INTRODUCTION

People living in poverty are particularly vulnerable to the risks of noncommunicable diseases (NCDs) due to health behaviors and disparities in access to health care (Bukhman et al., 2020; Pullar et al., 2018). This situation tends to worsen during emergency situations such as the COVID-19 pandemic (Kluge et al., 2020; Palmer et al., 2020). The implementation of public health measures in response to the pandemic, in particular physical distancing and lockdowns, affected society and resulted in a loss of income for many people (Gopalan & Misra, 2020; Pothisiri & Vicerra, 2021). Households’ lowered spending capacity affected their purchasing choices regarding healthier foods and their ability to attend to their health, such as going to a medical facility for consultation (Kluge et al., 2020; Kriaucioniene et al., 2020).

The abovementioned difficulties related to lifestyle changes due to pandemic control measures significantly affect individuals with NCDs and metabolic risk factors. Individuals with diabetes, myocardial diseases, and pulmonary issues, among other diseases, are part of a high-risk group in relation to COVID-19 (Gupta et al., 2020; Ruan et al., 2020). Besides having a higher risk of infection due to the presence of these factors, these individuals are also at higher risk of complications and deaths from COVID-19 (Gupta et al., 2020; Kriaucioniene et al., 2020).
NCDs and metabolic risk factors, a severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection can further exacerbate these existing health conditions (Palmer et al., 2020). Further damage resulting from COVID-19 infection, such as myocardial, pancreatic, hepatic, and gastrointestinal injuries, have been recorded among older people (Stefan et al., 2021). Moreover, the overall health of older people is jeopardized due to COVID-19 infection because, as with other influenza diseases, functional decline is often noted and prolonged hospitalization becomes highly probable (Gozalo et al., 2012; Palmer et al., 2020).

In Thailand, the prevalence of NCDs has been increasing in past few decades (Kaufman et al., 2011; Nawamawat et al., 2020). This rise is partially attributed the country’s economic growth and modernization (Chavasit et al., 2017). Health behaviors, including smoking, drinking, less physical activity, and poor dietary choices, have been found to be associated with this escalating problem, including in the older population (Angkurawaranon et al., 2013; Areechokchai et al., 2017; Sari & Artsanthia, 2019). In light of the current public health situation, the country’s older population is at increased risk of illness. At the onset of COVID-19 pandemic, the older population in Thailand became one of the primary clusters of infection (Jindahra et al., 2021). Subsequent waves of infection have also seen a prevalence of cases within this age group. This has created a strain on the healthcare system due to the increased level of care needed by people with pre-existing conditions.

In the context of the pandemic, it is important to examine the health status of economically vulnerable people, particularly those in their later years. It is also important to know how members of this age group perceive the risks related to COVID-19, due to their higher risk of infection and exposure to the severe effects of COVID-19 (Clark et al., 2020). A similar study involving adults in China observed that people with diabetes had a greater perceived risk of being infected with COVID-19 compared with non-diabetics (Yan et al., 2020). This theme has yet to be explored in the Thai context. With the society’s aging population structure, it is important to ensure an equitable welfare status among those with vulnerabilities, particularly in regard to their economic and health statuses.

The current study is different from existing studies in that it focuses on later-life adults who have compounded vulnerabilities, particularly those living in poverty in urban areas. Although urban populations were perceived to have better access to health services in Thailand before the pandemic (Aekplakorn et al., 2011; Quashie & Pothisiri, 2019), notable challenges already existed in relation to access to health information and expenditures for basic needs such as food and housing at the onset of the pandemic (Pothisiri & Vicerra, 2021; Vicerra, 2021). Thus, the aim of this study was to further understand the confluence of urban poverty, NCDs, and advanced age to determine the concerns of people with multiple vulnerabilities.

2 | METHODS

2.1 | Data

This study relies on data from the 2021 Survey on Housing and Support Services for Poor Older Adults (Jumnianpol et al., 2021), which aimed to develop a policy framework to allow low-income older persons to age at home, and to identify the support systems currently available and those needed in the future to accommodate their needs. The survey explored the current living conditions, health, and well-being of men and women entering into late adulthood, that is, aged 55 or older at the time of the survey, and who either earned less than 40,000 THB (equivalent to US$1330) per year or were the beneficiaries of the government’s cash transfer program commonly known as the “Card of the Poor” program. Informed consent was obtained in writing, and participants were assured that the data collected were to remain anonymous.

As the fieldwork was scheduled during the easing of the third phase of the coronavirus-triggered lockdown (May–June 2021), the survey sought further information regarding the effect of the COVID-19 pandemic on the health and well-being of the respondents. The survey utilized a stratified multistage cluster sampling design, in which 2,139 respondents residing in the sampled households in both urban and rural areas across five geographical regions of Thailand, including Bangkok, were interviewed.

2.2 | Sample

The total urban sample included 1,255 people aged at least 55 years. A restricted sample was then created by excluding cases in which (1) the respondent was bedridden and (2) a proxy answered the survey in its entirety. After consideration of these criteria, the resulting analytic sample was 1,155. Sample selectivity was assessed by comparing the unrestricted and restricted samples. No difference was observed concerning key characteristics, namely age, gender, and place of residence. The unrestricted sample was also tested against the Survey of Older Persons in Thailand, a nationally representative survey collected in 2017. There was no observed a statistically significant difference in characteristic distribution.
### TABLE 1  
Prevalence of noncommunicable diseases by sociodemographic, economic, and health-related characteristics

| Age group    | Total (N = 1,155) | Stroke (n = 39) | %   | p  | Dementia (n = 17) | %   | p  | CKD<sup>b</sup> (n = 39) | %   | p  | Diabetes (n = 323) | %   | p  | At least one NCD (n = 374) | %   | p  |
|--------------|-------------------|----------------|-----|----|------------------|-----|----|------------------|-----|----|------------------|-----|----|------------------|-----|----|
|              |                   |                |     |    |                   |     |    |                   |     |    |                   |     |    |                   |     |    |
| 55–59        | 130               | 1.54           | .532|    | 0                | .001|    | 1.54            | .286|    | 15.38           | .006|    | 15.38           | <.001|
| 60–69        | 496               | 3.43           | 0.2 | 2.42 | 29.84           | 32.86|    | 34.45           | 34.45|    |                  |     |    |                  |     |    |
| 70–79        | 357               | 2.52           | 3.08| 4.2 | 29.97           | 34.45|    |                  |     |    |                  |     |    |                  |     |    |
| 80 and over  | 172               | 4.07           | 1.16| 0.07| 25.58           | 33.72|    |                  |     |    |                  |     |    |                  |     |    |
| Sex          |                   |                |     |    |                   |     |    |                   |     |    |                   |     |    |                   |     |    |
| Male         | 372               | 5.11           | .005|    | 1.34            | .778|    | 4.03            | .217|    | 25.27           | .218|    | 31.45           | .974|    |
| Female       | 783               | 2.04           | 1.15| 2.68 | 28.74           | 31.55|    |                  |     |    |                  |     |    |                  |     |    |
|              |                   |                |     |    |                   |     |    |                   |     |    |                   |     |    |                   |     |    |
| Education attainment |       |                |     |    |                   |     |    |                   |     |    |                   |     |    |                   |     |    |
| Lower than primary | 176          | 3.41           | .95 | 1.14 | .787 | 3.98 | .464 | 24.87 | .06 | 30.68 | .076|
| Primary level | 807               | 2.97           | 1.12| 3.22 | 28.92           | 33.21|    |                  |     |    |                  |     |    |                  |     |    |
| Higher than primary | 172          | 2.91           | 1.74| 1.74 | 20.57           | 24.42|    |                  |     |    |                  |     |    |                  |     |    |
| Employment status |       |                |     |    |                   |     |    |                   |     |    |                   |     |    |                   |     |    |
| Employed     | 378               | 0.53           | .001| 0.53 | 0.139 | 1.59 | 0.037 | 21.43 | 0.001 | 22.22 | <.001|
| Unemployed   | 777               | 4.25           | 1.54| 3.86 | 30.63           | 36.04|    |                  |     |    |                  |     |    |                  |     |    |
| Income bracket |       |                |     |    |                   |     |    |                   |     |    |                   |     |    |                   |     |    |
| ≤2,600 Baht/month | 760       | 3.95           | .012| 1.32 | .655 | 3.68 | .124 | 28.68 | .261 | 33.68 | .028|
| >2,600 Baht/month | 395       | 1.27           | 1.01| 2.03 | 25.57           | 27.34|    |                  |     |    |                  |     |    |                  |     |    |
| Housing      |                   |                |     |    |                   |     |    |                   |     |    |                   |     |    |                   |     |    |
| Other's house | 380          | 2.63           | .58 | 1.32 | .822 | 3.95 | .255 | 31.58 | .035 | 35 | .074|
| Own house    | 775               | 3.23           | 1.16| 2.71 | 25.68           | 29.81|    |                  |     |    |                  |     |    |                  |     |    |
| Subjective crowding |       |                |     |    |                   |     |    |                   |     |    |                   |     |    |                   |     |    |
| No           | 1,068             | 3              | .813| 1.31 | .283 | 3.09 | .853 | 28.46 | .024 | 32.58 | .006|
| Yes          | 87                | 3.45           | 0   | 3.45 | 17.24           | 18.39|    |                  |     |    |                  |     |    |                  |     |    |
| Smoked tobacco |       |                |     |    |                   |     |    |                   |     |    |                   |     |    |                   |     |    |
| No           | 783               | 2.68           | .316| 1.53 | .149 | 3.07 | .883 | 28.22 | .504 | 32.31 | .398|
| Yes          | 372               | 3.76           | 0.54| 3.23 | 26.34           | 29.84|    |                  |     |    |                  |     |    |                  |     |    |
| Consumed alcohol |       |                |     |    |                   |     |    |                   |     |    |                   |     |    |                   |     |    |
| No           | 715               | 1.96           | .007| 1.4  | .46  | 3.78 | .1   | 28.81 | .248 | 32.59 | .317|
| Yes          | 440               | 4.77           | 0.91| 2.05 | 25.68           | 29.77|    |                  |     |    |                  |     |    |                  |     |    |
| Total        | 1,155             | 3.03           | 1.21| 3.12 | 27.62           | 31.52|    |                  |     |    |                  |     |    |                  |     |    |

Source: Survey on Housing and Support Services for Poor Older Adults 2021.

<sup>a</sup>Significance level from χ<sup>2</sup> test.

<sup>b</sup>Clinic kidney disease.
2.3 | Measures

2.3.1 | Perceived health risks during the COVID-19 pandemic

Four items in the survey asked respondents about their worries during the pandemic. One item concerned the worry of being infected with COVID-19 itself. Another worry involved respondents’ health status becoming worse. Both items were dichotomous variables.

The other two areas of concern pertained to access, particularly worry about (1) a lack of economic resources for medical treatment and (2) reduced access to transportation to medical facilities. As these items are related, an index combining them was created. The Cronbach's alpha value for these items was 0.539. The final variable pertaining to worry about access to medical facilities was operationalized into a dichotomous variable, where having at least one concern was assigned a value of 1.

2.3.2 | Covariates

Sociodemographic factors, including age and gender, have been identified in the literature on health behaviors and the prevalence of NCDs (Clark et al., 2020; Nawamawat et al., 2020; Pampel et al., 2010). Educational attainment is indicative of socioeconomic status. The categories used here were (1) lower than primary education level, which includes having no education, (2) primary level, indicating completion of 4th to 6th grades, and (3) higher than primary level.

Poverty is demonstrated through economic factors such as employment and income level (Nawamawat et al., 2020; Yan et al., 2020). An aspect of poverty that is often overlooked in the literature is related to housing, particularly home ownership and household crowding (Pampel et al., 2010; Pepin et al., 2018). Subjective household crowding was measured in the present study, as culture can affect the perception of the adequacy of a house's size relative to the number of household members (Lauster & Tester, 2010). Housing-related factors have been observed to affect stress levels, which can manifest in relation to physical and psychological health and well-being (Lauster & Tester, 2010; Pepin et al., 2018). These housing characteristics have been highlighted as especially important during the pandemic, as crowding is conducive to household transmission (Haroon et al., 2020), and the tenure, type, and quality of the home have been observed to affect health and well-being (Carmona et al., 2020).

Health-related factors included the health risk behaviors of smoking tobacco and consuming alcohol. Health status was determined among those who reported having been diagnosed by a medical doctor with an NCD or metabolic risk factors. The survey asked about the following NCDs: stroke, dementia, chronic kidney disease, and diabetes. Metabolic risk factors included hypertension and hyperlipidemia. Being overweight was also included among metabolic risk factors. Respondents' body mass index (BMI) was calculated from their self-reported weight and height in the survey. A BMI equal to or above 23 was classified as a high BMI, thus indicating that the respondent was overweight. Dichotomous variables were created for NCDs and metabolic risk factors, respectively, in which the outcome categories indicated whether the respondent had at least one disease or risk factor.

2.4 | Methods of analysis

The results were divided into two sections. The first focused on the bivariate analyses of the prevalence of NCDs and metabolic risk factors by the covariates. In the second section, the bivariate analyses of the perceived risks during the COVID-19 pandemic by the covariates along with the prevalence of NCDs and metabolic risk factors were performed. The binary logistic regression analyses for each of the respective perceived risks by the selected independent variables are presented in the following section. To assess the goodness of fit of the models, the Wald test and the Akaike information criterion (AIC) were performed.

3 | RESULTS

3.1 | Prevalence of NCDs and metabolic risk factors and their distribution by social characteristics

The NCD with the lowest reported prevalence within the sample was dementia at 1.21% (Table 1). Individuals who reported having had a stroke or chronic renal disease each comprised approximately 3% of the sample. Being diagnosed with diabetes had the highest prevalence at approximately 27%. Overall, the proportion of the sample with at least one NCD was estimated at almost 32%.

The prevalence of having at least one NCD was lowest, approximately 15%, within the youngest age group, 55–59 years. There was no correlation between the NCDs and gender, except for stroke, with 5% of men and only 2% of women reporting having had a stroke.
Individuals in the sample who were unemployed and belonged to the lower-income bracket reported a higher prevalence across all NCDs. Such a pattern was not observed among those who experienced housing poverty nor among individuals who engaged in either health risk behavior.

Table 2 shows the prevalence of metabolic risk factors. It was observed that among those in the sample, hypertension had the highest prevalence at almost 56%, while being overweight and having hyperlipidemia were observed at approximately 37% and 34%, respectively. Overall, 72% of the sample had at least one metabolic risk factor.

| TABLE 2 | Prevalence of metabolic risk factors by sociodemographic, economic, and health-related characteristics |
|---------|---------------------------------------------------------------------------------------------------|
|         | Total (N = 1,155) | Overweight (n = 437) | Hypertension (n = 663) | Hyperlipidemia (n = 408) | At least 1 risk factor (n = 865) |
| Age group | % | p<sup>a</sup> | % | p<sup>a</sup> | % | p<sup>a</sup> | % | p<sup>a</sup> |
| 55–59 | 130 | 42.31 | <.001 | 35.38 | <.001 | 17.69 | <.001 | 58.46 | .002 |
| 60–69 | 496 | 42.54 | 53.02 | 35.48 | 72.98 |
| 70–79 | 357 | 33.33 | 62.75 | 38.38 | 75.07 |
| 80 and over | 172 | 22.67 | 63.95 | 36.05 | 76.16 |
| Sex | | | | | | | | | |
| Male | 372 | 28.49 | <.001 | 48.92 | .001 | 27.96 | .001 | 63.44 | <.001 |
| Female | 783 | 40.61 | 58.88 | 37.55 | 76.76 |
| Education attainment | | | | | | | | | |
| Lower than primary | 176 | 36.93 | .876 | 57.39 | .419 | 29.55 | .038 | 69.89 | .103 |
| Primary level | 807 | 36.31 | 56.26 | 36.8 | 74.23 |
| Higher than primary | 172 | 38.37 | 51.16 | 28.49 | 66.86 |
| Employment status | | | | | | | | | |
| Employed | 378 | 39.68 | .144 | 48.41 | .001 | 27.25 | <.001 | 67.99 | .017 |
| Unemployed | 777 | 35.26 | 59.2 | 37.97 | 74.65 |
| Income bracket | | | | | | | | | |
| ≤2,600 Baht/month | 760 | 33.82 | .005 | 58.03 | .025 | 36.84 | .018 | 73.03 | .555 |
| >2,600 Baht/month | 395 | 42.28 | 51.14 | 29.87 | 71.39 |
| Housing | | | | | | | | | |
| Other’s house | 380 | 35.26 | .475 | 57.37 | .416 | 37.37 | .145 | 71.58 | .636 |
| Own house | 775 | 37.42 | 54.84 | 33.03 | 72.9 |
| Subjective crowding | | | | | | | | | |
| No | 1,068 | 37.08 | .362 | 56.37 | .095 | 35.3 | .035 | 73.13 | .079 |
| Yes | 87 | 32.18 | 47.13 | 24.14 | 64.37 |
| Smoked tobacco | | | | | | | | | |
| No | 783 | 41 | <.001 | 57.98 | .022 | 36.53 | .032 | 75.61 | .001 |
| Yes | 372 | 27.69 | 50.81 | 30.11 | 65.86 |
| Consumed alcohol | | | | | | | | | |
| No | 715 | 39.3 | .02 | 57.48 | .114 | 35.1 | .556 | 74.97 | .015 |
| Yes | 440 | 32.5 | 52.73 | 33.41 | 68.41 |
| Total | 1,155 | 36.71 | 55.67 | 34.46 | 72.47 |

Source: Survey on Housing and Support Services for Poor Older Adults 2021.

<sup>a</sup>Significance level from $\chi^2$ test.
Age, gender, income level, and smoking behavior were each observed to be correlated with all three metabolic risk factors. Each of these characteristics was also correlated with having at least one risk factor, along with employment status, home crowding, and alcohol consumption.

### 3.2 Perceived risks during the COVID-19 pandemic

The perceived risks among individuals according to their social characteristics are shown in Table 3. Around 62% of the sample were worried about being infected with COVID-19. The age group with the highest level of concern, at 65%, were those 55–59 years old, and those in the oldest age group had the lowest level of concern at 55%. Men, those with a primary education level, employed individuals, and those at a higher income level were found to have an increased concern of being infected within their respective categories. Respondents’ views of home crowdedness were observed to have a correlation with this perceived risk.

Approximately 53% of respondents indicated that they were worried about their health status worsening. The respondents who most perceived this specific risk were those aged 70–79 years, those with lower than a primary education, unemployed individuals, those with a lower-income level, those who smoked tobacco, and those with at least one NCD or metabolic risk factor.

Finally, those who were worried about access to health care during the pandemic made up approximately 22% of the respondents. The characteristics of the sample correlated with this concern included age, gender, educational attainment, income, home crowding, and both health risk behaviors.

Table 4 presents the odds ratios (ORs) from the logistics regression analyses for perceived risks during the pandemic. The results of the Wald test show the goodness of fit for the three model outcomes. The covariates used for the perceived risk related to accessing health care were found to have the lowest AIC value.

Educational attainment was observed to be statistically significant for all areas of worry, although there were differences in the direction of the association. Having a primary level of education (OR = 1.32) or a higher than primary level (OR = 1.15) was associated with being worried about getting infected with COVID-19. On the contrary, the odds of being worried about worsening health and access to healthcare were lower among those with higher educational attainment levels. Being in the higher income level was observed to have associations in similar directions. Having a higher income was positively associated with being concerned about infection (OR = 1.22) and negatively associated with worries about worsening health (OR = 0.84) and accessing health care (OR = 0.58).

The other factor consistently associated with each of the three perceived risks was related to housing poverty, particularly the opinion that one was living in a crowded home. The odds of being worried about infection, worsening health, and having access to health care were approximately 3.39, 2.12, and 5.52, respectively.

The relationship between being worried about a worsening health condition and age was statistically significant for those from 70 to 79 years of age (OR = 1.43) and 80 years and over (OR = 1.15). Having at least one metabolic risk factor was also observed to be positively associated (OR = 1.23) with the perceived risk of worsening health. Worry about access to healthcare was also found to be associated with having at least one metabolic risk factor (OR = 1.10) and alcohol consumption (OR = 1.36).

### 4 DISCUSSION

The COVID-19 preventive measures implemented in many countries, including Thailand, were centered on preventing transmission among people. Early on, one segment of the population that was identified as highly vulnerable were adults of advanced age. This age group is particularly at risk of having severe effects if they contract COVID-19; however, they also have additional vulnerabilities, as shown in the current study. Poverty and the prevalence of NCDs and metabolic risk factors were found to be notable, and this has subsequently affected the worries of later-life adults during the pandemic.

Based on the present analysis, being 70 years old or older and having a metabolic risk factor were associated with worry about worsening health status. At the onset of the pandemic, worsening health was the main concern of older individuals in Thailand (Pothisiri & Vicerra, 2021). Disruptions to social life, including the capacity to attend to medical needs, were noted as a strain experienced in general by this age group (Le Couteur et al., 2020). The strain among older individuals was exacerbated by the further risks brought on by particular health statuses such as metabolic risk factors (Ayalon et al., 2020).

The abovementioned effects on social life and health are also linked with the nature of the COVID-19 infection situation. SARS-CoV-2 developed into different variants of concern with dissimilar transmissibility and effects on infected individuals (Tani-Sassa et al., 2022). At the time the survey used in this study was collected, the number of new cases was relatively low (Rajatanavin et al., 2021). The variants present in Thailand were alpha, beta, gamma, and delta, although the latter two had fewer cases and were not considered dominant. Due to the perception of these variants, many continued to be wary of becoming infected and concerned about their respective health effects, as observed in
This may have contributed to the perception of the virus and the development of worries among the older population related to the COVID-19 pandemic situation.

Different aspects of socioeconomic status and poverty were observed to have particular effects in terms of perceived risks. Higher educational attainment and higher income level were differently associated with the worry of being infected with COVID-19 and worries concerning...
health status and healthcare access. Shortcomings in income and loss of employment were found to be associated with psychological distress among older adults (Pothisiri & Vicerra, 2021). Maintaining sufficient earnings is important and may result in people continuing to work despite the pandemic, thereby increasing their exposure to the virus. Income has been noted as a factor affecting the health gradient in Thailand's urban locations (Zimmer & Prachuabmoh, 2012). Social welfare policies were thought to be more beneficial in rural areas, since the cost of living in urban locations was higher. People have continued to prioritize essentials other than health care, which may help to explain the greater worry about infection as opposed to worry about health status and healthcare access.

Housing characteristics such as ownership and comfort level have been found to be associated with health behavior and status (Pampel et al., 2010; Pepin et al., 2018). These factors were considered to be associated with the experience of poverty. During the pandemic, stress due to a lack of or inadequate living space has been linked with lower well-being and having greater exposure to COVID-19 (Carmona et al., 2020). As residential spaces in urban areas in Thailand tend to be costly, people with a lower socioeconomic status often resort to living in close proximity (Bhikhoo et al., 2017). Interpersonal dynamics may also have been a contributing factor to stress in older people.

Several caveats must be mentioned concerning this study. All items studied were self-reported. The prevalence of diseases and risk factors was based on individuals’ responses regarding previous diagnoses. Information such as height and weight were also self-reported. The survey used here was cross-sectional; therefore, no causation was established in terms of the covariates and the perceived risks related to COVID-19. Despite these limitations, this study offers a dynamic and timely analysis during the unprecedented pandemic situation.

### 5 | CONCLUSION

The sample studied here was different from the samples in the literature in terms of age, and it was observed in this study that the NCDs of individuals within the sample were not associated with perceived risks related to COVID-19. However, a relationship was found between metabolic risk factors and concerns about worsening health status and access to healthcare services and facilities. Factors related to socioeconomic status and poverty were associated with all perceived risks. This shows that vulnerability is multifaceted and compounded for urban-dwelling older people living in poverty.

The findings presented here highlight the heterogeneity of the lived experience among Thai older population. Vulnerabilities are linked not only because of these individuals' ages and perceived health status but also because, for some, their socioeconomic status exacerbates...
the precariousness of their standard of living. The government’s welfare support programs must be reassessed in consideration of the current situation. These programs need to be sufficient to support the everyday needs of vulnerable segments of the population while also guaranteeing that when economic shocks occur in society, these individuals can be better protected from abject poverty and worsening strains on their physical and mental health.

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