–37], suicidal ideation [32], and suicide attempt [35].

Other health risk behaviour outcomes associated with meal skipping include that skipping breakfast has among adolescents been associated with substance use, such as smoking, alcohol use [28, 38], and drug use [39], physical inactivity [28, 35, 40] and sedentary behaviour [26, 28]. Poor oral hygiene, such as fewer tooth brushings,

poor hand hygiene, such as not washing hands before meals [41], and not wearing seatbelts [39, 41] were some of the other effects. The study aimed to investigate the type of most and any meal skipping prevalence, its associated factors and associations between most meal skipping types and dietary, mental, and various health risk behaviour outcomes in school-going adolescents in the Philippines.

Methods

Data source

This paper uses data from the 2019 Philippines Global School-based Student Health Survey (GSHS) conducted by the Department of Health, Philippines, which is the fifth iteration of the survey in the country, and can be publicly accessed from the World Health Organization [42]. The GSHS is a self-administered, nationally representative survey that assesses a wide range of behaviours including protective factors, mental health, and alcohol use among other modules [42]. The sample was selected using a two-stage cluster sample design, and the 2019 survey had an overall response rate of 85% (100% school and 85% student response rate) in the Philippines. Student privacy was protected through anonymous and voluntary participation. informed consent was obtained from participants or their guardians before the survey was administered [42]. As an analysis of de-identified, publicly available data, this study did not require approval of human subjects' research by an institutional review board. It complies with the Declaration of Helsinki. According to the Terms and Conditions of the World Health Organization NCD Microdata Repository "The data will be used for statistical and scientific research purposes only."

Study variables (see Table 1)

When the GSHS questionnaires were initially developed in English and Spanish, the participating countries translated and verified them into their own languages [43]. Core, core-expanded, and country-specific questions in the relevant language are used to construct country-specific questions for a self-administered questionnaire [43]. The GSHS is comparable to the "CDC Youth Risk Behavior Survey," for which test- and retest reliability has been proven [44]. Furthermore, the GSHS questionnaire demonstrated a 77% test–retest consistency, according to Becker et al. [45].

Outcome and exposure variable

Meal skipping was assessed with the item, "During the past 30 days, which meal do you most often skip in a day?" (Responses were: "1 = I do not skip any meal during the past 30 days, 2 = Breakfast, 3 = Lunch, 4 = Dinner"). Any meal skipping was defined as skipping breakfast, or lunch, or dinner.

Independent variables

Independent variables included age, sex, type of school, hunger, or food insecurity (as a proxy for socioeconomic status), school attendance, whether the student is religious or spiritual, peer and parental support. Parental support included four items, including parental supervision, connectedness, bonding, and parental respect; items were summed and grouped into 0–1 = low, 2 = moderate, and 3–4 = high parental support. Cronbach alpha for this parental support index was 0.66 in this sample.

Dietary exposure indicators included two items: (1) "During this school year, were you taught in any of your class the benefits of healthy eating?" and (2) "Can you buy sugar-sweetened beverages such as sports drink, energy drinks, fruit drinks that are not 100% juice, and/or carbonated soft drinks in your school?"

Dietary outcome indicators included low fruit intake, low vegetable intake, soft drink consumption, fast food intake and body mass index (BMI). The International Obesity Task Force recommended using Cole's classification to assess body weight status and self-reported height and weight to calculate children's BMI (kg/m^2); overweight was defined as 'more than + 1 standard deviation (SD) and obesity more than + 2 SD from the median body mass index by age and sex' [46, 47].

Mental health outcome indicators included suicide ideation, suicide plan, suicide attempt, and psychological distress. Psychological distress was sourced from two items, (1) on loneliness and (2) on worry induced sleep disturbance. Response options "Never = 1, Rarely = 2, Sometimes = 3, Most of the time = 4, Always = 5," were coded as "Never = 0, Rarely = 1, Sometimes.

= 1, Most of the time = 2, Always = 3." According to earlier research, the sum of the two items' scores was used to define psychological distress as three or higher [48].

Health risk behaviour outcomes included sedentary behaviour, physical inactivity, current alcohol use, history of intoxication, current drug use, physical injury, hand hygiene (before meals, and with soap), inadequate teeth brushing and seat belt use (not always) (see Table 1).

Data analysis

To describe the prevalence of the variables in the study, descriptive statistics was conducted using frequencies and percentages for all variables in the study. In order to estimate a nationally representative sample, cases were weighted using the recommended weighing factor [42]. Collinearity was checked using Variance Inflation Factor (Minimum VIF = 1.07; Maximum VIF = 1.31). Multinomial logistic regression was performed to test for the association between the predictor variables and the

Table 1 Description of global School-based student health survey (GSHS) study variables

Variables	Question	Response options (coding scheme)
	Outcome and exposure variable	
Meal skipping	During the past 30 days, which meal do you most often skip in a day?	1 = I do not skip any meal during the past 30 days, 2 = Breakfast, 3 = Lunch, 4 = Dinner (coded for any meal skipping: 1 = 0 and 2–4 = 1)
	Independent variables	
Age	How old are you?	11 years old or younger to 18 or years old or older (coded ≤ 11–14 years = 0 and 15–18 + years = 1)
Sex	What is your sex?	Male, Female
Type of school	Are you going to a public or private school now?	1 = Public and 0 = Private
Food insecurity	During the past 30 days, how often did you go hungry because there was not enough food in your home?	1 = never to 5 = always (coded 1–3 = 0, and 4–5 = 1)
Is religious or spiritual	Do you think of yourself as a religious or spiritual person?	1 = Yes and 0 = No
School attendance	During the past 30 days, on how many days did you miss classes or school without permission?	1 = 0 days to 5 = 10 or more days (coded 1 = 1 and 2–5 = 0)
Peer support	During the past 30 days, how often were most of the students in your school kind and helpful?	1 = never to 5 = always (coded 1–3 = 0 and 4–5 = 1)
Parental supervision	During the past 30 days, how often did your parents or guardians check to see if your homework was done?	1 = never to 5 = always (coded 1–3 = 0 and 4–5 = 1)
Parental connectedness	During the past 30 days, how often did your parents or guardians understand your problems and worries?	1 = never to 5 = always (coded 1–3 = 0 and 4–5 = 1)
Parental bonding	During the past 30 days, how often did your parents or guardians really know what you were doing with your free time?	1 = never to 5 = always (coded 1–3 = 0 and 4–5 = 1)
Parental respect	During the past 30 days, how often did your parents or guardians go through without your approval?	1 = never to 5 = always (coded 3–5 = 0 and 1–2 = 1)
	Dietary exposure indicators	
Taught healthy eating	During this school year, were you taught in any of your class the benefits of healthy eating?	1 = Yes, 0 = No or do not know
Can buy soft drinks in school	Can you buy sugar-sweetened beverages such as sports drink, energy drinks, fruit drinks that are not 100% juice, and/or carbonated soft drinks in your school?	1 = Yes, 0 = No
	Dietary outcome indicators	
Low fruit intake	During the past 7 days, how many times did you eat fruit, such as bananas, mangoes, or papaya?	1 = did not eat fruit during the past 7 days, 2 = 1 to 3 times during the past 7 days, 3 = 4 to 6 times during the past 7 days, 4 = 1 time per day, 5 = 2 times per day, 6 = 3 times per day, 7 = 4 or more times per day (coded < 1 per day, 1–3 = 1, 4–7 = 0)
Low vegetable intake	During the past 7 days, how many times did you eat vegetables, such as tomatoes, kangkong, cabbage and string beans?	1 = did not eat vegetables during the past 7 days, 2 = 1 to 3 times during the past 7 days, 3 = 4 to 6 times during the past 7 days, 4 = 1 time per day, 5 = 2 times per day, 6 = 3 times per day, 7 = 4 or more times per day" (coded < 1 per day, 1–3 = 1, 4–7 = 0)
Soft drink intake	During the past 7 days, how many times did you drink a can, bottle, or glass of carbonated soft drinks, such as Coke or Pepsi?	1 = did not drink carbonated soft drinks during the past 7 days, 2 = 1 to 3 times during the past 7 days, 3 = 4 to 6 times during the past 7 days, 4 = 1 time per day, 5 = 2 times per day, 6 = 3 times per day, 7 = 4 or more times per day" (coded 1 + per day, 4–7 = 1, 1–3 = 0)
Fast food consumption	During the past 7 days, on how many days did you eat food from a fast-food restaurant, such as McDonalds, Jollibee, or Pizza Restaurants, etc.?	1 = 0 to 8 = 7 days (coded 1 = 0 and 2–8 = 1)
	How tall are you without your shoes on? (in metres)	
	How much do you weigh without your shoes on? (in kilograms)	
	Mental health outcome indicators	
Suicidal ideation	During the past 12 months, did you ever seriously consider attempting suicide?	Yes, No
Suicide plan	During the past 12 months, did you make a plan about how you would attempt suicide?	Yes, No

Table 1 (continued)

Variables	Question	Response options (coding scheme)
	Outcome and exposure variable	
Suicide attempt	During the past 12 months, how many times did you actually attempt suicide?	1 = 0 times to 5 = 6 or more times (coded: 1 = 0 and 2–5 = 1)
Loneliness	During the past 12 months, how often have you felt lonely?	1 = never to 5 = always (coded 1–3 = 0 and 4–5 = 1)
Worry-induced sleep disturbance	During the past 12 months, how often have you been so worried about something that you could not sleep at night?	1 = never to 5 = always (coded 1–3 = 0 and 4–5 = 1)
	Health risk outcome behaviours	
Sedentary behaviour	How much time do you spend during a typical or usual day sitting and watching television, playing computer games, talking with friends, or doing other sitting activities such as playing cards?	1 = less than 1 h per day; 2 = 1–2 h/day; 3 = 3–4 h/day; 4 = 5–6 h/day; 5 = 7–8 h/day and 6 = 8 or more hours per day (coded 1–2 = 0 and 3–6 = 1)
Physical inactivity	During the past 7 days, on how many days were you physically active for a total of at least 60 min per day?	0 = 0 days to 7 = 7 days (coded 7 = 0 and 0–6 = 1)
Current alcohol use	During the past 30 days, on how many days did you have at least one drink containing alcohol?	1 = 0 days to 7 = All 30 days (coded 1 = 0 and 2–7 = 1)
History of intoxication	During your life, how many times did you drink so much alcohol that you were really drunk?	1 = 0 times to 4 = 10 or more times (coded 1 = 2–4 and 1 = 0)
Current drug use	During the past 30 days, what was the last drug/substance that you used?	1 = I did not use any drug/substance in the past 30 days, 2 = Marijuana, 3 = Shabu, 4 = Ecstasy, 5 = Rugby, 6 = Cocaine (coded 1 = 0 and 2–5 = 1)
Physical injury	During the past 12 months, how many times were you seriously injured?	1 = 0 times to 8 = 12 or more times (coded 1 = 0 and 2–8 = 1)
Hand washing before meals (not always)	During the past 30 days, how often did you wash your hands before eating?	1 = never to 5 = always (coded 1–4 = 1 and 5 = 0)
Hand washing with soap (not always)	During the past 30 days, how often did you use soap when washing your hands?	1 = never to 5 = always (coded 1–4 = 1 and 5 = 0)
Inadequate teeth brushing	During the past 30 days, how many times per day did you usually clean or brush your teeth?	1 = 0 times in the past 30 days, 2 = Less than 1 time per day, 3 = 1 time per day, 4 = 2 times per day, 5 = 3 times per day, 6 = 4 or more times per day (coded 1–3 = 0 and 4–6 = 1)
Seat belt use (not always)	During the past 30 days, how often did you use a seat belt when riding in a car or other motor vehicle driven by someone else?	1 = I did not ride in a motor vehicle driven by someone else, 2 = Never, 3 = Rarely, 4 = Sometimes, 5 = Most of the time, 6 = Always (Coded 2–4 = 1 and 1 or 6 = 0)

outcome variables (skipping breakfast, skipping lunch, and skipping dinner, with not any meal skipping as reference category). Binary logistic regression was further performed to test for the association between the predictor variables and the outcome variable (any meal skipping, with no meal skipping as reference category). Furthermore, binary logistic regression was conducted to assess the associations between the exposure of meal skipping categories (skipping breakfast, skipping lunch, skipping dinner, and skipping any meal) with dietary, mental health and health risk behaviour outcomes. Only the significant predictors ($p < 0.05$) in the univariate analysis were included in the multivariable analysis, adjusted for food insecurity, sex, age, type of school, religiosity, school attendance, peer, and parental support. The complex sampling was taken into consideration when performing statistical analyses using STATA software version 16.0 (Stata Corporation, College Station, TX, USA).

Results

Sample characteristics

The study sample included 10,175 school adolescents (mean 13.8 years, 1.5 years standard deviation). The past-month prevalence of most skipping breakfast was 37.1%, most skipping lunch 20.1%, most skipping dinner 10.8%, and any meal skipping 68.1%. Most of the students (89.1%) reported having been exposed to healthy eating classes in school, and 51.7% said that they cannot buy soft drinks in school (see Table 2).

Associations with meal skipping categories

In unadjusted analysis, having been taught on healthy eating had a lower risk ratio of skipping lunch, and being able to buy soft drinks in school increased the risk ratio of skipping dinner, and increased the odds of any meal skipping (see Table 3).

In adjusted analysis, compared to younger adolescents (≤ 11–14 years), older adolescents (15–18 years or more) had a higher risk ratio of skipping breakfast (Adjusted

Table 2 Sample characteristics by most meal skipping status, school adolescents, Philippines, 2019

Variable	Sample	Skip breakfast	Skip lunch	Skip dinner	Any meal skipping	No meal skipping
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
All	10,175	3508 (37.1)	2048 (20.1)	1005 (10.8)	6561 (68.1)	3213 (31.9)
Sex						
Female	5421 (50.5)	1981 (39.6)	1069 (19.8)	567 (11.3)	3617 (70.7)	1612 (29.3)
Male	4686 (49.5)	1505 (34.6)	959 (20.3)	429 (10.2)	2893 (65.1)	1592 (34.9)
Age in years						
≤11–14	6653 (65.5)	2155 (35.1)	1287 (19.2)	665 (11.1)	4107 (65.4)	2260 (34.6)
15–18+	3496 (34.5)	1346 (41.0)	754 (21.8)	338 (10.3)	2438 (73.0)	944 (27.0)
Type of school						
Private	2023 (19.3)	654 (35.1)	396 (18.9)	224 (12.1)	1274 (66.1)	681 (33.9)
Public	7843 (80.7)	2739 (37.5)	1590 (20.4)	750 (10.5)	5079 (68.3)	2451 (31.7)
Food insecurity						
No	8799 (87.3)	3056 (37.4)	1716 (19.6)	832 (10.5)	5604 (67.5)	2843 (32.5)
Yes (mostly or always)	1356 (12.7)	448 (34.9)	330 (23.9)	171 (13.0)	949 (71.8)	367 (28.2)
Religious						
No	3008 (33.0)	1106 (39.5)	634 (21.0)	302 (11.4)	2042 (71.8)	851 (28.2)
Yes	6540 (67.0)	2215 (36.6)	1276 (19.4)	623 (10.2)	4114 (66.2)	2184 (33.8)
School attendance						
No	3144 (32.6)	1154 (38.6)	692 (22.4)	334 (11.7)	2180 (72.7)	845 (27.3)
Yes (every day)	6910 (67.4)	2322 (36.6)	1326 (19.0)	658 (10.4)	4306 (66.0)	2333 (34.0)
Peer support						
No	6647 (66.3)	2347 (38.0)	1412 (21.1)	660 (10.9)	4419 (70.0)	1964 (30.0)
Yes (mostly or always)	3378 (33.7)	1125 (36.0)	598 (17.8)	330 (10.6)	2053 (64.4)	1208 (35.6)
Parental support						
Low (0–1)	5797 (57.2)	2060 (38.2)	1284 (22.1)	559 (10.5)	3903 (70.7)	1668 (29.3)
Moderate (2)	2356 (23.8)	818 (37.7)	437 (18.9)	263 (12.5)	1518 (69.1)	743 (30.9)
High (3–4)	1963 (19.0)	614 (33.7)	312 (15.7)	176 (9.5)	1102 (58.1)	787 (41.9)
Taught healthy eating						
No	1008 (10.9)	375 (36.2)	250 (22.3)	124 (12.9)	749 (71.3)	288 (28.7)
Yes	8869 (89.1)	3064 (37.2)	1753 (19.9)	856 (10.4)	5673 (67.5)	2879 (32.5)
Can buy soft drinks in school						
No	5143 (51.7)	1757 (36.9)	1023 (20.2)	470 (9.9)	3250 (67.0)	1709 (33.0)
Yes	4894 (48.3)	1717 (37.5)	1001 (20.1)	502 (11.4)	3220 (69.0)	1471 (31.0)

% is weighted

Relative Risk Ratio-ARRR: 1.53, 95% Confidence Interval-CI 1.30–1.80) lunch (ARRR: 1.55, 95% CI: 1.30–1.85) and dinner (ARRR: 1.39, 95% CI: 1.14–1.70), and higher odds of skipping any meal (Adjusted Odds Ratio-AOR: 1.51, 95% CI: 1.33–1.72). Male students and those attending school (every day in the past month) had a lower risk ratio or odds of skipping breakfast, lunch, dinner, and any meal. Food insecurity or lower socioeconomic status increased the risk of skipping lunch (ARRR: 1.29, 95% CI: 1.05–1.59) and skipping dinner (APRR: 1.45, 95% CI: 1.14–1.86), and increased the odds of any meal skipping (AOR: 1.16, 95% CI: 1.03–1.30). Being religious, school attendance, having peer and higher parental support decreased the risk and odds ratio of any meal skipping, skipping breakfast, and/or skipping lunch and/or skipping dinner (see Table 4).

Associations between meal skipping types and dietary, mental health and other health risk behaviour outcomes

In adjusted analysis, in terms of dietary outcomes, skipping breakfast was positively associated with low vegetable intake (AOR: 1.16, 95% CI: 1.04–1.30), soft drink intake (AOR: 1.19, 95% CI: 1.04–1.36), fast food intake (AOR: 1.15, 95% CI: 1.01–1.31) and obesity (AOR: 1.43, 95% CI: 1.05–1.93). Skipping lunch was positively associated with soft drink intake (AOR: 1.32, 95% CI: 1.13–1.55), and obesity (AOR: 1.52, 95% CI: 1.01–2.27). Skipping dinner was positively associated with soft drink intake (AOR: 1.34, 95% CI: 1.06–1.71), fast food intake (AOR: 1.27, 95% CI: 1.06–1.52), overweight (AOR: 1.44, 95% CI = 1.06–1.96) and obesity (AOR: 2.05, 95% CI: 1.29–3.26). Skipping any meal was positively associated with soft drink intake, fast food consumption, and obesity. In adjusted analysis, in terms of mental health outcomes, skipping breakfast, lunch, dinner and any meal

Table 3 Multinomial logistic regression with skipping breakfast, skipping lunch, and skipping dinner (with no meal skipping as reference category) (unadjusted risk ratios), and binary logistic regression with any meal skipping (with no meal skipping as reference category) (unadjusted odds ratios)

Variable	Skipping breakfast	Skipping lunch	Skipping dinner	Any meal skipping
	RRR (95% CI)	RRR (95% CI)	RRR (95% CI)	OR (95% CI)
Sex				
Female	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Male	0.73 (0.64 to 0.84)***	0.86 (0.72 to 1.02)	0.76 (0.65 to 0.90)***	0.77 (0.68 to 0.88)***
Age in years				
≤11–14	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
15–18+	1.50 (1.26 to 1.y78)***	1.46 (1.25 to 1.70)***	1.19 (1.02 to 1.40)*	1.43 (1.26 to 1.63)***
Type of school				
Private	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Public	1.14 (0.89 to 1.46)	1.16 (0.86 to 1.56)	0.92 (0.75 to 1.13)	1.10 (0.97 to 1.26)
Food insecurity				
No	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Yes (mostly or always)	1.08 (0.94 to 1.23)	1.41 (1.16 to 1.71)***	1.43 (1.14 to 1.80)**	1.23 (1.10 to 1.37)***
Religious				
No	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Yes	0.77 (0.66 to 0.90)**	0.77 (0.64 to 0.92)**	0.75 (0.62 to 0.91)**	0.77 (0.67 to 0.88)***
School attendance				
No	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Yes (every day)	0.76 (0.68 to 0.86)***	0.68 (0.60 to 0.78)***	0.71 (0.60 to 0.85)***	0.73 (0.66 to 0.80)***
Peer support				
No	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Yes (mostly or always)	0.80 (0.71 to 0.90)***	0.71 (0.61 to 0.82)***	0.82 (0.68 to 0.99)*	0.78 (0.70 to 0.86)***
Parental support				
Low (0–1)	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Moderate (2)	0.93 (0.82 to 1.07)	0.81 (0.68 to 0.96)*	1.13 (0.90 to 1.42)	0.92 (0.81 to 1.04)
High (3–4)	0.63 (0.53 to 0.74)***	0.51 (0.42 to 0.61)***	0.65 (0.49 to 0.85)**	0.59 (0.51 to 0.69)***
Taught healthy eating				
No	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Yes	0.91 (0.71 to 1.17)	0.79 (0.63 to 0.98)*	0.72 (0.51 to 1.00)	0.84 (0.67 to 1.04)
Can buy soft drinks in school (yes)				
No				
Yes	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
	1.08 (0.96 to 1.22)	1.06 (0.92 to 1.22)	1.22 (1.05 to 1.42)**	1.10 (1.00 to 1.22)*

RRR = Relative Risk Ratio; OR = Odds Ratio; CI = Confidence Intervals; *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

were all positively associated with suicidal ideation, plan, attempt and psychological distress. In adjusted analysis, in terms of health risk behaviour outcomes, skipping breakfast, lunch, dinner and/or any meal were all positively associated with sedentary behaviour, current alcohol use, history of intoxication, current drug use, physical injury, hand hygiene (not always before meals and with soap), inadequate tooth brushing and not always using a seatbelt (see Table 5).

Discussion

The study found a high past-month prevalence of most skipping breakfast (37.1%), most skipping lunch (20.1%), most skipping dinner (10.8%), and any meal skipping (68.1%) in a nationally representative sample of adolescents attending school in the Philippines. This result in terms of skipping breakfast seems to be higher than in a previous study among adolescents in the Philippines (1.8%) [13], among children and adolescents from 33 countries (mostly between 10 and 30%) [7], and similar to a review of adolescent girls in LMICS (40.3%) but higher than among girls (27.6%) in South Asia [9]. The proportion of the type of meal skipping was the highest for breakfast, followed by lunch and dinner. A similar sequence was found in a study among children and adolescents in Iran, with the frequency of breakfast being the highest (13.8%) followed by dinner (7.5%) and lunch (6.8%) [10], while in a small sample of adolescents in Indonesia, dinner was skipped most frequently, followed by lunch and breakfast [12]. Different age groups and different definitions of skipping breakfast may be the cause of some of these discrepancies.

Table 4 Multinomial logistic regression with skipping breakfast, skipping lunch, and skipping dinner (with no meal skipping as reference category) (adjusted risk ratios), and binary logistic regression with any meal skipping (with no meal skipping as reference category) (adjusted odds ratios)

Variables	Skipping breakfast	Skipping lunch	Skipping dinner	Any meal skipping
	ARRR (95% CI)	ARRR (95% CI)	ARRR (95% CI)	AOR (95% CI)
Sex				
Female	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Male	0.69 (0.61 to 0.78)***	0.78 (0.65 to 0.93)**	0.63 (0.51 to 0.77)***	0.70 (0.62 to 0.80)**
Age in years				
≤11–14	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
15–18+	1.53 (1.30 to 1.80)***	1.55 (1.30 to 1.85)***	1.39 (1.14 to 1.70)***	1.51 (1.33 to 1.72)***
Type of school				
Private	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Public	1.11 (0.82 to 1.50)	1.15 (0.84 to 1.57)	0.96 (0.76 to 1.20)	1.09 (0.92 to 1.29)
Food insecurity				
No	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Yes (mostly or always)	1.01 (0.87 to 1.18)	1.29 (1.05 to 1.59)*	1.45 (1.14 to 1.86)**	1.16 (1.03 to 1.30)**
Religious				
No	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Yes	0.79 (0.67 to 0.94)**	0.83 (0.68 to 1.01)	0.76 (0.63 to 0.93)**	0.80 (0.70 to 0.92)**
School attendance				
No	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Yes (every day)	0.76 (0.65 to 0.88)***	0.75 (0.62 to 0.91)**	0.78 (0.63 to 0.96)*	0.76 (0.66 to 0.87)***
Peer support				
No	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Yes (mostly or always)	0.87 (0.76 to 0.99)*	0.85 (0.73 to 1.00)	0.91 (0.73 to 1.12)	0.87 (0.77 to 0.98)*
Parental support				
Low (0–1)	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Moderate (2)	0.99 (0.86 to 1.13)	0.84 (0.69 to 1.03)	1.14 (0.91 to 1.44)	0.97 (0.85 to 1.10)
High (3–4)	0.68 (0.57 to 0.81)***	0.56 (0.47 to 0.68)***	0.76 (0.57 to 1.01)	0.65 (0.56 to 0.76)***
Taught healthy eating				
No	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Yes	0.92 (0.71 to 1.20)	0.86 (0.67 to 1.09)	0.83 (0.56 to 1.25)	0.89 (0.70 to 1.12)
Can buy soft drinks in school (yes)				
No	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Yes	1.07 (0.94 to 1.22)	1.00 (0.85 to 1.18)	1.15 (0.98 to 1.35)	1.06 (0.96 to 1.17)

ARRR = Adjusted Relative Risk Ratio; AOR = Adjusted Odds Ratio; CI = Confidence Intervals; *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Most of the students (89.1%) reported having been exposed to healthy eating classes in school, and 51.7% said that they cannot buy soft drinks in school in this study. In unadjusted analysis, having been taught on healthy eating had a lower risk ratio of skipping lunch, and being able to buy soft drinks in school increased the risk ratio of skipping dinner, and increased the odds of any meal skipping. Although the proportion of exposure to the healthy eating school curriculum in the Philippines was very high (89.1%) in this study and more than half of the students (51.7%) were not able to buy soft drinks in school, the promotion of good eating habits – eating regular meals, especially breakfast, avoiding soft drinks and junk diet can be strengthened [14, 15]. A previous systematic review notes that adolescent healthy eating behaviours, including having regular meals, can be effectively promoted by school-based multi-component healthy eating interventions that integrate system-level improvements with individual-level interventions, e.g., especially when they incorporate multiple components like education, the availability of nutritious food alternatives in the cafeteria, and environmental changes within the school setting [49]. The single component healthy eating education in this study may therefore not be effective enough in changing meal skipping behaviour, and therefore school-based multi-component healthy eating interventions are recommended.

Consistent with previous research [16–19], this study found that female sex and older adolescents were associated with all meal skipping types. It is possible that girls are more weight and/or body image conscious and engage therefore more likely than boys in skipping meals [19]. Furthermore, consisted with previous research [16–19], this study found an association between low

Table 5 Binary logistic regression between the exposure of meal skipping categories (skipping breakfast, skipping lunch, skipping dinner, and skipping any meal) with dietary, mental health and health risk behaviour outcomes

Variable		Skipping breakfast	Skipping lunch	Skipping dinner	Any meal skipping
	Model	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Dietary indicators					
Low fruit intake	1	1.13 (1.00 to 1.27)*	1.02 (0.90 to 1.16)	1.02 (0.83 to 1.26)	1.08 (0.98 to 1.18)
(*N* = 6707, 66.9%)	2	1.08 (0.95 to 1.22)	0.96 (0.84 to 1.11)	0.99 (0.80 to 1.24)	---
Low vegetable intake	1	1.21 (1.09 to 1.33)***	1.02 (0.88 to 1.20)	1.09 (0.90 to 1.32)	1.13 (1.02 to 1.25)*
(*N* = 6326, 62.9%)	2	1.16 (1.04 to 1.30)**	1.00 (0.85 to 1.17)	1.06 (0.88 to 1.29)	1.10 (0.99 to 1.22)
Soft drink intake (≥ 1/day)	1	1.26 (1.12 to 1.42)***	1.33 (1.13 to 1.55)***	1.32 (1.05 to 1.67)*	1.29 (1.14 to 1.46)***
(*N* = 3261, 31.5%)	2	1.19 (1.04 to 1.36)*	1.32 (1.13 to 1.55)***	1.34 (1.06 to 1.71)*	1.26 (1.11 to 1.43)***
Fast food consumption (≥ 1/week)	1	1.15 (1.02 to 1.29)*	1.11 (0.91 to 1.34)	1.28 (1.08 to 1.53)**	1.16 (1.03 to 1.30)*
(*N* = 5623, 56.9%)	2	1.15 (1.01 to 1.31)*	1.10 (0.91 to 1.33)	1.27 (1.06 to 1.52)**	1.15 (1.01 to 1.30)*
Overweight	1	1.17 (0.91 to 1.51)	0.91 (0.70 to 1.19)	1.39 (1.02 to 1.88)*	1.13 (0.90 to 1.41)
(*N* = 799, 9.6%)	2	1.26 (0.98 to 1.61)	1.00 (0.76 to 1.32)	1.44 (1.06 to 1.96)*	---
Obesity	1	1.24 (0.92 to 1.66)	1.29 (0.88 to 1.90)	1.87 (1.22 to 2.88)**	1.35 (1.01 to 1.81)*
(*N* = 321, 4.0%)	2	1.43 (1.05 to 1.93)*	1.52 (1.01 to 2.27)*	2.05 (1.29 to 3.26)**	1.51 (1.11 to 2.05)**
Mental health indicators					
Suicidal ideation	1	1.65 (1.43 to 1.90)***	1.61 (1.40 to 1.85)***	1.81 (1.56 to 2.11)***	1.66 (1.48 to 1.87)***
(*N* = 2165, 22.7%)	2	1.60 (1.36 to 1.87)***	1.42 (1.24 to 1.64)***	1.62 (1.35 to 1.94)***	1.55 (1.36 to 1.78)***
Suicide plan	1	1.44 (1.23 to 1.70)***	1.47 (1.25 to 1.72)***	1.84 (1.50 to 2.26)***	1.51 (1.30 to 1.75)***
(*N* = 1638, 16.7%)	2	1.36 (1.13 to 1.62)***	1.32 (1.12 to 1.55)***	1.72 (1.40 to 2.11)***	1.41 (1.20 to 1.65)***
Suicide attempt	1	1.61 (1.43 to 1.80)***	1.59 (1.36 to 1.86)***	1.80 (1.48 to 2.20)***	1.63 (1.47 to 1.81)***
(*N* = 2428, 24.6%)	2	1.55 (1.35 to 1.78)***	1.40 (1.20 to 1.64)***	1.66 (1.29 to 2.14)***	1.52 (1.33 to 1.75)***
Psychological distress	1	1.73 (1.50 to 1.99)***	1.51 (1.30 to 1.76)***	1.65 (1.40 to 1.95)***	(1.65 1.46 to 1.86)***
(*N* = 2932, 29.0%)	2	1.66 (1.44 to 1.92)***	1.37 (1.17 to 1.59)***	1.49 (1.24 to 1.80)***	1.55 (1.38 to 1.76)***
Health risk behaviours					
Sedentary behaviour	1	1.22 (1.07 to 1.41)**	1.18 (1.01 to 1.37)*	1.28 (1.09 to 1.50)**	1.22 (1.08 to 1.37)***
(*N* = 3279, 34.3%)	2	1.23 (1.07 to 1.42)**	1.12 (0.95 to 1.33)	1.23 (1.01 to 1.49)*	1.20 (1.06 to 1.36)**
Physical inactivity	1	1.09 (0.89 to 1.33)	1.20 (0.98 to 1.49)	1.11 (0.88 to 1.39)	1.23 (1.02 to 1.48)*
(*N* = 9440, 93.5%)	2	---	---	---	1.12 (0.97 to 1.23)
Current alcohol use	1	1.37 (1.20 to 1.57)***	1.62 (1.35 to 1.94)***	1.52 (1.27 to 1.78)***	1.46 (1.31 to 1.63)***
(*N* = 2319, 24.6%)	2	1.31 (1.14 to 1.50)***	1.453 (1.16 to 1.78)**	1.44 (1.20 to 1.73)***	1.36 (1.21 to 1.54)***
History of intoxication	1	1.53 (1.33 to 1.76)***	1.66 (1.35 to 2.04)***	1.47 (1.24 to 1.75)***	1.56 (1.37 to 1.77)***
(*N* = 2177, 23.5%)	2	1.36 (1.19 to 1.56)***	1.39 (1.12 to 1.72)**	1.32 (1.11 to 1.73)**	1.38 (1.23 to 1.55)***
Current drug use	1	1.05 (0.90 to 1.23)	1.48 (1.24 to 1.76)***	1.63 (1.27 to 2.09)***	1.26 (1.10 to 1.46)**
(*N* = 1361, 14.1%)	2	1.04 (0.82 to 1.30)	1.31 (1.04 to 1.66)*	1.63 (1.20 to 2.22)**	1.21 (1.00 to 1.47)*
Physical injury	1	1.42 (1.24 to 1.63)***	1.51 (1.28 to 1.77)***	1.63 (1.30 to 2.04)***	1.48 (1.31 to 1.67)***
(*N* = 3979, 46.0%)	2	1.52 (1.27 to 1.81)***	1.49 (1.26 to 1.75)***	1.61 (1.27 to 2.04)***	1.51 (1.30 to 1.75)***
Hand washing before meals (not always)	1	1.44 (1.38 to 1.71)***	1.54 (1.38 to 1.71)***	1.39 (1.21 to 1.60)***	1.46 (1.36 to 1.57)***
(*N* = 4167, 41.6%)	2	1.36 (1.23 to 1.50)***	1.36 (1.19 to 1.55)***	1.28 (1.09 to 1.50)**	1.34 (1.23 to 1.47)***
Hand washing with soap (not always)	1	1.39 (1.23 to 1.58)***	1.43 (1.28 to 1.60)***	1.64 (1.36 to 1.98)***	1.50 (1.39 to 1.69)***
(*N* = 5002, 48.8%)	2	1.39 (1.22 to 1.57)***	1.42 (1.27 to 1.59)***	1.64 (1.35 to 1.98)***	1.44 (1.30 to 1.58)***
Tooth brushing (< 2/day)	1	1.19 (1.00 to 1.41)*	1.22 (1.04 to 1.43)*	1.33 (1.07 to 1.66)*	1.22 (1.06 to 1.40)**
(*N* = 2010, 18.7%)	2	1.23 (1.02 to 1.49)*	1.22 (1.03 to 1.45)*	1.32 (1.06 to 1.64)*	1.23 (1.05 to 1.44)**
Seat belt (not always)	1	1.21 (1.10 to 1.34)***	1.22 (1.09 to 1.36)*	1.18 (1.02 to 1.36)*	1.21 (1.12 to 1.30)***
(*N* = 6282, 61.0%)	2	1.17 (1.05 to 1.31)**	1.14 (0.99 to 1.31)	1.10 (0.96 to 1.27)	1.15 (1.06 to 1.28)**

OR = Odds Ratio; CI = Confidence Interval; Model 1: Unadjusted; Model 2: Adjusted for age, sex, food insecurity, type of school, religiosity, school attendance, peer and parental support; *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

socioeconomic status (food insecurity as proxy) and meal skipping. The study found a high proportion of food insecurity (12.7%) among adolescents. In a 2015 Nutrition Survey in the Philippines, it was discovered that 12%, 32%, and 22% of the population, respectively, had mild, moderate, and severe degrees of household insecurity [50], and according to a Social Weather Stations (SWS) poll in 2024, 14.2% of Filipino families went without food at least once in the previous three months, a condition known as involuntary hunger [51]. Food insecurity among adolescents has been associated with meal skipping [52]. It is recommended that the Philippines school

feeding programme is expanded from breakfast to lunch and targeting up until the adolescent age [13, 53].

Moreover, in line with previous studies on breakfast skipping among adolescents [20, 21], school attendance, being religious, having peer and/or parental support were protective against meal skipping in this study. Therefore, strategies to promote school attendance, and peer and parental support may help in reducing meal skipping in this population. A prior study has shown the beneficial effects of mothers and best friends on the meal-skipping behaviours of adolescents [54]. Adequate meal intake may be fostered by religiosity, a phenomenon closely linked to norms and value systems that dictate appropriate interpersonal conduct [20].

In line with previous research [12, 22, 23], at least one type of meal skipping was in this study associated with overweight and obesity. Several studies have shown that skipping breakfast or main meals was associated with low fruits and vegetables intake [5, 17, 24–27], while in the current study only skipping breakfast was associated with low vegetable intake but not with low fruit intake. Consistent with a previous study [28], this survey shows that meal skipping was significantly associated with soft drink and fast-food consumption.

Regarding mental health outcomes associated with meal skipping, this study showed in agreement with a number of studies [29–37], strong positive associations between all meal skipping types and suicidal behaviour, and psychological distress. Breakfast may help prevent poor mental health in a number of ways. For instance, glucose produced from carbohydrates after eating breakfast is necessary to produce tryptophan, a precursor protein for the synthesis of serotonin, which controls mood swings, depression symptoms, and cognitive function [55–57].

In terms of other health risk behaviour outcomes associated with meal skipping, previous studies [26, 28, 35, 40] showed that skipping breakfast was associated sedentary behaviour and physical inactivity, while in this study only an association between skipping breakfast and skipping dinner with sedentary behaviour, but not with physical inactivity. Consistent with previous studies [28, 38, 39], we found that meal skipping was associated with substance use (alcohol and drug use). Furthermore, in line with former research [39, 41], the study found that meal skipping was associated with not always wearing a seatbelt, poor oral and hand hygiene. This study appears to support the notion that meal skipping is associated with a number of other unhealthy behaviors, including poor eating habits, mental illness, and other risky behaviors like physical injury and sedentary behavior [28, 33]. These results confirm previous research demonstrating the diverse range of potential impacts of meal skipping on poor mental indicators and various health risk behaviors. It is possible that eating breakfast helps teenagers "function better cognitively and psychosocially," which could explain how skipping meals affects risky behaviours and mental health [32, 55]. Considering the identified factors associated with meal skipping, school health education, including the promotion of good eating habits, such as eating regular meals, especially breakfast, should be strengthened. For example, by targeting females, older adolescents, those with lower socioeconomic status, and those not being religious, and interventions incorporating parental and peer engagement as well as promoting school attendance.

Study limitations

The cross-sectional design of the study, the inclusion of only teenagers enrolled in school, and the use of self-reported measurements such as height and body weight placed restrictions on the research. A major limitation included the meal skipping variable "During the past 30 days, which meal do you most often skip in a day?" that only allowed participants to choose one response option between 1 = no meals, 2 = breakfast, 3 = lunch or 4 = dinner. However, it is possible that some participants could equally skip some meals but are forced to choose one. Or they skip dinner slightly less than breakfast but choose dinner alone. This does not adequately assess who is skipping each meal. It refers to the meal they skip the most. Future research should make sure to evaluate the frequency, context, and diet quality of each meal skipping type, as this was not done in this study. More longitudinal research is needed to determine causal associations, regarding the different types of meal skipping. For instance, it is possible that students who experience mental health issues start skipping breakfast because of those issues. Finally, little is known about how or why religious participation influences teenage health and behaviours based on single global items to measure religiousness, such as "How religious are you?" [58, 59]. Therefore, future research among adolescents should include multidimensional measures of religiousness or spirituality [59].

Conclusion

Almost seven in 10 adolescents skipped any meal in the past month. Sociodemographic factors (female sex, older adolescents, lower socioeconomic status, and not being religious) increased the odds and protective factors (school attendance, peer, and parental support) decreased the odds of meal skipping. Exposure to skipping breakfast, lunch, dinner, or any meal increased the odds of low vegetable, soft drink, and fast-food intake, overweight, obesity, suicidal ideation, plan, and attempt, psychological distress, sedentary behaviour, alcohol use, drug use, physical injury, poor hand, and oral hygiene, and not always wearing a seatbelt. Interventions incorporating

parental and peer engagement could be strengthened alongside school health education to effectively address meal skipping behaviours.

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Author contributions
All authors fulfil the criteria for authorship. SP, KP, T-T N-T and IJ conceived and designed the research, performed statistical analysis, drafted the manuscript, and made critical revisions of the manuscript for key intellectual content. All authors read and approved the final version of the manuscript and have agreed to the authorship and order of authorship for this manuscript.

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Data availability
The data on which is paper is based is available at the World Health Organization, NCD Repository at https://extranet.who.int/ncdsmicrodata/index.php/catalog/944/get-microdata.

Declarations

Ethics approval and consent to participate
Before the survey was given out, the participating schools, the parents, and the students provided the required approvals and permits, including informed consent. As an analysis of de-identified, publicly available data, this study did not require approval of human subjects' research by an institutional review board. It complies with the Declaration of Helsinki. According to the Terms and Conditions of the World Health Organization NCD Microdata Repository "The data will be used for statistical and scientific research purposes only. Institutional review board approval was not obtained because this study used publicly available data from the World Health Organization (WHO) website, which contains anonymous individual information.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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