
PUBLIC HEALTH RESEARCH

Methodology of National Health and Morbidity Survey (NHMS): Adolescent Health, Malaysia 2022

Lim Kuang Kuay, Maznieda Mahjom, S Maria Awaluddin, Noor Syaqlah Shawaluddin, Tuan Mohd Amin Tuan Lah, Hamizatul Akmal Abd Hamid, Muhammad Fadhli Mohd Yusoff, Tan Lee Ann and Noor Ani Ahmad*

Institute for Public Health, National Institutes of Health, Ministry of Health Malaysia.

**For reprint and all correspondence: Lim Kuang Kuay, Institute for Public Health, National Institutes of Health, Ministry of Health Malaysia, Jalan Setia Murni U13/52, Seksyen U13 Setia Alam, 40170 Shah Alam, Selangor. Email: limkk@moh.gov.my*

ABSTRACT

Introduction	In Malaysia, the adolescent health surveys conducted in 2012 and 2017 revealed an increasing trend of adolescent health risk behaviours and protective factors. This current article aims to describe the methodology of the National Health and Morbidity Survey (NHMS) 2022: Adolescent Health in Malaysia.
Methods	The current nationwide cross-sectional survey of Malaysian secondary school students used multistage stratified sampling to select 240 nationally representative schools. This survey is conducted from June to July 2022 among the students in forms 1, 2, 3, 4, and 5 in all Malaysian states by 34 data collection teams. A validated self-administered questionnaire is used, similar to those used in the NHMS 2012 and NHMS 2017. The quality control is done twice, once at the field level and once at the central level. Sample weighting and analysis are conducted using SPSS statistical software version 28.0.
Results	A total of 239 out of 240 randomly selected schools with 33,523 adolescents are involved in this study (overall response rate is 89.0%). The distribution of state, sex, and form among adolescents is almost equal. Compared to both previous adolescent health surveys using the same methodology and approaches, the overall response rates for NHMS 2017 and NHMS 2012 are 89.2% and 88.8%, respectively.
Conclusions	The implementation of NHMS 2022 has employed an acceptable methodology for a survey of the adolescent population. This reliable data provides national estimates for adolescent health risk behaviours and protective factors. The survey allows the relevant authorities to carried out further improve the health status of adolescents in Malaysia.
Keywords	Adolescent - NHMS - Methodology - Malaysia.

Article history

Received: 27 March 2023

Accepted: 7 July 2023

Published: 1 September 2023

INTRODUCTION

Adolescence is a period of life in which health opportunities are abundant and adult health habits are established, it's a crucial time of physical, emotional, cognitive, and social growth, and community upheavals.¹ One-third of the worldwide disease burden is attributed to adolescent behaviours.² According to a recent Global Burden of Disease study,³ chronic non-communicable diseases (NCDs) are the leading causes of death worldwide. With 1.2 billion adolescents aged 10-19 years, the biggest adolescent population in human history, representing more than 16% of the world's population. Investments in adolescent health and well-being will yield advantages for adolescents, their adult life, and future generations.^{2,4} Evidence from high, middle, and low-income nations demonstrates that adolescents face several barriers to adequate health care and that services are typically fragmented and poorly integrated.⁵

To improve adolescent health globally, the World Health Organization (WHO) has developed the Global School-based Student Health Survey (GSHS), a tool for measuring health risk behaviours.⁶ Briefly, The GSHS is a low-cost school-based survey that uses a self-administered questionnaire to collect data on adolescents' health behaviours and protective factors related to adulthood morbidity and mortality. The information assists the government in setting priorities, creating programmes, and requesting funding for initiatives and policies relating to adolescents' health.^{7,8} Currently, over 140 countries use the GSHS to periodically assess the prevalence of key health risk behaviours and protective factors among adolescents.⁹

In Malaysia, about 15.6% of the entire Malaysian population consists of adolescents.¹⁰ Like other countries in the world, due to their inability to cope with the challenges of everyday life, adolescents in Malaysia are also faced with a variety of difficulties in life, which may have effects on the country as a whole.¹¹ Hence, understanding the adolescent health risk factors are crucial for early detection and treatment with more favourable outcomes. In 2012, the Ministry of Health, Malaysia (MOH) collaborates with the WHO to conduct the first GSHS (NHMS 2012) among adolescents aged 13 to 17 years to determine the baseline of the health status of adolescents in Malaysia.¹² In 2017, the

second adolescent health survey (NHMS 2017) is conducted in the country to monitor and keep track of adolescents' health status.¹³ The studies found an upward trend in health risk behaviours and protective factors among Malaysian adolescents.^{12,13} With the increasing trends of risk factors for non-communicable diseases and other behaviour-related risks, it is timely for the survey to be repeated in 2022 to further monitor the country's adolescent health status. The MOH with cooperation from the Ministry of Education (MOE) conducted this national survey on adolescents to provide adolescent population-based data and comprehensive information. In addition, the survey provides current information on the COVID-19 pandemic's impact on adolescents.

METHODOLOGY

Study design

The National School-Based Health Survey 2022 (NHMS 2022) is a national cross-sectional survey that recruited secondary school students in Malaysia. Secondary school students are adolescents aged 13 to 17 who enrolled in Form 1 through Form 5 of their school. As a sampling frame, the national secondary schools registered in 2021 are utilised which included government and private schools under the purview of MOE as well as schools under the Ministry of Rural and Regional Development (MARA). According to the frame, there are 2798 secondary schools in Malaysia (Table 1).

Sample size calculation

The sample size is calculated based on the objectives of each module by using a single proportion formula based on the prevalence of the previous adolescent health survey (NHMS 2017) findings.¹³

$$n_0 = \frac{z_{\alpha/2} p(1-p)}{e^2}$$

To achieve an optimal sample size and to ensure sufficient precision on the survey health conditions, the design effect of two and non-response rates of 20% are taken into account.^{14,15} Thus, 36,000 adolescents are required for national-level analysis and 2,250 adolescents for state-level analysis (Table 1).

Table 1 Distribution of secondary schools and students sampled in Malaysia by state, NHMS 2022

State	Total number of schools	Number of schools sampled	Number of students sampled
Johor	328	16	2250
Kedah	219	16	2250
Kelantan	189	16	2250
Melaka	88	16	2250
N. Sembilan	142	16	2250

Methodology of adolescent health survey, Malaysia 2022

Pahang	211	16	2250
Pulau Pinang	148	16	2250
Perak	276	16	2250
Perlis	33	16	2250
Selangor	380	16	2250
Terengganu	166	16	2250
Sabah	245	16	2250
Sarawak	214	16	2250
WP Kuala Lumpur	135	16	2250
WP Labuan	12	8	2250
WP Putrajaya	12	8	2250
Total	2798	240	36,000

Sampling design

The nation is stratified according to 16 states and federal territories. Two phases of a multistage stratified cluster sampling approach are utilised. The first phase involved the selection of secondary schools from all eligible Malaysian schools (N = 2798). Then, 240 schools are chosen at random with a probability proportional to enrollment in forms 1, 2, 3, 4, and 5. In each state, 16 schools are randomly selected, except for two smaller federal territories like Labuan and Putrajaya, with 8 schools each. In the second phase of selection, which is also the secondary sampling unit, classrooms are chosen. The sampling frame covers all classes in forms 1, 2, 3, 4, and 5. Each school's classes are chosen using systematic probability sampling. Based on sampling schools and student enrollment, the number of classes at each school is determined. The number of classes chosen by each school ranged from 3 to 9 units. All students in the selected classes are invited to participate in the survey.

Inclusion and exclusion criteria

The survey included all government and private schools under the jurisdiction of the MOE and MARA. However, special education schools and those illiterate or unable to provide consent or assent to participate are excluded from the survey.

Instrument

For data collection, a validated self-administered questionnaire used in NHMS 2012 and NHMS 2017 is utilized and has been mentioned elsewhere.^{12,13} To ensure the quality of the translation, the questionnaires are translated into Malay, Chinese, and Tamil and then back-translated into English. The questionnaires are then field-tested before being revised and finalized for the survey. The NHMS 2022 Questionnaire Review Committee approved the final version of the questionnaire. The questionnaire has ten modules which included alcohol use, dietary behaviours, drug use, hygiene, mental health problems (including depression), physical activity, protective factors, risky sexual behaviour, tobacco use, and violence and unintentional injury. The NHMS 2022 survey uses a standardized questionnaire comprising core

questionnaire modules which are required for all countries participating in the adolescent survey. In addition, a few country-specific questions are added to the questionnaire to meet the requirements of the adolescent health programmes in the country. In terms of anthropometry measurements, the body weight is measured using a TANITA HD-319 digital weighing scale with a 0.1 kg precision. While height is measured using Seca Stadiometer 213 to the nearest 0.1 cm. Each measurement is taken twice, and the average is recorded as the final reading. On average, this self-administered questionnaire took approximately 45 minutes to be completed.

Mode of data collection

This cross-sectional adolescent health survey is conducted from June to July 2022 involving students in Form 1, 2, 3, 4, and 5 from all states in Malaysia. There are 34 data collection teams: two for each state in Peninsular Malaysia (including Labuan), and three for Sabah and Sarawak during the data collection period of four weeks. Each state is assigned a field supervisor to oversee the survey activities. Prior to data collection, a one-week training workshop is conducted for the field supervisor and 133 newly appointed short-term data collectors. The training aimed to familiarize the data collectors with the questionnaires and developed good teamwork. They received information on the self-administered questionnaire modules throughout the training and then participated in a simulated role-play in the classroom. Furthermore, the issues and logistic problems from the two previous similar studies in 2012 and 2017 are also highlighted. After completing the training, the assigned field supervisor and data collection teams travelled to their respective survey sites to conduct the survey at the selected schools. The students answered the questionnaires on the optical mark recognition answer sheet (OMR). After that, the team leader checked the OMR sheets before each bundle of survey responses is couriered to the Institute for Public Health (IPH).

Quality control

Quality control of the whole survey is done at various stages. During the planning stage, quality is

ensured through correct survey design, validated questionnaires and tools, manuals, and standardized training. In the field, the team leader and field supervisor checked the quality of the data collected. While members of the Central Coordinating Team (CCT) at IPH monitored data collection progress and conducted data quality control every week. In addition, all OMR forms are double-checked by the data processing team to ensure that the answers are valid before the data are used for analysis.

Data management and analysis

All data processing activities are centralised at IPH. All OMR answer sheets are processed using a scanner, and the data captured from the scanning process is checked and verified before the data are used for analysis. Then, the data are examined for quality control and further cleaned. The distributions and frequencies are examined. Outliers are determined based on the distribution as a whole as

well as the values that are considered acceptable for the variables. Finally, a complex sample analysis process is applied.

RESULT

A total of 239 out of 240 randomly selected schools with 33,523 adolescents are involved in this study (overall response rate is 89.0%). The distribution of state, sex, and form among adolescents is almost equal. Compared to both previous adolescent health surveys using the same methodology and approaches. The first adolescent health survey conducted in 2012 (NHMS 2012) revealed that the overall response rate is 88.8% based on the 25,507 adolescents from 234 schools participating in the survey. While, in the second adolescent health survey (NHMS 2017), a total of 27,497 adolescents from 212 schools participated in the survey with overall response rates of 89.2% (Table 2).

Table 2 Response rate at student level, by state, NHMS 2022, NHMS 2017 and NHMS 2012

State	NHMS 2022				NHMS 2017				NHMS 2012			
	Selected schools	Eligible students	Completed OMR forms	Response Rate (%)	Selected schools	Eligible students	Completed OMR forms	Response Rate (%)	Selected schools	Eligible students	Completed OMR form	Response Rate (%)
Johor	16	2336	2005	85.8	14	1,915	1,731	90.4	17	1978	1746	88.2
Kedah	16	2312	2172	93.9	14	1,930	1,691	87.6	17	1943	1665	85.6
Kelantan	16	2368	2138	90.2	14	1,900	1,631	85.8	17	1663	1515	91.1
Melaka	16	2373	1986	83.6	14	1,986	1,872	94.3	14	2016	1810	89.7
N. Sembilan	16	2422	2210	91.2	14	1,930	1,718	89.0	14	1879	1546	82.2
Pahang	16	2382	2171	91.1	14	1,948	1,784	91.6	17	1705	1585	92.9
Pulau Pinang	16	2300	2044	88.8	14	1,974	1,749	88.6	17	1995	1783	89.3
Perak	16	2384	2126	89.1	14	1,931	1,754	90.8	17	2135	1877	87.9
Perlis	16	2160	2004	92.7	14	1,992	1,667	83.7	14	1807	1588	87.8
Selangor	16	2366	2048	86.5	14	1,840	1,671	90.8	17	1917	1627	84.9
Terengganu	16	2314	2219	95.8	14	1,880	1,669	88.8	17	1850	1665	90.0
Sabah	16	2342	2086	89.0	14	1,965	1,686	85.8	17	1917	1708	89.0
Sarawak	16	2442	2189	89.6	14	1,919	1,779	92.7	17	1791	1662	92.7
WP Kuala Lumpur	16	2338	2114	90.4	14	1,937	1,721	88.8	14	2060	1792	86.9
WP Labuan	8	2267	2033	89.6	8	1,907	1,712	89.8	-	-	-	-
WP Putrajaya	8	2373	1978	83.3	8	1,869	1,662	88.9	8	2076	1938	93.3
Total	240	37,479	33,523	89.0	212	30,823	27,497	89.2	234	28,732	25507	88.8

DISCUSSION

The 2022 National Health and Morbidity Survey (NHMS): Adolescent Health is implemented by the Institute for Public Health (IPH) with cooperation from the Ministry of Education (MOE) that used the Global School-based Student Health Survey (GSHS), which are internationally standardized research instruments to obtain data on health behaviours and protective factors among adolescent in the country.⁶ It is the third comprehensive nationwide cross-sectional survey that used the internationally standardised research tools developed by the WHO, United Nations Programme

on HIV/AIDS (UNAIDS), United Nations Educational, Scientific and Cultural Organisation (UNESCO), United Nations International Children's Emergency Fund (UNICEF), and with technical support from the United States Centres for Disease Control and Prevention (CDC).⁸

In order to get a representative sample of the country's adolescent population for this nationwide survey, samples from public and private schools that are governed by the MOE and MARA are deemed to be the most reliable. Although, the survey didn't include special education schools and those illiterate or unable to provide consent/assent.

However, these exclusions wouldn't have a big effect on the results because the proportion of these schools and students is so small. Furthermore, every necessary step, including survey design, questionnaire validation, data collection method, quality control, and data management has been performed to ensure accurate and high-quality data. This current survey is conducted by IPH using the hardcopy OMR answer sheet approach. IPH also used this method for data collection in both previous national adolescent surveys (NHMS 2012, NHMS 2017). OMR answer sheet used in the survey improved the quality of data acquired because data entry is performed using a scanner and it is beneficial to avoid the time-consuming and resource-intensive data entry process.¹⁶ Besides providing current data and information on the health status of the adolescent, this repeated survey enabled the related agencies to compare the findings of the previous NHMS 2012 and NHMS 2017 on the trends of important modules such as; 1) alcohol usage, 2) dietary behaviours, 3) drug usage, 4) hygiene, 5) mental health problems, 6) physical activity, 7) protective factors, 8) risky sexual behaviours, 9) tobacco usage, 10) violence and unintentional injury.

CONCLUSION

The implementation of NHMS 2022 has employed an acceptable methodology for a survey of the adolescent population. This reliable data provides national estimates for alcohol usage, dietary behaviours, drug usage, hygiene, mental health problems, physical activity, protective factors, risky sexual behaviours, tobacco usage and violence, and unintentional injury. The results of this survey allow the relevant authorities to further improve the health status of adolescents in Malaysia.

Funding

Research is funded by the Ministry of Health Malaysia

Data availability

The data used to support the findings of this survey are available from the corresponding author upon request.

Ethics approval

Ethics approval is obtained from the Medical and Research Ethics Committee (MREC), Ministry of Health, Malaysia (NMRR-21-157-58261). The Ministry of Education and the school principals granted permission for the survey to be undertaken at their schools. Only consented adolescents with consented parents are included and their participation in the survey is voluntary. There is no replacement for the refusal. The OMR and consent/assent forms are treated as strictly confidential and stored in secure filing cabinets at the IPH according to the MOH data

storage regulations.

Author disclosures

The authors declare that they have no conflicting interests.

ACKNOWLEDGEMENT

We would like to thank the Director General of Health Malaysia for his support of this article. We would also like to thank the Director General of Education of the Malaysian Ministry of Education for the permission to conduct the survey.

REFERENCES

1. Sawyer SM, Afifi RA, Bearinger LH, Blakemore SJ, Dick B, Ezech AC, et al. Adolescence: A foundation for future health. *Lancet* 2012;379:1630e40.
2. Guthold R, Moller AB, Azzopardi P, Ba MG, Fagan L, Baltag V, et al. The Global Action for Measurement of Adolescent Health (GAMA) Initiative-Rethinking Adolescent Metrics. *J Adolesc Health*. 2019 Jun;64(6):697-699.
3. Long KQ, Ngoc-Anh HT, Phuong NH, Tuyet-Hanh TT, Park K, Takeuchi M, et al. Clustering Lifestyle Risk Behaviours among Vietnamese Adolescents and Roles of School: A Bayesian Multilevel Analysis of Global School-Based Student Health Study 2019. *The Lancet Regional Health - Western Pacific*. 2021;15:100225.
4. Sheehan P, Sweeny K, Rasmussen B, Wils A, Friedman H, Mahon J, et al. Building the foundations for sustainable development: A case for global investment in the capabilities of adolescents. *Lancet* 2017;390:1792e806.
5. World Health Organization (WHO). Global Accelerated Action for the Health of Adolescents (AA-HA!): guidance to support country implementation. Summary. Geneva: World Health Organization; 2017 (WHO/FWC/MCA/17.05).
6. World Health Organization (WHO). Global school-based student health survey [Internet]. [cited 2023 Jan 12]; Available from: <https://www.who.int/teams/noncommunicable-diseases/surveillance/systems-tools/global-school-based-student-health-survey>
7. Centers for Disease Control and Prevention. Adolescent and school health [Internet]. 2018 [cited 2022 Nov 25]; Available from: <http://www.cdc.gov/GSHS>.
8. World Health Organization (WHO). Noncommunicable diseases and their risk factors: Global school-based student health survey (GSHS) [Internet]. 2021 [cited 2023

- Jan 10); Available from: <https://www.who.int/ncds/surveillance/gshs/en/>.
9. Bisis T, Townsend N, Huda M, Maravilla J, Begum T, Pervin S, et al. Prevalence of multiple non-communicable diseases risk factors among adolescents in 140 countries: A population-based study. *Clin Med.* 2022;52: 101591.
 10. United Nations Children's Fund (UNICEF). Situation analysis of adolescents in Malaysia [Internet]. 2020 [cited 2022 Dis 22]; Available from: <https://www.unicef.org/malaysia/media/1521/file/Situation%20Analysis%20of%20Adolescents%20in%20Malaysia.pdf>.
 11. Seffetullah K, Shahabuddin H, Hairul Nizam I. Malaysian adolescent adolescents' needs for enhancing thinking skills, counteracting risk factors, and demonstrating academic resilience. *Int Adolesc Youth.* 2015;20:32-47.
 12. Institute for Public Health (IPH) 2012. National Health and Morbidity Survey (NHMS) 2012: Adolescent Health Survey 2012, Malaysia.
 13. Institute for Public Health (IPH) 2017. National Health and Morbidity Survey (NHMS) 2017: Adolescent Health Survey 2017, Malaysia.
 14. Naing L, Winn T, Rusli BN. Practical issues in calculating the sample size for prevalence studies. *ArchOrofac Sci.* 2006;1:9-14.
 15. Lwanga SK, Lemeshow S. Sample size determination in health studies: A practical manual. Geneva: World Health Organization; 1991.
 16. Modesti PA, Massetti L, Bamoshmoosh M, Baldereschi M, Cambi GE, Rapi S. The impact of fine-tuning of optical recognition system on database reliability. *Comput Biol Med.* 2012;42(7):778–783.