Review Article

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Prevalence of Noncommunicable Diseases and Social Determinants of Health in Thailand: Insights from Public Datasets

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Abstract

This review delved into publicly available datasets to scrutinise Noncommunicable Diseases (NCDs) and Social Determinants of Health (SDHs) in Thailand from 2013 to 2021. The causality between NCDs and SDHs lies in how socioeconomic factors, environmental conditions, and access to healthcare significantly influence the distribution of NCDs risk factors and health outcomes, exacerbating health disparities and shaping individual behaviors that contribute to NCD development. NCDs prevalence studied include cancer (CA), coronary artery disease (CAD), chronic obstructive pulmonary disease (COPD), diabetes mellitus (DM), hypertension (HTN), and stroke. SDHs data encompassed household income, expenses, loans, education, smokers, alcohol consumers, and particulate matter 2.5 levels. Descriptive analysis was employed to scrutinize publicly available datasets. Findings revealed significant increase in household incomes, loans, and PM2.5 concentrations, posing environmental risks. NCDs prevalence rates, including DM, HTN, Stroke, CAD, CA, and COPD, exhibited upward trends. Provincial disparities in NCD prevalence underscored the necessity for targeted interventions. Future research may focus on longitudinal trends in SDHs. To mitigate escalating NCDs prevalence, comprehensive health promotion programs are imperative, emphasizing risk factor awareness, lifestyle changes, and enhanced access to preventive healthcare services. Investigating provincial disparities and socioeconomic factors impacting health outcomes is vital for policy formulation.

Keywords: Noncommunicable diseases, Social determinants of health, Public datasets, Prevalence, Descriptive analysis

Introduction

In 2022, the World Health Organization (WHO) updated the definition of Noncommunicable diseases (NCDs) to include illnesses caused by a combination of genetic, physiological, environmental, behavioural factors and prolonged duration. The modifiable behavioural and metabolic risk factors contribute to NCDs, with smoking being one of the most important behavioural risk factors, causing over 8 million deaths annually[25]. The consequences of NCDs substantially impact public policy planning, including the cost of illness, productivity loss, and labour loss that drive a particular community's economy[25]. In Thailand, NCDs are an important public health concern with a high prevalence of coronary artery disease (CAD), cancers (CAs), respiratory diseases, and diabetes[2].

To accomplish the well-being goals of the United Nations (UN) 2030 Agenda for Sustainable Development Goals (SDGs), public health policies must address all gaps and ensure sustainable development in compliance with the SDGs. Especially, the third goal of the SDGs is to "Ensure healthy lives and promote well-being for all at all ages"[18]). Social determinants of health (SDHs) are critical in shaping health outcomes that impact NCDs, particularly in low- and middle-income countries like Thailand. SDHs in Thailand include economic instability, limited access to education, unequal access to quality healthcare, environmental factors, and social and community contexts[13].

NCDs are heavily influenced by SDHs such as socioeconomic status, gender, ethnicity, and disability. These determinants contribute to health inequalities, with NCDs being major contributors to the social gradient in health outcomes, observed globally. SDHs shape the distribution of NCDs risk factors and influence stress pathways affecting mental health and environmental exposure to pollutants[29]. In low- and middle-income countries, including South Africa[28], NCDs are prevalent, especially among poor communities, highlighting the importance of addressing SDHs in NCDs prevention and control policies. Addressing SDH is crucial for effectively tackling the root causes of NCDs and reducing their burden on populations[29].

In conformity with a survey conducted by the WHO on the status of NCDs prevention and control across different countries, many countries still have significant gaps and challenges[23]. The survey revealed that inadequate infrastructure, governance, and financing impede effective NCDs prevention and control in many countries. Policies, action plans, and strategies related to NCDs often need to be more fully implemented. NCDs surveillance systems often need to be more robust and present, making tracking and responding to the NCDs burden challenging.

Countries must improve the availability and accessibility of tests, procedures, and medicines for early detection, diagnosis, and treatment of NCDs. Additionally, countries need to strengthen their health system capacities for NCDs prevention and control by developing guidelines and referral criteria and providing training and resources for healthcare workers. Finally, countries should prioritise and enlarge evidence-based NCDs prevention and control interventions, such as cancer screening, Human papillomavirus (HPV) vaccination, and cardiovascular risk stratification.

Prevalence data quantified the extent of health issues like NCDs, aiding in burden assessment and intervention prioritization. It helps allocate resources effectively by identifying high-prevalence areas or populations, enabling targeted interventions. Targeted programs and interventions are designed based on prevalence data, addressing unique needs of high-prevalence populations. Analysis of prevalence variations across populations and regions informs tailored strategies to address health disparities. Prevalence data also offers insights into the economic impact of health issues, informing policymakers on healthcare investments and interventions[27].

In Thailand, NCDs are a significant public health concern, with eight out of the top 10 causes of death between 2017 and 2019 being NCDs, as reported by the World Health Organization[21]. According to data from the Thai Government Open Data portal, the estimated prevalence of NCDs, such as Diabetes Mellitus (DM), Hypertension (HTN), Coronary Artery Disease (CAD), and Stroke, was approximately 6,557 persons per 100,000 in 2020, with a death rate of 131 persons per 100,000 (6). These statistics highlight the importance of effective management and attention to NCDs among the Thai population. To address this issue, the Bureau of Noncommunicable Diseases Department of Disease Control Division was established in 2002, aiming to control and prevent NCDs nationwide. The bureau's primary contribution is facilitating healthcare providers through relevant public health policies and projects to achieve the assigned missions. The three schemes managed by the government of Thailand to provide universal health coverage to its citizens are the Universal Health Coverage Scheme (UCS), the Security Scheme (SSS), and the Civil Service Medical Benefits Scheme (CSMBS). The UCS covers all Thai citizens not covered by other schemes, the SSS insures all labourers except civil servants, and the CSMBS covers all civil servants and their families. Besides, health spending per capita has increased since 2006, rising from 3.10% to 3.79% in 2019, as reported by the World Bank[19].

To explore the prevalence of NCDs and SDHs in Thailand, this review utilised relevant public datasets selected based on their availability and relevance to the research questions.

Related Works

The increasing burden of NCDs in Thailand has become a growing concern, particularly as it intersects with SDHs in this context. A diverse body of research has emerged, uncovering the nuanced and often unexpected factors that shape health outcomes in this area. Aekplakorn et al.[1] found that the prevalence of overweight and obesity is rising in Thailand, with men and women experiencing an increasing burden between 1997 and 2004. The study revealed that education was contrarily related to the odds of being overweight or obese in women but positively related to men. However, significant gaps in the evidence-based on the cost implications of NCDs for individuals at different stages of the care continuum in low- and middle-income countries were identified by Kazibwe et al.[3]. Marmot and Bell[5] proposed an integrated approach to policy development, cutting across multiple sectors to mitigate health inequalities resulting from SDHs. Nawamawat et al.[8] identified customised NCDs prevention policies as necessary, particularly those that address the differential disease burden identified in the rural-urban divide. Potempa et al.[10] discussed the challenges faced by Thailand in addressing the dual demands of an ageing population and increasing incidence of NCDs.

Meanwhile, Stringhini et al.[14] found that low socioeconomic status and risk factors such as diabetes, high alcohol intake, high blood pressure, obesity, physical inactivity, and smoking were associated with a higher risk of loss of physical functioning at older ages. Reap et al.[11] utilised the Social Determinants of Health framework to identify the specific determinants that are most significant and present the greatest risk to the health and well-being of the Urak Lawoi' (UL), a "sea nomad" group indigenous to southern Thailand. Lastly, Khunakorncharatphong et al.[4] discussed the increasing trend of NCDs in Thailand and the need for effective preventive interventions. This research demonstrates the complex interplay between NCDs and SDHs in Thailand. It highlights the need for identifying targeted and comprehensive interventions to address this growing public health issue. In this study, exploring available NCDs prevalence and SDHs in Thailand to identify the target is the beginning step for any further interventions.

Review Methodology

This cross-sectional study used publicly available datasets to explore the prevalence of NCDs and SDHs in Thailand. The study relied on three primary sources of data: the Open Data web portal by the MOPH[6], the National Statistical Office (NSO) website[7], and the Pollution

Control Department's Air4Thai website[9]. The data were retrieved on two separate occasions: 10 September 2022 and 12 November 2022.

The MOPH Open Data web portal provided a comprehensive dataset on various health-related aspects of Thai citizens. This included information on health service access, healthcare providers, health status by essential diseases (including NCDs), cause of illness, tuberculosis-related activities, and conditions from occupation or environment. The MOPH Open Data web portal was the primary source of information on the number of NCDs patients for at least a decade before 2021. Prevalence rates of specific NCDs were obtained from 2013 to 2021, including Cancer (CA), CAD, Chronic Obstructive Pulmonary Disease (COPD), DM, HTN, and Stroke. Hospital lists matched the number of patients to each hospital code and determined the locations of the hospitals in different provinces.

The NSO website was the source of data on SDHs, including household income, expenses, loans, years of education, number of educational institutions, number of smokers, and number of alcoholic consumers. At the same time, the levels of particulate matter 2.5 (pm2.5) can be found on the Pollution Control Department's website[9], Ministry of Natural Resources and Environment of Thailand. Data on household income, expenses, and loans were collected to assess Economic Stability. Education Access and Quality were evaluated by collecting data on the years of education and the number of educational institutions in each province. Data were collected on the number of hospitals for each province to evaluate Health Care Access and Quality. The Neighbourhood and Built Environment domain was assessed by collecting data on the levels of particulate matter 2.5 (pm2.5) in each province. Lastly, Social and Community Context was assessed using hospital location (province) data.

A descriptive analysis was performed on the retrieved datasets NCDs prevalence rates from 2013 to 2021. Additionally, spatial analysis was conducted to determine the geographic distribution of NCDs across different provinces of Thailand using map chart feature in Microsoft Excel. Other available features of Microsoft Excel and Google Sheets have been used for data analysis including map chart, filter, pivot table, etc. The following equation methodologies were employed.

- R square, $R^2 = 1 - (SSres/ SStot)$, where SSres is the sum of squares of residuals (the differences between the observed values and the values predicted by the model), SStot is the total sum of squares, which measures the total variance in the dependent variable.
- Average = Sum of all values/ Number of values

Result

Various SDHs, shown in Table 1, influence the overall health status of individuals in Thailand from 2013 to 2021. The data includes statistics on household income, expenses, loans, education, health, and environmental factors. The "Household Income (THB/month)" column represents the average monthly income of households, while "Household Expense (THB/month)" denotes the average monthly expenses incurred. The "Household Loan (Year)" column refers to the average loan amount taken by households, and the "Year of Schooling (Year)" shows the average number of years of schooling completed by individuals. The "Educational Facility (Institution)" column identifies the number of educational institutions an individual attends. Additionally, Table 1 reports on two behavioural risk factors: "Alcohol Intake (/100,000)" and "Smoking Rate (/100,000)," which report the number of deaths related to alcohol and smoking per 100,000 people in Thailand each year. The "PM2.5 levels ($\mu g/m^3$)" column indicates the mean concentration of PM2.5 particles in the air in Thailand, measured in micrograms per cubic meter. Not all columns have yearly data, as indicated by the "Not available" label. Nevertheless, the data provides valuable insights into the SDHs affecting Thailand's health. For instance, the average household income increased from 23,182 THB/month in 2013 to 24,666 THB/month in 2021, while the average loan amount taken by households increased from 148,971 years in 2013 to 202,947 years in 2021, indicating a potential financial burden on households. Additionally, the average concentration of PM2.5 particles in the air increased from 235 $\mu g/m^3$ in 2013 to 1,677 $\mu g/m^3$ in 2021, highlighting an environmental hazard that may impact public health.

Table 1 Overview of average household Statistics: income, expenses, loans, education, and health factors from 2013 – 2021

Year	Household income (THB/month) (Min, Max)	Household expense (THB/month) (Min, Max)	Household loan (Year) (Min, Max)	Year of schooling (Year) (Min, Max)
2013	23 182 (8 821, 49 191)	17 731 (7 405, 35 024)	148 971 (9 857, 386 957)	27 (4.2, 8.9)
2014	Not available	18 665 (9 686, 34 426)	Not available	28 (4.3, 9)
2015	23 542 (13 497, 45 572)	18 982 (11 864, 33 086)	156 346 (8 090, 373 325)	29 (4.49, 9.38)
2016	Not available	18 777 (11 859, 35 101)	Not available	29 (4.53, 9.47)
2017	23 840 (11 809, 45 707)	18 959 (10 441, 35 351)	173 535 (28 438, 294 901)	29 (4.55, 9.6)
2018	Not available	18 764 (11 213, 43 301)	Not available	29 (4.6, 9.68)
2019	23 568 (13 971, 46 978)	18 521 (11 243, 37 086)	157 704 (16 895, 288 110)	30 (4.74, 9.78)
2020	Not available	19 173 (11 532, 33 824)	Not available	31 (4.94, 10.02)
2021	24 666 (15 496, 41 129)	19 500 (12 214, 33 996)	202 947 (47 603, 370 531)	31 (5.08, 10.13)

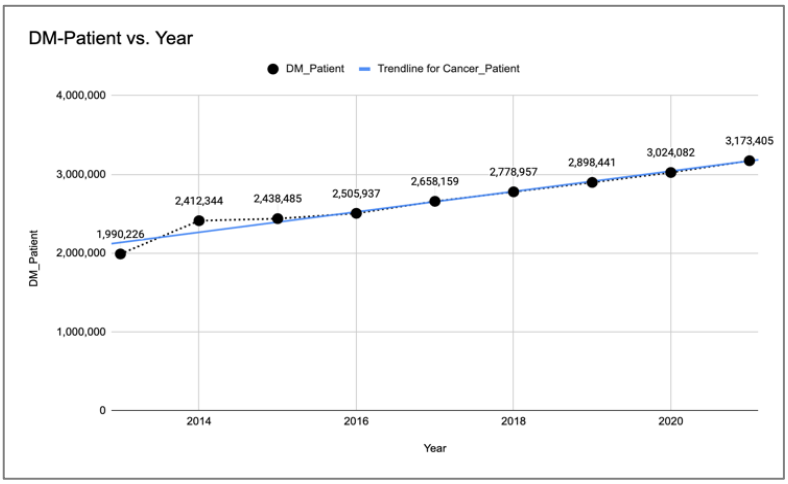
Table 1 Overview of average household Statistics: income, expenses, loans, education, and health factors from 2013 – 2021 (Cont.)

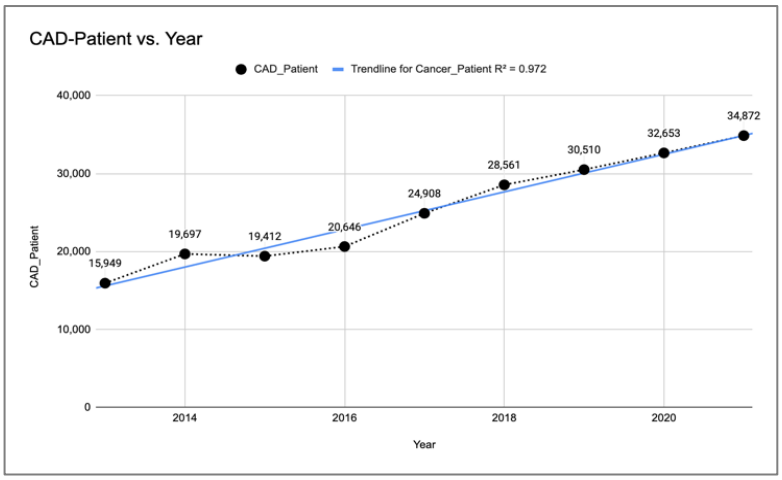
Year	Educational facility (Institution)	Alcohol intake Rate (/100,000)	Smoking rate (/100,000)	PM2.5 levels ($\mu g/m^3$) (Min, Max)
2013	Not available	32,892	Not available	33.51 (19.46, 62.07)
2014	Not available	32,950	Not available	28.78 (19.68, 39.30)
2015	Not available	34,786	Not available	27.91 (16.39, 46.23)
2016	77,258	Not available	Not available	26.93 (11.78, 43.27)
2017	76,516	29,050	Not available	22.40 (8.89, 35.83)
2018	76,712	Not available	Not available	23.72 (8.76, 41.39)
2019	75,962	Not available	Not available	25.49 (9.69, 40.57)
2020	75,475	Not available	Not available	23.27 (7.69, 42.39)
2021	Not available	28,600	570	21.50 (9.72, 39.59)

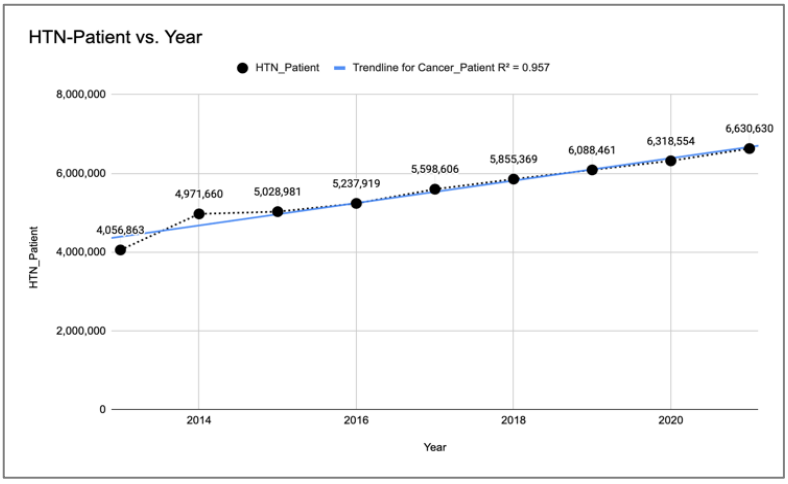
The prevalence of NCDs in Thailand from 2013 to 2021 is demonstrated in Figure 1. The data indicate an increase in patients diagnosed with DM, HTN, stroke, CAD, Cancers (CAs), and COPD. For example, the number of patients diagnosed with DM increased from 1,990,226 in 2013 to 3,173,405 in 2021, with an average per cent increase of 6.01%. Similarly, the number of patients diagnosed with hypertension increased from 4,056,863 in 2013 to 6,630,630 in 2021, with an average per cent increase of 6.33%. These trends suggest that NCDs are becoming more prevalent over time.

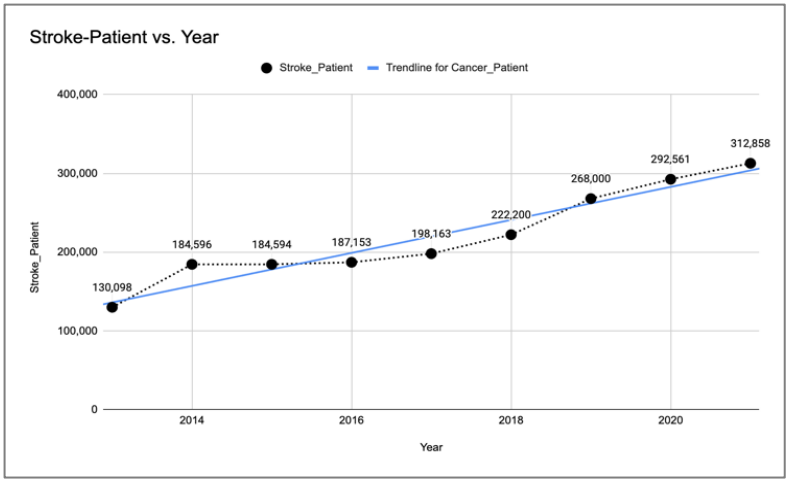
Figure 2. presents the cumulative rates of six prevalent diseases, namely DM, COPD, CAs, stroke, CAD, and HTN, across multiple provinces in Thailand. The highest cumulative rates (patients/ 100,000 population) for each disease were observed in specific provinces, with Singburi recording the highest rate for DM (8,421), Nan for COPD (1,350), Yasothon for CA (792) and CAD (792), Phatthalung for stroke (1,632), and Sukhothai for HTN (21,592). Phuket demonstrated the lowest cumulative rate for COPD (151), CAs (45), and CAD (56), Pattani for DM (2,826), Samut Prakan for HTN (7,462), and Amnat Charoen for Stroke (132). The study suggests that certain central, northern, southern, and northeastern Thailand provinces have higher cumulative rates of DM, COPD, CAs, stroke, HTN, and CAD. In comparison, the southern (Phuket) has the lowest cumulative rates for COPD, CAs, and CAD.

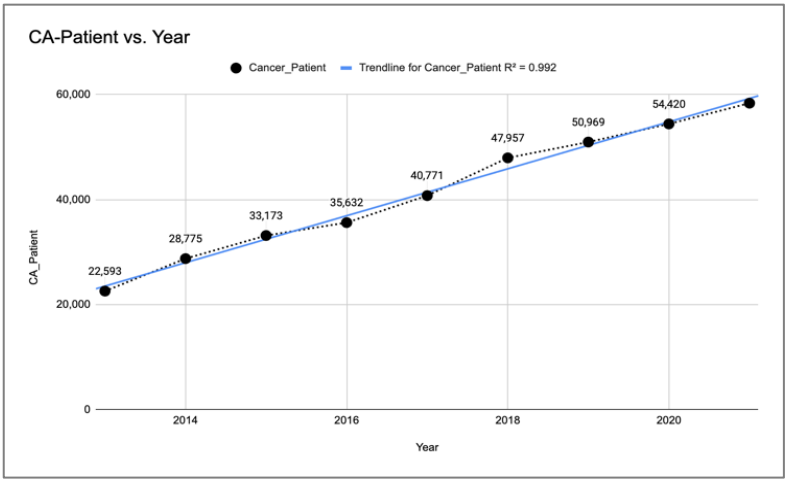
The presented Figure 3. offered insights into socio-economic and environmental factors for various provinces in Thailand. The information in the table pertains to several metrics, such as the number of hospitals, average household income, average household expense, average household loan, PM2.5 concentration, and average population for each province. Notably, Bangkok has the highest number of hospitals, with 799 hospitals, followed by Nakhon Ratchasima with 481 and Chiang Mai with 426 hospitals. Conversely, Phuket has the lowest number of hospitals, with only 43. Regarding average household income, Bangkok boasts the highest average monthly income of 41,698 THB, while Mae Hong Son has the lowest average monthly income of 10,845 THB. Nonthaburi, Chanthaburi, and Krabi also have relatively high average household incomes above 20,000 THB monthly. The highest average household expense is in Bangkok at 33,643 THB per month, followed by Pathum Thani and Nonthaburi, while Mae Hong Son has the lowest average at 11,103 THB per month. Udon Thani has the highest average household loan at 217,272 THB, followed by Bueng Kan and Khon Kaen, while Chaiyaphum has the lowest average household loan at 66,895 THB.











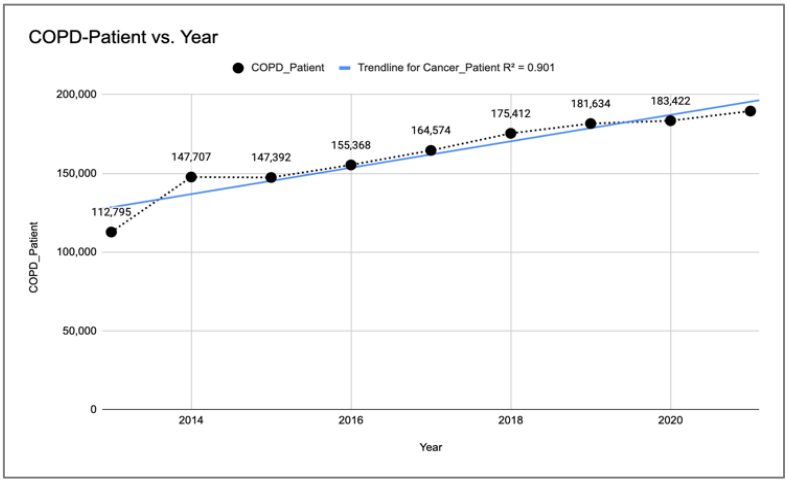


Figure 1. Analyzing the evolution of NCDs patient trends in Thailand.

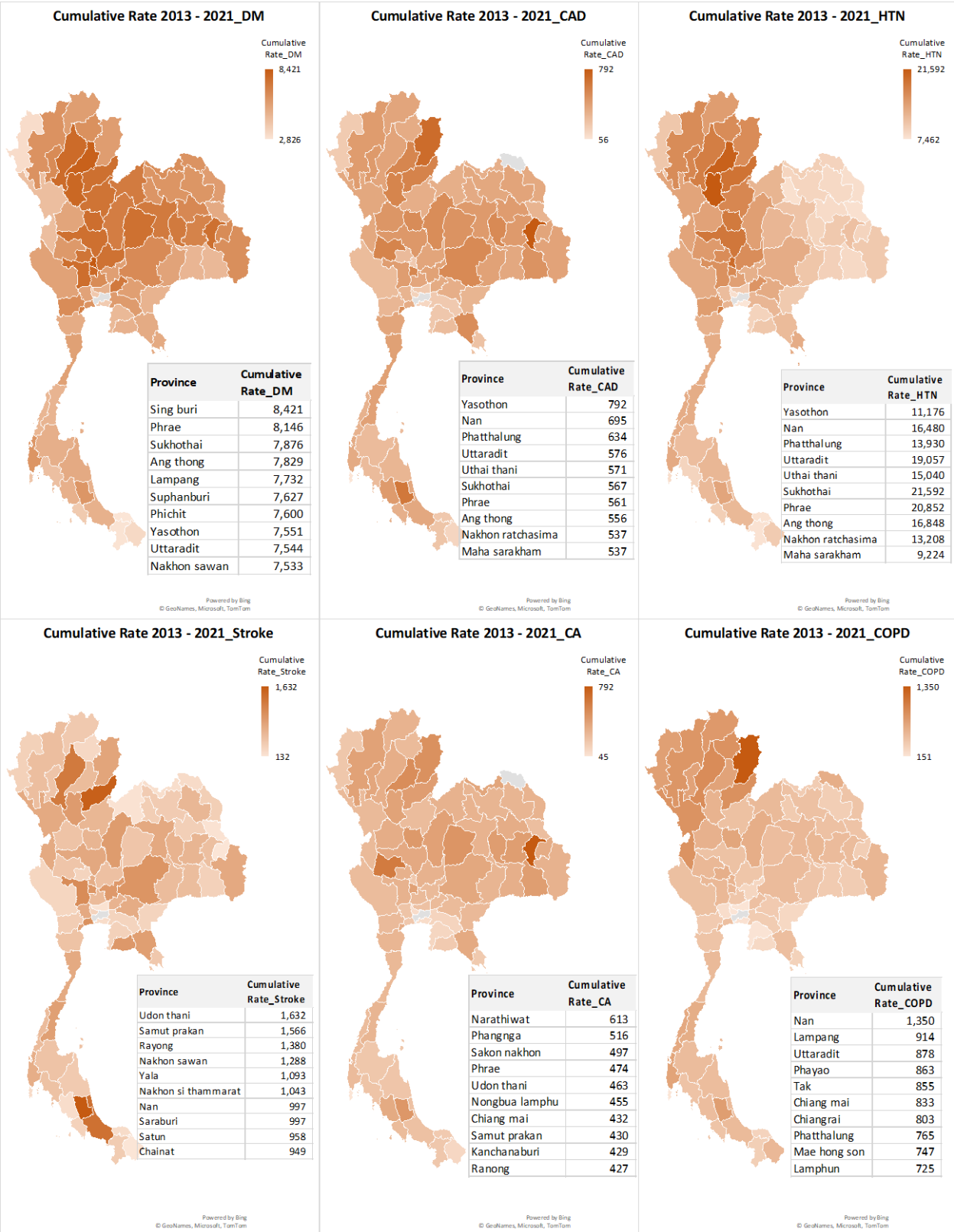


Figure 2. Spatial analysis of cumulative NCDs rates in Thailand.

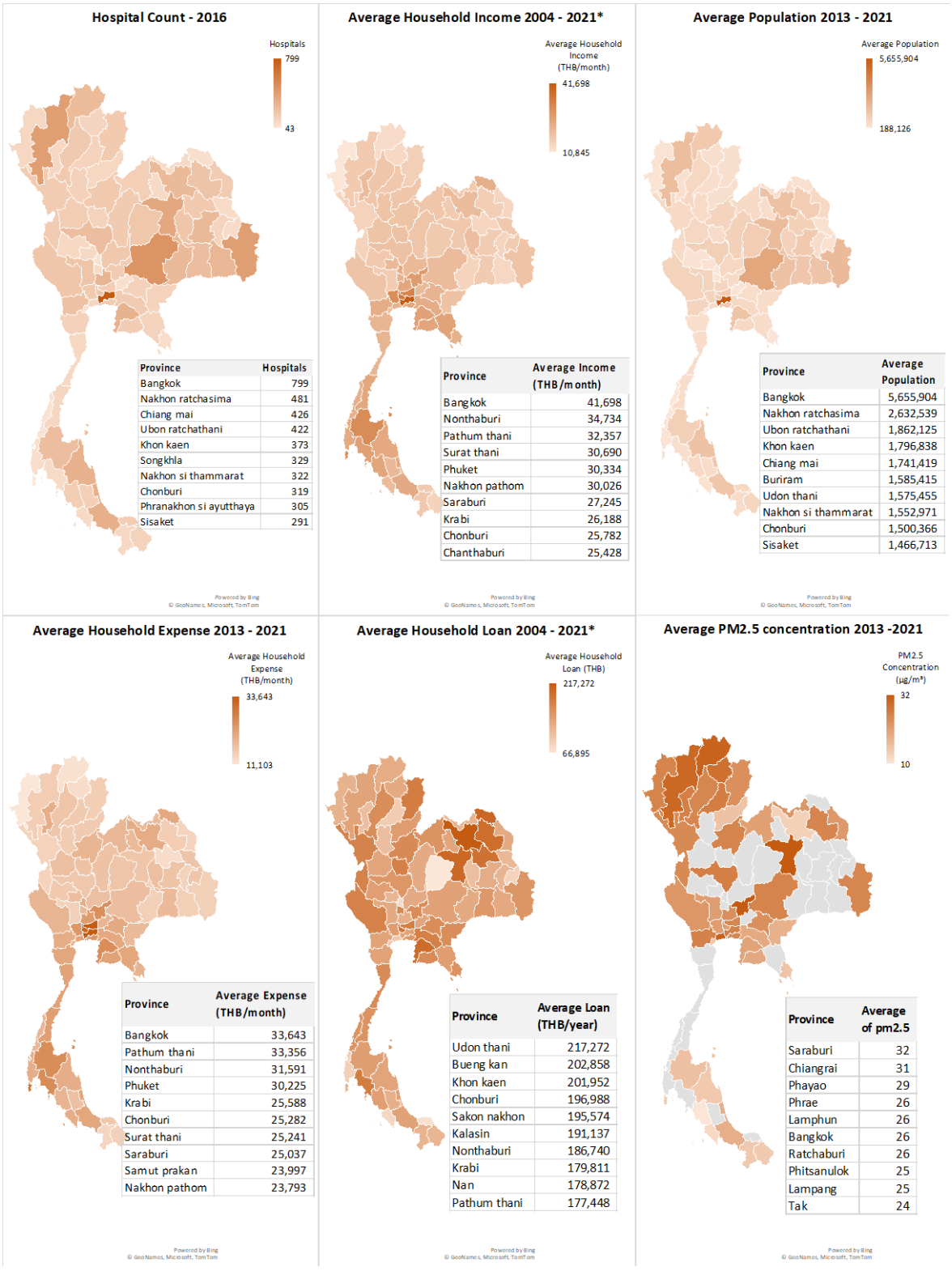


Figure 3. Geographic patterns of SDHs in Thailand. (* Available for 2004, 2005, 2007, 2009, 2011, 2013, 2015, 2017, 2019, and 2021)

Moreover, Khon Kaen has the highest average PM2.5 concentration with a value of 32.15 $\mu g/m^3$, followed by Saraburi with 32.00 $\mu g/m^3$, whereas Trang has a relatively low PM2.5 concentration of 10 $\mu g/m^3$. Lastly, Bangkok has the highest average population, with 5,655,904 people, followed by Nakhon Ratchasima, 2,632,539 people, and Ubon Ratchathani, 1,862,125 people. Ranong has the lowest average population, with 188,126 people.

Figure 4. provides information about the average loan, monthly expense, and monthly income of individuals in Thailand from 2004 to 2021. The average loan increased from 96,961 THB in 2004 to 202,947 THB in 2021, indicating a general trend of increased borrowing over time. Moreover, the monthly expense increased from 17,731 THB in 2013 to 19,500 THB in 2021, suggesting that Thailand's cost of living has been rising. Finally, the average monthly income increased from 13,357 THB in 2004 to 24,666 THB in 2021, reflecting a growth in the economy and improved employment opportunities or higher salaries. Yet, there were also fluctuations over time, with a peak in 2013 (23,182 THB). Overall, the data suggests a general trend of increasing borrowing, expenses, and income in Thailand over the past two decades, with some years exhibiting less pronounced or even reversed trends.

Figure 4. Historical trends of household financial profiles in Thailand.

(The missing year showing as No Column)

Discussion

This study utilised publicly available datasets to explore the characteristics of NCDs and SDHs in Thailand. Data on NCDs were collected from 2013 to 2021 and included breast cancer, coronary artery disease, cervical cancer, chronic obstructive pulmonary disease, diabetes mellitus, hypertension, lung cancer, and stroke. SDHs data encompassed household income, expenses, loans, education, smokers, alcohol consumers, and levels of particulate matter 2.5. The presented data on the various SDHs and their impact on the NCDs prevalence provides valuable insights into the factors influencing public health in the country. The data encompasses several critical indicators, including household income, expenses, loans, education, health, environmental factors, and behavioural risk factors such as alcohol intake and smoking rates.

The results indicated that there had been significant changes in the average household incomes and loans taken by households, with an increase in the former and a potential financial burden arising from the latter. Furthermore, the increased PM2.5 particle concentration in the air is a concerning environmental hazard that may have significant implications for public health. Additionally, the prevalence of NCDs in Thailand has increased, with DM, HTN, stroke, CAD, CAs, and COPD exhibiting increasing trends over time. These trends suggest that NCDs are becoming more prevalent and require targeted interventions to mitigate their impact. Furthermore, the data on the prevalence rates of diverse NCDs across different provinces in Thailand highlights the need for targeted interventions to reduce the incidence and severity of these NCDs in specific regions. Identifying provinces with the highest prevalence rates of various health conditions can inform healthcare policymakers and professionals in developing targeted interventions to address these issues. Lastly, the data on critical socio-economic and environmental indicators for various provinces in Thailand underscores the need to address the disparities between different regions. Addressing these disparities requires a multifaceted approach that considers each region's unique challenges and opportunities.

In order to further our understanding of SDHs in Thailand, future research could involve conducting a longitudinal study. This study would specifically focus on household income, expenses, loans, education, health, and environmental factors to analyse the evolving trends and patterns in SDHs over time. To address the escalating levels of PM2.5 particles and air pollution, it is crucial to implement targeted interventions. These measures may encompass enforcing stricter environmental regulations, promoting clean energy sources, and raising public awareness regarding the detrimental health effects of air pollution.

The mounting prevalence of NCDs in Thailand necessitates the development and implementation of comprehensive health promotion programs. These programs should emphasize raising awareness about risk factors, fostering the adoption of healthy lifestyles, and improving access to preventive healthcare services. Additionally, it is essential to investigate regional disparities in NCDs rates, identify contributing factors, and design tailored interventions. By enhancing healthcare access, providing health education, and addressing regional social and economic determinants of health, we can effectively combat the growing burden of NCDs.

Addressing NCDs demands health promotion programs raising awareness about risk factors and encouraging healthy choices, particularly in underserved communities. Targeted interventions tailored to provincial disparities are crucial, leveraging community partnerships for early detection and management. Advocating for policies stabilizing household income and reducing financial burdens through income support and economic empowerment initiatives tackles social determinants of health. Strengthening education systems, enacting environmental regulations for hazards like PM2.5 pollution, and promoting sustainable practices are essential components. Longitudinal studies investigating social determinants, data-driven decision-making, evaluation of existing policies, and robust public health surveillance systems are pivotal for evidence-based policy. Fostering collaboration among stakeholders, including government agencies, healthcare providers, academia, and community organizations, is vital for promoting multidisciplinary research, knowledge sharing, and informed decision-making at all levels.

This analysis faced limitations due to incomplete data coverage. Data availability varies across years and provinces, potentially impacting the comprehensiveness and generalizability of findings. While the data encompasses key SDH indicators (income, education, etc.), quality and completeness may differ across regions and sources. These limitations should be considered when interpreting results and drawing conclusions.

To enhance health outcomes in Thailand, it is valuable to compare the country's health indicators and SDHs with those of other countries on regional and global scales. This comparative analysis will facilitate identifying and adapting effective practices and policies from other nations tailored to Thailand's specific context.

Integration and analysis of data from Tables 1 and Figure 3 and other relevant datasets should be pursued. By utilising advanced analysis and modelling techniques, we can explore relationships, identify key predictors of health outcomes, and derive evidence-based policy

decisions. An evaluation of the effectiveness of existing policies and interventions targeting SDHs and reducing NCDs prevalence is crucial. This evaluation should assess the impact of implementation, identify gaps, and provide actionable recommendations for improvement. Strengthening Thailand's public health surveillance systems is of utmost importance to ensure timely and accurate data collection, analysis, and reporting. Empowering evidence-based decision-making processes by enhancing the capacity for monitoring health indicators, risk factors, and SDHs. Promoting collaborations among government agencies, healthcare providers, academia, community organisations, and international partners is vital. These collaborative efforts aim to foster multidisciplinary research and knowledge sharing, effectively addressing health challenges, implementing impactful interventions, and ultimately improving Thailand's population's overall health and well-being.

Conclusion

This study highlighted a significant trend for SDHs and NCDs in Thailand using the descriptive analysis, emphasizing the need for targeted interventions to address the rising prevalence of NCDs, particularly in areas with high rates. It also suggested further research is necessary to understand the intricate relationship between socioeconomic factors and health outcomes in Thailand. NCDs such as DM, HTN, stroke, CAD, cancer, and COPD have been steadily increasing in Thailand, with individuals from lower-income households and lower education levels showing higher susceptibility. Provincial variations in NCDs prevalence underscored the importance of tailored interventions for specific provinces. Policy implications include the urgency for interventions to raise awareness about risk factors, promote healthy lifestyles, improve access to preventive healthcare, address regional disparities in healthcare infrastructure, and invest in research to inform more effective policies aimed at improving health equity. Future research should focus on longitudinal studies tracking NCD and SDHs trends, investigating the mechanisms linking SDHs to NCDs, developing and evaluating interventions to reduce NCDs prevalence, and exploring the cost-effectiveness of different strategies.

Author Contributions

PB designed, collected, and analysed the study with guidance from NS. PB wrote the manuscript with advice from NS. All authors read and approved the manuscript before submission for publication.

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The authors did not receive funding to carry out the work presented in this article.

Conflicts of Interest

The authors declare no conflicts of interest related to this research. This study was conducted with the sole objective of advancing knowledge in the field of public health, specifically regarding NCDs and SDHs in Thailand.

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