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Prevalence of Abnormal Health Check-Up Status in Bangkok Metropolitan Administration Officers

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ABSTRACT

Objective: Non-communicable diseases (NCDs) are a growing concern among urban workers. This study aimed to determine the prevalence and associated factors of abnormal health screening results among Bangkok Metropolitan Administration (BMA) employees.

Materials and Methods: A retrospective cross-sectional study was conducted among 3,652 BMA employees who underwent a health screening at Charoenkrung Pracharak Hospital in 2024. Data on laboratory results, chest X-rays, and behavioral risk factors were analyzed using multivariable logistic regression.

Results: The most common abnormalities were obesity (61.8%), hyperuricemia (32.9%), anemia (22.8%), and elevated liver enzymes (12.2%). Diabetes and hypertension were found in 8.0% and 11.3%, respectively. Chest X-ray findings included old pulmonary tuberculosis (4.9%) and active tuberculosis (1.5%). Male gender and obesity were significantly associated with hypertension (odds ratio (OR) = 2.08 and 4.75) and elevated liver enzymes (OR = 4.29 and 2.59).

Conclusion: A high burden of modifiable metabolic risk was observed among BMA employees, reflecting the health impact of urbanized lifestyles. These findings emphasize the importance of urban health strategies tailored to the metropolitan workforce, including routine screenings, early interventions, and city-based wellness initiatives that integrate lifestyle medicine into workplace settings to prevent the long-term burden of NCDs.

Keywords: health check-up, non-communicable diseases, prevalence, urban health

INTRODUCTION

The rising prevalence of non-communicable diseases (NCDs) poses a major challenge to health systems worldwide. These chronic conditions including diabetes, hypertension, dyslipidemia, and obesity account for a significant share of the global disease burden,[1] contribute to considerable losses in Disability-Adjusted Life Years (DALYs),[1] and impose increasing economic and societal costs. Routine health check-ups play a role in prevention by identifying and controlling risks, and detecting early stage chronic diseases.[2] These assessments are particularly important for urban government employees, who often face sedentary work, psychological stress, and irregular schedules that heighten health risks.[3] In Thailand, recent national surveys show high levels of NCD risk behaviors: unhealthy diets (56.9%), overweight/obesity (50.0%), physical inactivity (42.7%), alcohol consumption (29.7%), and smoking (16.6%).[4] Socioeconomic disparities also influence health behaviors, with wealthier individuals consuming more alcohol and unhealthy foods, while smoking is more prevalent in lower-income groups.[4]

The Bangkok Metropolitan Administration (BMA) workforce plays a central role in maintaining the urban infrastructure and delivering public services, making their health status crucial for the efficiency of city governance.[5] As Thailand becomes an aging society, NCD-related disability and healthcare demands are expected to increase.[6] In response, BMA launched the "Healthy City for All" policy, including urban health zoning and citywide health screening initiatives. BMA staff, due to their urban lifestyle and work stress, face elevated risks for both non-communicable[7] and communicable diseases, such as tuberculosis.[8] Thailand mandates annual health checkups for high-risk employees, including civil servants, aligning with national labor regulations. According to national data, diabetes affects 8.9%, hypertension 24.7%, and obesity 37.5% of the population.[9] Poor dietary habits[4] and physical inactivity remain key contributors.[10] Charoenkrung Pracharak Hospital has taken the lead in annual health screenings for BMA workers across various departments to support early detection and public health resilience in Bangkok.

MATERIALS AND METHODS

This descriptive study aimed to assess the prevalence of abnormal health screening results among BMA civil servants and employees. Participants included those who underwent annual health checkups at Charoenkrung Pracharak Hospital between February 1 and May 31, 2024. Data were retrospectively collected from medical records and case report forms, with all personal identifiers anonymized for confidentiality. Independent variables included age, sex, body mass index (BMI), alcohol consumption, smoking, and job characteristics. Dependent variables were abnormal screening outcomes including NCDs (hypertension, diabetes, and dyslipidemia), obesity (classified as: normal BMI 18.5-22.99, overweight 23-24.99, obesity class I 25-29.99, class II 30-34.99, and morbid obesity ≥ 35), and chest X-ray abnormalities. Clinical assessments were conducted by licensed physicians. Laboratory tests were analyzed in certified labs, and chest X-rays interpreted by radiologists. Definitions followed national and World Health Organization diagnostic criteria: hypertension was defined as systolic Blood Pressure (BP) ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg; diabetes as fasting blood sugar (FBS) ≥ 126 mg/dL; hyperlipidemia as total cholesterol > 200 mg/dL or triglycerides > 150 mg/dL; anemia as hemoglobin <13.0 g/dL in males and < 12 g/dL in females;[11] hyperuricemia as a serum uric level ≥ 7 mg/dL in males and ≥ 6 mg/dL in female;[12] Elevated liver enzymes were defines as either aspartate aminotransferase or alanine transaminase levels exceeding the upper limit of normal set by the laboratory;[13] the estimated glomerular filtration rate (eGFR) was calculated using the THAI eGFR equation, which has been specifically validated for use in Thai population.[14] Descriptive statistics were used for quantitative variables and frequencies for categorical data. Associations between behavioral factors and outcomes were tested using multivariable logistic regression, with significance set at $p < 0.05$. Statistical analysis was performed using Statistical Package for the Social Sciences version 26. The study received ethics approval from the BMA's Ethics Review Committee (ethics certificate No. 99, Project ID: N003hn/68_EXP).

RESULTS

A total of 3,652 BMA employees were screened. The average age was 41.7 years, with 71.6% aged ≥ 35. Females made up 57.3%. Over 61% of employees had a BMI in the overweight or obese range. Among respondents, 48.9% reported alcohol use and 28.7% had a history of smoking **(Table 1)**.

Table 1 Demographics and Lifestyle Characteristics

Characteristics	Total (n = 3,652)
Age (years); mean ± SD	41.7 ± 10.5
Age > 35 years; n (%)	2,616 (71.6)
Gender; n (%)	
Male	1,559 (42.7)
Female	2,093 (57.3)
BMI (kg/m^2); mean ± SD (of 3,638 respondents)	25.1 ± 5.1
Overweight/obese; n (%) (of 3,638 respondents)	2,249 (61.8)
Alcohol use; n (%) (of 1,757 respondents)	860 (48.9)
Smoking history; n(%) (of 1,762 respondents)	506 (28.7)

Abbreviations: BMI, body mass index; kg/m^2, kilograms per square meter; n, number; SD, standard deviation

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Overall, 76.6% had at least 1 abnormal finding. Diabetes was found in 8.0%, hypertension in 11.3%, and chronic kidney disease (CKD) in 1.7%. Liver enzyme elevation occurred in 12.2%, while hyperuricemia affected 32.9%. Chest X-ray abnormalities included old tuberculosis (TB) (4.9%) and active TB (1.5%) **(Table 2)**.

Risk factor analysis showed a significant association between behavioral factors and NCDs **(Table 3)**. Diabetes: obesity (OR = 2.66, $p = 0.004$) was significantly associated. Male sex, alcohol, and smoking history were not statistically significant. Hypertension: significantly related to male sex (OR = 2.08, $p < 0.001$), age ≥ 35 years (OR = 2.81, $p < 0.001$), alcohol use (OR = 1.38, $p = 0.037$), and obesity (OR = 4.75, $p < 0.001$). Smoking was not significant. Liver enzyme elevation: significantly associated with male sex (OR = 4.29, $p < 0.001$) and obesity (OR = 4.29, $p = 0.003$). Alcohol and smoking were not significant. Abnormal chest X-ray: Age ≥ 35 (OR = 1.85, $p = 0.009$) was associated with lung abnormalities. Male sex, Alcohol, smoking, and obesity were not statistically significant predictors.

Table 2 Health Screening Results for BMA Employees

	Total (n)	Normal n (%)	Abnormal n (%)
Fasting blood sugar	2,604	1,676 (64.4)	928 (35.6)
Diabetes (FBS ≥ 126 mg/dL)			209 (8)
Impaired fasting glucose (FBS = 100-125 mg/dL)			719 (27.6)
Hypercholesterolemia (≥ 200 mg/dL)	2,604	2,210 (84.9)	394 (15.1)
Hypertriglyceridemia (≥ 150 mg/dL)	2,605	2,376 (91.2)	229 (8.8)
Hypertension	3,611	3,204 (88.7)	407 (11.3)
Hyperuricemia	1,475	989 (67.1)	486 (32.9)
Elevated liver enzymes	2,604	2,287 (87.8)	318 (12.2)
Chronic kidney disease (eGFR)	2,605	2,561 (98.3)	44 (1.7)
CKD stage 1			10 (0.4)
CKD stage 2			6 (0.2)
CKD stage 3a			22 (0.8)
CKD stage 3b			6 (0.2)
CKD stage 4			2 (0.1)
Pyuria + positive nitrite (suggestive of urinary tract infection)	1,733	1,729 (99.8)	4 (0.2)
Anemia (< 13.0 g/dL for males and < 12 g/dL for females)	3,639	2,811 (77.2)	828 (22.8)
Positive fecal occult blood			10 (0.3)
Chest X-ray	1,839	1,628 (88.5)	211 (11.5)
Old TB			91 (4.9)
Active TB			28 (1.5)
Suspected lung mass			20 (1.2)
Cardiomegaly			10 (0.5)
Aortic calcification			9 (0.5)
Others (ventriculoperitoneal shunt, catheter devices)			3 (0.2)

Abbreviations: ALT, alanine transaminase; AST, aspartate aminotransferase; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; FBS, fasting blood sugar; g/dL, grams per deciliter; mg/dL, milligrams per deciliter; n, number; TB, tuberculosis

Table 3 Summary of the Factors Associated with Abnormal Health Outcomes

Factor	DM Adjusted OR (95%CI), P-value	HT Adjusted OR (95%CI), P-value	Elevated AST/ALT Adjusted OR (95%CI), P-value	Abnormal CXR Adjusted OR (95%CI), P-value
Male gender	1.42 (0.90, 2.24), p = 0.131	2.08 (1.48, 2.93), p = < 0.001*	4.29 (2.70, 6.09), p = < 0.001*	1.49 (0.98, 2.26), p = 0.063
Age ≥ 35 years	No data	2.81 (1.73, 4.59), p = < 0.001*	No data	1.85 (1.17, 2.92), p = 0.009*
Alcohol use	1.32 (0.87, 1.99), p = 0.190	1.38 (1.02, 1.86), p = 0.037*	1.18 (0.84, 1.65), p = 0.334	1.17 (0.79, 1.75), p = 0.426
Smoking	0.81 (0.53, 1.26), p = 0.350	0.79 (0.57, 1.08), p = 0.137	1.05 (0.75, 1.46), p = 0.782	0.73 (0.47, 1.13), p = 0.161
Obesity (BMI ≥ 23)	2.66 (1.37, 5.17), p = 0.004*	4.75 (2.91, 7.75), p = < 0.001*	2.59 (1.39, 4.82), p = 0.003*	No data

Abbreviations: ALT, alanine transaminase; AST, aspartate aminotransferase; CI, confidence interval; CXR, chest X-ray; DM, diabetes mellitus; HT, hypertension; OR, odds ratio

Adjusted OR by male gender, Age ≥ 35 years, alcohol use, smoking and obesity (BMI ≥ 23)

* $p < 0.05$

Discussion

This study revealed a high prevalence of metabolic risk factors among BMA employees, with 76.6% exhibiting at least one abnormal health parameter. The most frequent findings included obesity, hyperuricemia, liver enzyme elevation, and anemia. These results are consistent with national trends, where nearly half of the adult population is overweight or obese, reflecting lifestyle and occupational patterns that promote physical inactivity[10] and poor dietary behaviors.[4]

Obesity, found in 61.8% of participants, is a well-established risk factor for diabetes and hypertension. In this cohort, obesity was significantly associated with diabetes (OR 2.66) and hypertension (OR 4.75), consistent with previous evidence linking central adiposity to insulin resistance[15] and hemodynamic dysregulation.[16] Male gender emerged as a significant predictor of hypertension, aligning with global and population-based studies demonstrating that men tend to develop NCD-related risk factors such as elevated blood pressure and obesity at younger age.[1,17] The prevalence of diabetes (8.0%) aligns with the national estimates(7.5-8.9%).[9,18] The prevalence of prediabetes (27.6%) was higher than national survey (10.6%).[18] However, the hypertension prevalence in this study (11.3%) was lower than the national data (25-30%),[19] likely reflecting a healthy-worker effect or the influence of single-occasion blood pressure measurements in less stressful screening environments. Nevertheless, multivariable logistic regression confirmed that hypertension was independently associated with male sex, age ≥ 35 years, alcohol consumption, and obesity. These associations are well explained by the underlying pathophysiology of sympathetic activation, renin–angiotensin–aldosterone system dysregulation, and vascular aging, mechanisms widely documented in prior epidemiologic and physiologic studies.[16,19] Interestingly, CKD prevalence was relatively low (1.7%) compared to previous Thai population studies, which reported rates up to 17.5%.[20] The lower detection may stem from one-time eGFR testing and the relatively healthy working population. The high prevalence of obesity and other NCDs raises concern for future renal burden, particularly as aging progresses.

Liver enzyme elevation (12.2%) was significantly associated with male gender and obesity, supporting the known role of metabolic and behavioral factors in liver dysfunction.[21-23] Notably, age was not a significant predictor, likely due to the narrow age distribution in this cohort. These findings mirror data from military[21] and diabetic populations,[22] where non-alcoholic fatty liver disease and alcohol-related liver damage are common.[21-23] Hyperuricemia affected 32.9% of participants, which is markedly higher than community-based reports in Thailand.[24] This may reflect urban dietary habits, male predominance, and coexisting metabolic risk factors, such as obesity and alcohol use, which alter uric acid metabolism.[25] Hyperuricemia is increasingly recognized as a contributor to metabolic syndrome, cardiovascular disease, and CKD progression.[26]

The prevalence of anemia in our cohort was 22.8%. This finding is consistent with recent reports in Thailand suggesting a significant health concern among the metropolitan workforce. This finding, combined with the fact that all cases were microcytic, emphasizes the need for screening inherited hemoglobin disorders and iron deficiency in the Thai population.[27] Iron deficiency anemia (IDA) must remain a primary consideration. This distinction is crucial, as IDA can be caused by chronic occult blood loss from colorectal cancer.[28] A finding supported by the 0.3% of our participants who tested positive for fecal occult blood, highlighting the clinical importance of differentiating these causes for appropriate management. The chest X-ray findings revealed old or active TB in 6.4% of screened individuals. While Bangkok remains endemic for TB, these findings emphasize the utility of routine imaging even in asymptomatic populations. Older age was significantly associated with radiologic abnormalities, aligning with TB epidemiology and cumulative exposure risk.[8] Incidental findings such as cardiomegaly and vascular calcification also hint at subclinical cardiovascular disease, further supporting the integration of imaging in comprehensive screening.

Collectively, this is the inaugural report describing screening outcomes among BMA workers. The findings reflect a high burden of modifiable NCD risk factors in an urban workforce. The associations observed support existing evidence and underscore the need for continued investment in health promotion, routine surveillance, and targeted lifestyle interventions. One limitation of this study is that the health screening was conducted under a government welfare program, with screening protocols determined primarily by age groups rather than occupational risk. Nonetheless, the scope of the screening remains broadly relevant, as it captures key health risks prevalent among urbanized populations.

CONCLUSION

This study identified a high prevalence of modifiable NCD risk factors among employees of the BMA. Obesity, elevated liver enzymes, hyperuricemia, and anemia were common, with male gender and obesity emerging as consistent predictors of multiple health abnormalities. Although the prevalence of some conditions, such as hypertension and CKD, appeared lower than national averages, the widespread presence of early metabolic disturbances signals a substantial future burden if unaddressed. These findings highlight the pressing need for urban-specific disease prevention strategies. In densely populated cities like Bangkok, civil servants often face unique health challenges related to sedentary work, limited green space, psychosocial stress, and dietary patterns shaped by the urban environment. Integrating routine health screenings with proactive lifestyle interventions, including nutrition education, workplace wellness programs, mental health support, and physical activity promotion, can play a pivotal role in reversing these trends. Preventive efforts tailored to urban contexts are essential for reducing the burden of NCDs and preserving the health, productivity, and resilience of the metropolitan workforce.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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Author Contributions

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Formal analysis: N.C., W.N.
Funding acquisition: N.C., W.N.
Investigation: N.C.
Methodology: N.C., W.N.
Project administration: N.C., W.N.
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Supervision: N.C., W.N.
Validation: N.C.
Visualization: -
Writing – original draft preparation: N.C., W.N., P.C.
Writing – review & editing: N.C., W.N., P.C.

Data Availability Statement

Data supporting the findings of this study are available upon reasonable request from the corresponding author and subject to ethical approval.

REFERENCES

1. GBD 2019 Risk Factors Collaborators. Global burden of 87 risk factors in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet 2020;396(10258):1223-49. doi: 10.1016/S0140-6736(20)307522.
2. Liss DT, Uchida T, Wilkes CL, Radakrishnan A, Linder JA. General health checks in adult primary care: a review. JAMA 2021;325(22):2294-306. doi: 10.1001/jama.2021.6524.
3. Janwantanakul P, Pensri P, Jiamjarasrangsri V, Sinsongsook T. Prevalence of self-reported musculoskeletal symptoms among office workers. Occup Med (Lond) 2008;58(6):436-8. doi: 10.1093/occmed/kqn072.
4. Vichitkunakorn P, Bunyanukul W, Apiwan K, Tanasanchonnakul D, Sittisombut M. Prevalence of non-communicable disease risk factors and their association with economic status: findings from the 2021 health behaviour of population survey in Thailand. Glob Health Action 2025;18(1):2485689. doi: 10.1080/16549716.2025.2485689.
5. Mesa-Vieira C, Gonzalez-Jaramillo N, Díaz-Ríos C, Pano O, Meyer S, Menassa M, et al. Urban governance, multisectoral action, and civic engagement for population health, wellbeing, and equity in urban settings: a systematic review. Int J Public Health 2023;68:1605772. doi: 10.3389/ijph.2023.1605772.
6. Potempa K, Rajataramya B, Singha-Dong N, Furspan P, Kahle E, Stephenson R. Thailand's challenges of achieving health equity in the era of non-communicable disease. Pac Rim Int J Nurs Res 2022;26(2):187-97.
7. World Health Organization. Urban health and NCDs in Thailand [internet]. 2021 [cited 2025 Nov 01]. Available from: https://www.who.int/thailand/our-work/NCDs
8. World Health Organization. Global tuberculosis report 2023 [internet]. 2023 [cited 2025 Nov 01]. Available from: https://www.who.int/teams/global-programme-on-tuberculosis-and-lung-health/tb-reports/global-tuberculosis-report-2023
9. Ministry of Public Health, Thailand. National NCD prevention and control plan 2017-2021. Nonthaburi: Ministry of Public Health; 2017. [cited 2025 Jun 8]. Available from: https://www.iccp-portal.org/sites/default/files/plans/Thailand%20National%20NCD%20plan%202017-2021.pdf
10. Topothai T, Tangcharoensathien V, Edney SM, Suphanchaimat R, Lekagul A, Waleewong O, et al. Patterns and correlates of physical activity and sedentary behavior among Bangkok residents: a cross-sectional study. PLoS One 2023;18(10):e0292222. doi: 10.1371/journal.pone.0292222.
11. Cappellini MD, Motta I. Anemia in clinical practice-definition and classification: does hemoglobin change with aging? Semin Hematol 2015;52(4):261-9. doi: 10.1053/j.seminhematol.2015.07.006.
12. The American College of Rheumatology (ACR). Gout Guideline [internet]. 2020 [cited 2025 Oct 5]. Available from: https://rheumatology.org/gout-guideline#2020-gout-guideline
13. Kwo PY, Cohen SM, Lim JK. ACG clinical guideline: evaluation of abnormal liver chemistries. Am J Gastroenterol 2017;112(1):18-35. doi: 10.1038/ajg.2016.517.
14. The Nephrology Society of Thailand. Clinical practice recommendation for the evaluation and management of chronic kidney disease in adults 2022 (revised edition) [internet]. 2022 [cited 2025 Oct 18]. Available from: https://www.nephrothai.org/wp-content/uploads/2023/03/CKD-guideline-2565-revised-edition.pdf
15. Kahn SE, Hull RL, Utzschneider KM. Mechanisms linking obesity to insulin resistance and type 2 diabetes. Nature 2006;444(7121):840-6. doi: 10.1038/nature05482.
16. Franklin SS, Gustin W 4th, Wong ND, Larson MG, Weber MA, Kannel WB, et al. Hemodynamic patterns of age-related changes in blood pressure: the Framingham Heart Study. Circulation 1997;96(1):308-15. doi: 10.1161/01.cir.96.1.308.
17. Roerecke M, Tobe SW, Kaczorowski J, Bacon SL, Vafaei A, Hasan OSM, et al. Sex-specific associations between alcohol consumption and incidence of hypertension: a systematic review and meta-analysis of cohort studies. J Am Heart Assoc 2018;7(13):e008202. doi: 10.1161/JAHA.117.008202.
18. Aekplakorn W, Chariyalertsak S, Kessomboon P, Sangthong R, Inthawong R, Putwattana P, et al. Prevalence and management of diabetes and metabolic risk factors in Thai adults: the Thai National Health Examination survey IV, 2009. Diabetes Care 2011;34(9):1980-5. doi: 10.2337/dc11-0099.
19. Sakboonyarat B, Poovieng J, Srisawat P, Hatthachote P, Mungthin M, Rangsin R, et al. Prevalence, awareness, and control of hypertension and associated factors among Royal Thai Army personnel in Thailand from 2017 to 2021. Sci Rep 2023;13(1): 6946. doi: 10.1038/s41598-023-34023-z.
20. Ingsathit A, Thakkinstian A, Chaiprasert A, Sangthawan P, Gojaseni P, Kiattisunthorn K, et al. Prevalence and risk factors of chronic kidney disease in the Thai adult population: Thai SEEK study. Nephrol Dial Transplant 2010;25(5):1567-75. doi: 10.1093/ndt/gfp669.
21. Sakboonyarat B, Poovieng J, Lertsakulbunlue S, Jongcherdchootrakul K, Srisawat P, Mungthin M. Association between raised blood pressure and elevated serum liver enzymes among active-duty Royal Thai Army personnel. BMC Cardiovasc Disord 2023;23(1):143. doi: 10.1186/s12872-023-03181-5.
22. Teshome G, Ambachew S, Fasil A, Abebe M. Prevalence of liver function test abnormality and associated factors in type 2 diabetes mellitus: a comparative cross-sectional study. EJIFCC 2019;30(3):303-16.
23. Lee DH, Ha MH, Christiani DC. Body weight, alcohol consumption and liver enzyme activity--a 4-year follow-up study. Int J Epidemiol 2001;30(4):766-70. doi: 10.1093/ije/30.4.766.
24. Lohsoonthorn V, Dhanamun B, Williams MA. Prevalence of hyperuricemia and its relationship with metabolic syndrome

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in Thai adults receiving annual health exams. Arch Med Res 2006;37(7):883-9. doi: 10.1016/j.arcmed.2006.03.008.

25. Aihemaitijiang S, Zhang Y, Zhang L, Yang J, Ye C, Halimulati M, et al. The association between purine-rich food intake and hyperuricemia: a cross-sectional study in Chinese adult residents. Nutrients 2020;12(12):3835. doi: 10.3390/nu12123835.
26. Kuwabara M. Hyperuricemia, cardiovascular disease, and hypertension. Pulse (Basel) 2016;3(3-4):242-52. doi: 10.1159/000443769.
27. Pyae TW, Sanchaisuriya K, Athikamanon S, Sanchaisuriya P, Srivorakun H, Chaibunruang A, et al. Anemia in an ethnic minority group in lower northern Thailand: a community-based study investigating the prevalence in relation to inherited hemoglobin disorders and iron deficiency. PLoS One 2023;18(6):e0287527. doi: 10.1371/journal.pone.0287527.
28. Pham J, Laven-Law G, Winter JM, Wassie MM, Cock C, Symonds EL. The diagnostic accuracy of a fecal immunochemical test in detecting colorectal cancer and advanced precancerous colorectal neoplasia in patients with iron deficiency: a protocol for systematic review and meta-analysis. Gastroenterol Res Pract 2023;2023:5982580. doi: 10.1155/2023/5982580.