

Economic burden of asthma in Singapore

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ABSTRACT

Background and objective Up-to-date economic burden of asthma in Singapore is currently unknown.

Methods We quantify the per capita and total annual costs of asthma for adults and children by level of symptom control (uncontrolled, partly controlled, and well controlled) via a cross-sectional online survey administered to a national web panel. Participants were asked about healthcare utilisation, days missed from work, and reduced productivity due to their symptoms. These values were then monetised and multiplied by prevalence estimates of adult and child asthmatics to generate total costs.

Results A total of 300 adults and 221 parents of children with asthma were included in analysis. The total annual cost of adult asthma was estimated to be SGD 1.74 billion (US\$1.25 billion) with 42% coming from the uncontrolled group, 45% from the partly controlled group, and 13% from the well-controlled group. For children, the total cost is SGD 0.35 billion (US\$0.25 billion), with 64%, 26% and 10% coming from each group respectively. Combined, the annual economic burden of asthma in Singapore is SGD 2.09 billion (US\$1.50 billion) with 79% due to productivity losses.

Conclusion Poorly controlled asthma imposes a significant economic burden. Therefore, better control of disease has the potential to generate not only health improvements, but also medical expenditure savings and productivity gains.

INTRODUCTION

Asthma is a major chronic respiratory disease characterised by inflammation and constriction of the air passages.^{1,2} It manifests through recurrent attacks of symptoms, including shortness of breath, wheeze, chest tightness and cough.^{3,4} It affects approximately 340 million people globally and ranks 16th as the leading cause of years lived with disability.^{4,5}

Inhaled corticosteroids (ICS) are the most effective treatments and standard of care for asthma.^{4,6–8} ICS reduces asthma mortality and exacerbations while improving lung function and symptom control. In the Asia-Pacific region, despite the proven efficacy of ICS medications,^{9–12} most patients continue to rely on reliever medications to treat acute symptoms, resulting in suboptimal control.⁴ More than 40% of patients report at least one unscheduled emergency department (ED)

Key messages

- What is the annual economic burden of asthma among adults and children in Singapore?
- Annual economic burden of asthma is SGD 2.09 billion with 79% coming from lost productivity.
- We present the burden of asthma separately for adults and children, by direct and indirect costs, and by level of symptom control. We then discuss economic benefits of better symptom control.

visit or hospitalisation annually as a result of an asthma attack.^{2,13} Poorly managed asthma also generates avoidable direct costs through physician visits, diagnostic tests, medications and hospitalisations and greater indirect costs in the form of increased work absenteeism and presenteeism (ie, reduced productivity while at work), and in the case of a child asthmatic, time off for parents to care for sick children.^{14,15}

The direct and indirect burden due to asthma is available for numerous countries but no up to date information is available for Singapore.^{13,16–22} The most recent Singapore-based study is over two decades old and is likely no longer relevant due to changes in care pathways, costs of health services, and wage rates.²³ We therefore quantify the direct and indirect costs of asthma for adults and children by level of symptom control (uncontrolled, partly controlled, and well controlled). The results will help employers, providers and policy-makers understand the burden imposed by asthma for adults and children by level of symptom control.

METHODS

A cross-sectional online survey was administered in English to Singapore residents who are members of a national web panel. Participants were recruited through email invitations in early 2020 and provided with a link to a screener. Eligibility, as shown in online supplemental appendix A, required being a Singaporean citizen or permanent resident over age 21, a previous diagnosis of asthma



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or experiencing two or more of the following symptoms not otherwise explained: wheezing, shortness of breath, cough or tightness in the chest with worsening symptoms at night and/or in the morning or that vary over time or in intensity. These criteria were adapted from the National Asthma Education and Prevention Program diagnostic guidelines in consultation with clinical experts.²⁴

The screener identified 315 adult asthmatics (aged 21–65) and additionally, 257 adults who are parents of at least one child (aged 4–20 years) with asthma who consented to participate. Those who completed the questionnaire were compensated by the vendor.

All respondents reported demographic information and monthly employment income (online supplemental appendix A). Participants also responded to Section A of the Global Initiative for Asthma (GINA) questionnaire,⁸ a validated four-question instrument to measure degree of symptom control: frequency of symptoms, reliever use and inhibition in daily activities. Scoring of symptom control was done according to GINA recommendations: well controlled if responses to all questions were 'No', partly controlled if one to two responses were 'Yes', and uncontrolled if three to four responses were 'Yes'.⁸

To quantify healthcare utilisation, participants were asked about frequency of healthcare use 'due to your symptoms' over the prior 12 months as shown in online supplemental appendix A. Checklists were provided which inquired about frequency of physician and outpatient visits, medications, diagnostic tests, ED visits and hospitalisations. To monetise utilisation, unit costs were applied to each type of service based on costs collected through publicly available sources (online supplemental appendix tables C1 and C2). Only those in the labour force were able to generate costs for absenteeism and presenteeism. All costs are reported in 2020 Singapore dollars accompanied by the equivalent in US dollars (SGD 1=US\$0.72).

Lost productivity was quantified using a modified version of the Workplace Productivity and Activity Impairment Questionnaire: Specific Health Problem v2.²⁵ Given the episodic nature of asthma, the investigators found it more appropriate to apply a recall period of 1 month instead of the instrument's original period of 1 week. Absenteeism was captured by having respondents indicate the number of hours missed from work due to problems associated with asthma in the past month. This figure was then multiplied by 11.5 to generate annual hours missed and monetised by multiplying by an hourly wage for each respondent. For full-time employees (160+monthly hours), hourly wages were calculated by dividing reported monthly income by the sum of reported number of monthly hours worked and hours missed from work. Monthly income was assumed to be the midpoint of the reported income category or SGD 10 500 for those who report earnings in the SGD 10 000 or more category. For part-time employees or full-time employees with missing income data, hourly wages were estimated based on the mean hourly wage for full-time

employees in the corresponding occupation category. If a mean hourly wage for full-time employees was not available for a category, missing income was estimated based on the mean hourly wage for full-time employees in the entire sample.

Presenteeism was captured by participants indicating the degree to which asthma symptoms affect their productivity while working on a scale of 0–10, with 0 being 'no symptoms and/or symptoms had no effect on my work' and 10 being 'symptoms completely prevented me from working'. Monthly presenteeism hours were calculated as the product of a participants' presenteeism scale response and their reported monthly number of hours worked.²⁵ This estimate was then annualised and monetised using an analogous approach as for absenteeism.

Surveys for parents answering on behalf of their child were similar except questions were framed with 'due to your child's asthma'. If a participant indicated more than one child with asthma, they were asked to consider only the oldest child. Aside from this framing, the questions were analogous to the adult survey, except for absenteeism which was captured using the Caregiver Indirect and Informal Care Cost Assessment Questionnaire.²⁶ Absenteeism costs were conservatively set to zero for respondents not in the labour force.

Once the data were available, logic checks were conducted to ensure the reported data were in plausible ranges and to identify any responses that seemed problematic. The resulting dataset allowed for quantifying the per capita direct healthcare costs and indirect costs for absenteeism and presenteeism separately for adults and children. These were then stratified by levels of symptom control (well controlled, partly controlled, and uncontrolled) to generate averaged per capita costs for each stratum, which could then be multiplied by the number of individuals within each stratum to generate total costs by strata. The latter figure required us to know how many adults and children in Singapore currently suffer from asthma stratified by symptom control. This could be estimated by multiplying population counts for adults and children times the prevalence rate for asthma for each subgroup of interest. For healthcare costs, we applied population counts for all adults and children but for costs of lost productivity we considered only counts for employed adults.

The numbers of adults and children were available from the Singapore Department of Statistics²⁷ and the employment rate was available from the Ministry of Manpower.²⁸ Asthma prevalence rates were not readily available. For adults and children, we applied prevalence rates of 5.1% and 8.9%, respectively, based on two studies from 2004 as more recent prevalence data was not available.^{29 30} Moreover, the prevalence estimates do not contain information on level of symptom control. Therefore, we estimated the prevalence rate within each symptom control category by assuming the distribution across the three categories is the same in Singapore as it is among respondents to our survey.

Patient and public involvement

The public was involved in the research only during the data collection stage, through invitations to take an online survey. They were not involved in any other parts of the research.

RESULTS

After removing suspect responses (see online supplemental appendix B), 300 adults and 221 parents of children were included in analysis. Out of the adults, 24% were uncontrolled, 38% were partly controlled, and 38% were well controlled. For children, 45% were uncontrolled, 30% partly controlled and 25% well controlled. Using these relative values and ensuring that the sum of the three categories adds to the population prevalence of 5.1% for adults and 8.9% for children yields asthma prevalence of 1.2%, 1.9% and 1.9% for uncontrolled, partly

controlled, and well controlled for adults and 4.0%, 2.7%, and 2.3%, respectively, for children.

Sample characteristics stratified by control status are reported in [table 1](#). Adult participants were on average, 36 years old, of Chinese descent (80%), married (60%), and had completed at least tertiary education (58%). Parents were on average, 39 years old, predominantly Chinese (78%), and had completed at least tertiary education (65%).

Per capita costs are presented in [table 2](#) and online supplemental appendix table D. The left panel reveals that per capita healthcare expenditures for adults are SGD 3150 (US\$2270), SGD 1010 (US\$730) and SGD 270 (US\$190) for the uncontrolled, partly controlled and well-controlled groups, respectively. As shown in online supplemental appendix table D, the largest contributor to healthcare costs are medications.

Table 1 Sample characteristics by asthma control*

	Adult sample (n=300)			Parent sample† (n=221)		
	Uncontrolled (n=72)	Partly controlled (n=114)	Well controlled (n=114)	Uncontrolled (n=99)	Partly controlled (n=66)	Well controlled (n=56)
Age of survey respondent (mean (SD))	33 (8)	37 (10)	39 (34)	37 (8)	39 (9)	43 (9)
Female (%)	32	40	50	–	–	–
Chinese (%)	75	79	85	84	74	73
Married (%)	69	63	50	–	–	–
Employment status (%)						
Employed full time	18	34	32	7	14	7
Employed part time	79	57	54	72	53	57
Unemployed	3	9	13	19	32	34
Unknown	–	–	–	2	2	2
Education level (%)						
Employed full time						
No formal education	–	–	–	1	–	–
Primary to junior college‡	28	41	50	31	38	36
University and above	72	58	50	67	62	64
Unknown	–	0	–	1	–	–
Monthly income (%)						
Less than \$2999	14	18	33	13	20	29
\$3000–5999	40	54	38	34	42	30
\$6,000–9999	26	23	18	32	23	23
\$10 000 and above	18	4	4	19	15	14
Prefer not to answer	1	2	6	1	–	4

*Columns may not sum up to 100 due to rounding.

†Sample characteristics are representative of the parents who responded on behalf of their children.

‡This includes junior college, the Singapore–Cambridge General Certificate of Education Advanced Level (A-Level) examination, polytechnic education, diplomas, vocational training, and Institute of Technical Education (ITE) education. The A-Level is a national examination held annually in Singapore. The examination is taken by school candidates on the completion of preuniversity education at junior colleges, centralised institutions, and Integrated Programmes, and is also open to private candidates. ITE is a public vocational education institution agency in Singapore that provides pre-employment training to secondary school graduates, and continuing education and training to working adults.

**Table 2** Per capita costs by asthma control (SGD) for employed residents

Per capita costs (SD)	Adults			Children		
	Uncontrolled	Partly controlled	Well controlled	Uncontrolled	Partly controlled	Well controlled
Healthcare*	\$3150 (3930)	\$1010 (1870)	\$270 (860)	\$6000 (7410)	\$3680 (5290)	\$1430 (5020)
Absenteeism	\$4870 (12 610)	\$2400 (3820)	\$430 (1150)	\$4110 (5110)	\$2610 (3920)	\$1330 (2050)
Presenteeism	\$17 610 (18 150)	\$14 260 (15 360)	\$4530 (8360)			
Total	\$25 630 (25 000)	\$17 670 (17 450)	\$5230 (8750)	\$10 110 (9050)	\$6290 (7330)	\$2760 (6250)

*Healthcare costs per capita are assumed to be identical for individuals employed and unemployed.

The average number of asthma-related days missed from work per year for employed adults was 19 days, 10 days and 2 days, respectively (online supplemental appendix table E.1). Monetised this translates to SGD 4870 (US\$3510), SGD 2400 (US\$1730) and SGD 430 (US\$310). Presenteeism estimates were much higher. The mean presenteeism score reported was 6, 4 and 2, which translates to annual work loss valued at 62 days, 59 days and 21 days (online supplemental appendix table E.1). Note that although the presenteeism score for the partly controlled group is one-third lower than for the uncontrolled group, annual work loss is only slightly lower because nearly twice as many in the former group work full time (35% vs 18%), thus generating much greater work loss even for the same presenteeism score. Monetised the work loss converts to losses of SGD 17 610 (US\$12 680), SGD 14 260 (US\$10 270), and SGD 4530 (US\$3 260), respectively. Summing the three categories yields per capita total costs of SGD 25 630 (US\$18 450), SGD 17 670 (US\$12 720) and SGD 5230 (US\$3770), for the uncontrolled, partly controlled and well-controlled groups, respectively, for those who are either fully or partly employed. The largest percentage of per capita total costs come from presenteeism at 69%, 81% and 87%. Healthcare expenditures represent 12%, 6% and 5% of the total, respectively (online supplemental appendix table D).

The right panel of table 2 shows per capita costs for children. Trends are similar; children with uncontrolled asthma generate the highest healthcare and

absenteeism costs and children with well-controlled asthma generating the lowest costs. Healthcare expenditures make up the vast majority of costs for children. Additional details are included in online supplemental appendix table D.

Adult residents in Singapore total 3 193 502 and child residents total 627 923. The percentage of adults or parents employed either full or part time is 69%. Multiplying these counts times the asthma prevalence estimates times the per capita total costs yields total costs among adult asthmatics of SGD 0.73 billion (US\$0.53 billion), SGD 0.78 billion (US\$0.56 billion) and SGD 0.23 billion (US\$0.17 billion) for the uncontrolled, partly controlled and well-controlled asthma groups (table 3). Aggregating across the three groups results in a total cost of adult asthma of SGD 1.74 billion (US\$1.25 billion) with 42% coming from the uncontrolled group, 45% from the partly controlled group and 13% from the well-controlled group.

For children, total costs are SGD 0.22 billion (US\$0.16 billion), SGD 0.09 billion (US\$0.06 billion) and SGD 0.03 billion (US\$0.02 billion), respectively (table 3). Summing across groups yields a total cost of SGD 0.35 billion (US\$0.25 billion) for child asthma, with 64% coming from those with uncontrolled asthma, 26% from partly controlled and 10% from the well-controlled group. Aggregating costs for adults and children reveals that the total annual economic burden of asthma in Singapore is SGD 2.09 billion (US\$1.50 billion), with 46% coming from those with uncontrolled asthma, and

Table 3 Total cost of asthma in Singapore by asthma control*†

	Cost of asthma (SGD, billions)			
	Uncontrolled	Partly controlled	Well controlled	Total
Adults	\$0.73	\$0.78	\$0.23	\$1.74
Children	\$0.22	\$0.09	\$0.03	\$0.35
Total	\$0.95	\$0.87	\$0.26	\$2.09

*Numbers may not add up due to rounding.

†Total productivity costs are multiplied by the employment rate in Singapore before adding the total healthcare costs to adjust for those unemployed.

only 13% from those with well-controlled asthma. Children are responsible for 17% of the total.

DISCUSSION

This study quantified the economic burden of asthma in Singapore by level of symptom control. These costs are substantial, totaling SGD 2.09 billion (US\$1.50 billion) annually, with 79% of coming from lost productivity. These costs mainly come from presenteeism, as results reveal that those with asthma tend to come to work but perform below their potential due to their symptoms. Moreover, although they represent only 29% of the total asthma group, the uncontrolled group is responsible for 46% of total costs, whereas the 35% of the asthma population that is well controlled represent only 13% of the total. As a result, if all those with suboptimal control could be improved to well-controlled without cost, the total cost of asthma would be reduced by SGD 1.35 billion (US\$0.97 billion). Although greater control would come at a cost, many of the asthma control interventions, including national asthma programmes,^{31 32} ICS medications, newer biological treatments³³ and bronchial thermoplasty^{34 35} have been shown to be cost effective.^{4 36} Our results further show the potential for cost savings given the high medical cost and productivity burden among those with poor control.

Our results are in line with prior estimates. We find that 87% of our sample has uncontrolled or partly controlled asthma, which is identical to that reported in a prior study in Singapore.³⁷ We estimate annual asthma per capita healthcare costs across all symptom groups at SGD 1290 (US\$930). Consistent with Singapore being a low-cost provider of health services, this estimate is below that of Switzerland (Swiss Health Consumer Price Index (CPI): <http://www.oecd.org/sdd>; exchange rate: CHF 1=SGD 1.47) (SGD 2603), USA (USA Medical Care CPI: <https://fred.stlouisfed.org/series/CPIMEDSL>; exchange rate: US\$1=SGD 1.38) (SGD 2021), and Hong Kong (Hong Kong CPI: <https://data.worldbank.org/indicator/FP.CPI.TOTL?locations=HK>; costs were in US\$) (SGD 1957) after accounting for inflation and converting to SGD.^{13 17 38} For absenteeism, our sample reports an average of 6.6 hours missed over the past month, which is roughly half of the 13.6 hours average reported in a study of six countries.³⁹ Our respondents also report an average score of 4 on the presenteeism scale, just one unit above the average score from the same international study (4 vs 3).³⁹

This study is not without limitations. A primary limitation is the potential for selection bias of the survey respondents. The survey relies on a convenience sample of asthma participants (and their parents) from an online panel and there is no way to determine whether those who chose to participate are representative of individuals with asthma in the broader community. Because the survey relies on self-report, it is also prone to recall and self (and parent)-report bias. Also, although we were

able to quantify per capita and total medical costs, we did not assess whether these costs are paid by government, private insurance, out of pocket or other sources. Future studies should validate these results with utilisation or claims data from other sources and identify the percentage of costs that are funded by various payers.

Because we do not have asthma prevalence data by race or socioeconomic status, we also assume there are no differences by these factors in the use of health services. Yet, in Singapore, Malay asthmatics have higher health-care utilisation⁴⁰ and greater work impairment.⁴¹ They are also under-represented in the online panel, suggesting an additional source of potential bias. The analysis is also limited by use of dated statistics and imputation to generate current asthma prevalence by level of symptom control, by excluding those below age 4 and over age 65, and by not including caregiver costs for those who may take care of adult asthmatics. For all of these reasons, our prevalence, unit cost and total cost estimates are potentially biased and associated with high variability that could not be properly estimated. Rather than attempt to incorporate this uncertainty into the analysis, we note that even if our figures are off by an order of magnitude, more precise estimates will not change the conclusion that asthma imposes a significant economic burden in Singapore and that the potential exists to reduce the burden through effective policies and treatments.

Contributors EAF supervised this study overall. He conceptualised the study and methodology, conducted formal analyses, validated the survey, drafted the original version of the manuscript and was involved in all manuscript revisions leading to submission. EL conducted formal analyses, drafted the original version of the manuscript and was involved in all manuscript revisions leading to submission. BD conceptualised the study and methodology, validated the survey, worked on writing and editing the manuscript. BO acquired funding for this study, conceptualised the study and methodology, validated the survey, and was involved in all manuscript revisions leading to submission. MSK conceptualised the study and methodology, validated the survey, and was involved in all manuscript revisions leading to submission.

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Competing interests EAF: has done paid consulting work for AstraZeneca and other Pharma companies. BO: is an employee of AstraZeneca. However, he had no role in the analysis and AstraZeneca did not have a right of refusal on publication. MSK: has grant support from Astra-Zeneca, and received honoraria for lectures and advisory board meetings paid to her hospital (Singapore General Hospital) from GlaxoSmithKline, Astra-Zeneca, Sanofi, Novartis and Boehringer Ingelheim, outside the submitted work.

Patient consent for publication Not required.

Ethics approval Institutional Review Board (IRB) approval was obtained (NUS-IRB Ref: S19-289)

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. Deidentified data can be made available to replicate these results with an approved IRB document.

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Appendix A – Survey

Hello! You are invited to participate in a research study. This sheet provides you with information about the study. Please read through it carefully and respond with a 'Yes' or 'No' to express your consent. Based on your consent and responses to a short screener, you may be eligible for an online survey that will take about 15-20 minutes to complete.

PARTICIPANT INFORMATION SHEET & CONSENT FORM (For Social, Behavioural and Educational Research studies)



Thank you for your interest in this study. The following information explains the study in more detail.

1. Principal Investigator and co-investigator(s), if any, with the contact number and organization:

Duke-NUS Principal Investigator
Professor Eric A. Finkelstein
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2. What is the purpose of this research?

We are conducting a brief health and medical survey to learn about people's experiences with certain medical conditions. There are no right or wrong answers. Results will be used to increase our understanding of healthcare utilization and costs for these conditions.

3. Who can participate in the research? What is the expected duration of my participation? What is the duration of this research?

Individuals are eligible to participate in the study if they are Singaporeans or Singapore Permanent Residents, and aged between 21 and 65 years. Individuals meeting these criteria will also be eligible for a secondary survey if they have a child between the ages of 4 and 20 years old. The survey should take approximately 15-20 minutes to complete. Participants will be recruited over a period of up to 6 months, after which the results from the survey will be analysed and written up for publication in a peer-reviewed journal. All together, the research will be performed over a period of 9 months.

4. What is the approximate number of research participants involved?

Up to 1,000 participants will complete the survey.

5. What will be done if I take part in this research study?

You will be asked to complete a one-time online survey, which will take approximately 15-20 minutes to complete. The survey contains a number of questions that ask whether or not you or your child have experienced different medical symptoms such as wheezing, coughing, chest

tightness, and breathlessness and on the amount of money you have spent on healthcare and other items as a result of these symptoms.

- 6. How will my privacy and the confidentiality of my research records be protected?**
The survey is anonymous and no identifying information will be collected. All data will be analysed and reported as summary measures on a group level. All data will also be saved in password protected files on a password protected computer. Be assured that your identity and the information given will be kept strictly confidential and that only group data will be reported.
- 7. What are the possible discomforts and risks for participants?**
There are no risks associated with this study. The survey is anonymous and participation is completely voluntary.
- 8. What is the compensation for any injury?**
Not applicable, as the survey is a one-time, anonymous on-line survey.
- 9. Will there be reimbursement for participation?**
Participants will not receive payment for completing the survey. However, participants will receive points from the on-line vendor for participation.
- 10. What are the possible benefits to me and to others?**
By participating in the study, individuals will contribute to the advancement of knowledge concerning a better understanding of the burden of disease associated with the above-mentioned symptoms to Singaporean society. This information may be used to help facilitate the development of new treatments as well as improve access to existing treatments that address these symptoms. Participants will also receive points from the vendor for completing the survey, but aside from that there are no direct benefits of participation.
- 11. Can I refuse to participate in this research?**
Yes, you can. Your decision to participate in this research study is voluntary and completely up to you.
- 12. Whom should I call if I have any questions or problems?**
Please contact the Principal Investigator, Eric Finkelstein or Eden Lau (email: eden.lau@duke-nus.edu.sg) for all research-related matters."

"For an independent opinion regarding the research and the rights of research participants, you may contact a staff member of the National University of Singapore Institutional Review Board (at telephone (+65) 6516 4311 or email at irb@nus.edu.sg)."

Disclaimer: This survey is only for data collection purposes. Any content mentioned herein should not be treated as Medical Advice/Treatment/Prescription or related terms. Data collection company and NUS cannot be held liable for any medical or non-medical consequences.

Intro A: "Have you read the information section and agree to participate in this research study?"

- 1 Yes (If yes, move to intro b)
2 No (If no, show message "Feel free to read FAQ. Link is provided at the bottom of the page")

Intro B. Do you agree to participate in this research study?

- 1 Yes
2 No

[TERMINATE if NO]

SCREENER PART 1

Refuse to
answer

S1 Are you a Singaporean Citizen or Permanent Resident (PR)?	
<input type="checkbox"/> 1	Yes
<input type="checkbox"/> 2	No
<p>[TERMINATE if NO] [Thank you for participating. Unfortunately, you are not eligible for this particular study. However, we appreciate that you took the time to participate. We look forward to inviting you to a future study.]</p>	

S2	How old are you? <input type="text"/> years old [TERMINATE if <21 OR >65] [Thank you for participating. Unfortunately, you are not eligible for this particular study. However, we appreciate that you took the time to participate. We look forward to inviting you to a future study.]				
S3	Do you have any children who are between 4 and 18 years old? <table border="1"><tr><td><input type="checkbox"/>1</td><td>Yes</td></tr><tr><td><input type="checkbox"/>2</td><td>No</td></tr></table> <p>[If yes, participant will be asked S10. If no, do NOT ask child screener or survey.]</p>	<input type="checkbox"/> 1	Yes	<input type="checkbox"/> 2	No
<input type="checkbox"/> 1	Yes				
<input type="checkbox"/> 2	No				
S4	Have you EVER been diagnosed with asthma by a physician? <table border="1"><tr><td><input type="checkbox"/>1</td><td>Yes</td></tr><tr><td><input type="checkbox"/>2</td><td>No</td></tr></table> <p>[If "yes", skip to Introduction (direct inclusion in study).]</p>	<input type="checkbox"/> 1	Yes	<input type="checkbox"/> 2	No
<input type="checkbox"/> 1	Yes				
<input type="checkbox"/> 2	No				

S5		Have you EVER been diagnosed by a physician with having long-term cough or excessive mucus (phlegm)?	
<input type="checkbox"/> 1	Yes		
<input type="checkbox"/> 2	No		
<p>[If S5 = 'yes', end adult survey.] [(If S3=1) skip to S10.] [(If S3=2) TERMINATE: Thank you for participating. Unfortunately, you are not eligible for this particular study. However, we appreciate that you took the time to participate. We look forward to inviting you to a future study.]</p>			
S6		Have you experienced any of the following symptoms over the LAST 12 MONTHS? Please check all that apply.	
		Yes (1)	No (2)
S6.1	Wheezing (or a whistling noise in your chest)	<input type="checkbox"/>	<input type="checkbox"/>
S6.2	Shortness of breath	<input type="checkbox"/>	<input type="checkbox"/>
S6.3	Cough	<input type="checkbox"/>	<input type="checkbox"/>
S6.4	Tightness in your chest	<input type="checkbox"/>	<input type="checkbox"/>
<p>[If <2 "Yes", TERMINATE.] [Thank you for participating. Unfortunately, you are not eligible for this particular study. However, we appreciate that you took the time to participate. We look forward to inviting you to a future study.]</p>			
S7		Were your symptoms (wheeze, shortness of breath, cough, and tightness in chest) often worse at night or in the early morning?	
<input type="checkbox"/> 1	Yes		
<input type="checkbox"/> 2	No		

S8			
Did your symptoms vary over time and in intensity over the LAST 12 MONTHS?			
<input type="checkbox"/> 1	Yes		
<input type="checkbox"/> 2	No		
<p>[If “No” to both S7 and S8, TERMINATE] [Thank you for participating. Unfortunately, you are not eligible for this particular study. However, we appreciate that you took the time to participate. We look forward to inviting you to a future study.]</p>			
S9			
Were your symptoms triggered or worsened by any of the following? Please check all that apply.			
		Yes (1)	No (2)
S9.1	Viral infections (colds)	<input type="checkbox"/>	<input type="checkbox"/>
S9.2	Exercise or other physical activity	<input type="checkbox"/>	<input type="checkbox"/>
S9.3	Allergies	<input type="checkbox"/>	<input type="checkbox"/>
S9.4	Changes in the weather	<input type="checkbox"/>	<input type="checkbox"/>
S9.5	Pollution or irritants (e.g. car exhaust fumes, smoke, or strong smells)	<input type="checkbox"/>	<input type="checkbox"/>
S9.6	Dizziness, light-headedness, or an abnormal tingling sensation	<input type="checkbox"/>	<input type="checkbox"/>
<p>[If S9.1 to S9.5 are ALL “no” and/or S9.6 is “yes”, TERMINATE] [Thank you for participating. Unfortunately, you are not eligible for this particular study. However, we appreciate that you took the time to participate. We look forward to inviting you to a future study.]</p>			

INTRODUCTION

Thank you for completing the screener. **Your responses indicate that** you are eligible to participate in our online survey. In the above section, you indicated that you experienced certain symptoms such as coughing, chest tightness, wheezing, and shortness of breath. The following questionnaire asks you about these symptoms and how they affect your life. Please answer the questions to the best of your knowledge.

PLEASE CLICK '**NEXT**' TO BEGIN THE SURVEY.

GENERAL INFORMATION

G11	What is your gender?			
	<input type="checkbox"/> 1	Male		
	<input type="checkbox"/> 2	Female		
	<input type="checkbox"/> 3	Prefer not to answer		
G12	Which ethnic group do you belong to?			
	<i>If others, please type in your response in the text box and "others" will automatically be selected.</i>			
	<input type="checkbox"/> 1	Chinese		
	<input type="checkbox"/> 2	Malay		
	<input type="checkbox"/> 3	Indian		
<input type="checkbox"/> 4	Others (For e.g. Eurasians, Caucasians etc.), please specify _____			
G13	What is your current marital status?			
	<input type="checkbox"/> 1	Married	<input type="checkbox"/> 4	Divorced
	<input type="checkbox"/> 2	Separated	<input type="checkbox"/> 5	Single
	<input type="checkbox"/> 3	Widowed		

ASTHMA CHARACTERISTICS

You have indicated that you have previously experienced symptoms such as wheeze, cough, chest tightness and/or shortness of breath. In this section, we will ask questions that help describe your “symptoms” and how it affects how you feel and what you are able to do. To answer, please check **ONE** box that describes your answer.

Q1	In the <u>LAST 4 WEEKS</u>, have you had daytime symptoms more than twice per week?	
	<input type="checkbox"/> 1	Yes
	<input type="checkbox"/> 2	No
Q2	In the <u>LAST 4 WEEKS</u>, have you had any night walking due to your symptoms?	
	<input type="checkbox"/> 1	Yes
	<input type="checkbox"/> 2	No
Q3	In the <u>LAST 4 WEEKS</u>, have you had to use a reliever for your symptoms more than twice per week?	
	<input type="checkbox"/> 1	Yes
	<input type="checkbox"/> 2	No
Q4	In the <u>LAST 4 WEEKS</u>, have you had any activity limitation due to your symptoms?	
	<input type="checkbox"/> 1	Yes
	<input type="checkbox"/> 2	No

QUALITY OF LIFE

The following questions will ask about your quality of life due to your symptoms (cough, wheeze, chest tightness, and/or shortness of breath). Please respond by checking ONE box that best describes how you have been during the **LAST 4 WEEKS** as a result of your symptoms.

Q5 In general, how much of the time during the <u>LAST 4 WEEKS</u> did you:		None of the time (1)	Some of the time (2)	All of the time (3)
Q5A	Feel short of breath as a result of your symptoms?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q5B	Feel concerned about having your symptoms?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q5C	Feel bothered by or have to avoid going outside because of the weather or air pollution?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q5D	Have difficulty getting a good night's sleep as a result of your symptoms?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q5E	Feel limited in any activity done due to your symptoms?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

COMORBIDITIES

Q6		Have you ever been diagnosed by a physician as having any of the following? Please check all that apply: <i>If other, please type in your response in the text box and "other" will automatically be selected.</i>
<input type="checkbox"/>	1	Diabetes mellitus
<input type="checkbox"/>	2	Asthma
<input type="checkbox"/>	3	Overweight / Obesity
<input type="checkbox"/>	4	High blood cholesterol
<input type="checkbox"/>	5	High blood pressure (hypertension)
<input type="checkbox"/>	6	Heart disease
<input type="checkbox"/>	7	Cancer
<input type="checkbox"/>	8	Depression or other mental health condition
<input type="checkbox"/>	9	Osteoporosis
<input type="checkbox"/>	10	Arthritis or Osteoarthritis
<input type="checkbox"/>	11	Migraine
<input type="checkbox"/>	12	Stroke
<input type="checkbox"/>	13	Kidney ailments (weak or failing kidneys)
<input type="checkbox"/>	14	Psychosocial conditions
<input type="checkbox"/>	15	Gastroesophageal reflux disease (GERD)
<input type="checkbox"/>	16	Atopy (the tendency to develop allergic conditions such as allergic rhinitis, eczema, etc.)
<input type="checkbox"/>	17	Other major health condition
		If other, please specify: <input type="text"/>
<input type="checkbox"/>	18	No major health condition (exclusive option)

ABSENTEEISM AND PRESENTEEISM

Q7		Are you currently employed or self-employed (i.e., working for pay)?
<input type="checkbox"/> 1	Yes	
<input type="checkbox"/> 2	No	
[If yes, participant will SKIP to Q9.]		
Q8		If you are currently not employed, is it because of a medical condition?
<input type="checkbox"/> 1	Yes	
<input type="checkbox"/> 2	No	
[If no, participant will SKIP to Q11.]		
Q8A		(If Q8=1) Because of which of the following medical conditions are you currently not employed? Please check all that apply.
<input type="checkbox"/> 1	Diabetes mellitus	
<input type="checkbox"/> 2	Asthma	
<input type="checkbox"/> 3	Overweight / Obesity	
<input type="checkbox"/> 4	High blood cholesterol	
<input type="checkbox"/> 5	High blood pressure (hypertension)	
<input type="checkbox"/> 6	Heart disease	
<input type="checkbox"/> 7	Cancer	
<input type="checkbox"/> 8	Depression or other mental health condition	
<input type="checkbox"/> 9	Osteoporosis	
<input type="checkbox"/> 10	Arthritis or Osteoarthritis	
<input type="checkbox"/> 11	Migraine	
<input type="checkbox"/> 12	Stroke	
<input type="checkbox"/> 13	Kidney ailments (weak or failing kidneys)	
<input type="checkbox"/> 14	Psychosocial conditions	
<input type="checkbox"/> 15	Gastroesophageal reflux disease (GERD)	
<input type="checkbox"/> 16	Atopy (the tendency to develop allergic conditions such as allergic rhinitis, eczema, etc.)	
<input type="checkbox"/> 17	Other major health condition	
	If other, please specify: <input type="text"/>	

The following questions ask about the effect of your symptoms (cough, wheeze, chest tightness, and/or shortness of breath) on your ability to work over the **LAST 4 WEEKS**, not including today. Please fill in the blanks or select a number, as indicated.

Q9 During the **LAST 4 WEEKS**, how many hours did you miss from work because of problems associated with your symptoms?

Include hours missed on days you did not work at all, days you went in late, days you left early, etc. because of your symptoms. Do not include time you missed to participate in this study.

Hours

Q10 During the **LAST 4 WEEKS**, how many hours did you actually work?

Hours

[If 0, participant will SKIP to Q11]

Q10A During the **LAST 4 WEEKS**, how much did your symptoms affect your productivity while you were working?

Think about days you were limited in the amount or kind of work you could do, days when you accomplished less than you would like, or days you could not do your work as carefully as usual. If your symptoms affected your work only a little, choose a low number. Choose a high number if your symptoms affected your work a great deal.

No symptoms and/or symptoms had no effect on my work	0	1	2	3	4	5	6	7	8	9	10	Symptoms completely prevented me from working
---	---	---	---	---	---	---	---	---	---	---	----	--

HEALTHCARE RESOURCE CONSUMPTION AND EXPENDITURE DUE TO ASTHMA

The next questions will ask you about your healthcare resource consumption because of your symptoms (cough, wheeze, shortness of breath, and/or chest tightness).

Please DO NOT consider any other symptoms or medical conditions when answering the following questions.

Q11 Have you consulted a physician regarding your symptoms in the <u>LAST 12 MONTHS</u>?					
<input type="checkbox"/> 1	Yes				
<input type="checkbox"/> 2	No				
[If Q11 is NO, participant will SKIP to Q12.]					
Q11A (If Q11=1) Below is a list of clinics and physician types. If you have visited any of the following in the <u>LAST 12 MONTHS</u> because of your symptoms, please enter the number of visits made. Please <u>ONLY</u> include visits made for your symptoms (cough, wheeze, chest tightness, and/or shortness of breath) and <u>NOT</u> any other medical conditions you may have. <i>Please type in your response in the text box to automatically select that option.</i>					
			Yes (1)	No (2)	If yes, please state the number of visits made in the <u>LAST 12 MONTHS</u>.
	Q11A_1	Polyclinic	<input type="checkbox"/>	<input type="checkbox"/>	_____
	Q11A_2	Private General Practitioner (GP)	<input type="checkbox"/>	<input type="checkbox"/>	_____
	Q11A_3	Specialist (e.g. Allergist, Immunologist, Respiratory specialist, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	_____
	Q11A_4	Alternative Practitioner (e.g. Accupuncturist, Chiropractor, Biofeedback Therapist, Traditional Medicine (TCM, Ayurvedic), Homeopathy etc.)	<input type="checkbox"/>	<input type="checkbox"/>	_____
Q12 Have you taken any medication for your symptoms in the <u>LAST 12 MONTHS</u>?					
<input type="checkbox"/> 1	Yes				
<input type="checkbox"/> 2	No				

[If Q12 is NO, participant will SKIP to Q13.]

Q12A (If Q12=1) Below is a list of medications and medical devices commonly used to treat your symptoms. Please check all that you have taken in the <u>LAST 12 MONTHS</u> to address your symptoms and check how often you take these medications:				
<p>Disclaimer - This survey is only for data collection purposes. Any content mentioned herein should not be treated as Medical Advice/Treatment/Prescription or related terms. Data collection company and NUS cannot be held liable for any medical or non-medical consequences.</p>				
		Yes (1)	No (2)	If yes, <u>how often do you take these medications</u>
Inhaled Relievers				
Q12A_1	Blue inhaler/Ventolin (Salbutamol or other brands)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Inhaled Corticosteroids				
Q12A_2	Flixotide (Fluticasone)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q12A_3	Pulmicort (Budesonide)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q12A_4	Giona (Budesonide)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q12A_5	Becllo-asma (Beclomethasone)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Inhaled Corticosteroids with long-acting beta-agonist				
Q12A_6	Seretide (Fluticasone/Salmeterol)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q12A_7	Symbicort (Budesonide/Formoterol)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed

Q12A_8	Relvar (Fluticasone/Vilanterol)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q12A_9	Foster/Fostair (Beclometasone/Formoterol)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q12A_10	Flutiform (Fluticasone/Formoterol)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Other medications				
Q12A_11	Oral steroids (prednisolone, dexamethasone, hydrocortisone)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q12A_12	Singulair (Montelukast or other leukotriene antagonists such as Zafirlukast)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q12A_13	Oral Salbutamol (tablet or suspension)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q12A_14	Theophylline	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q12A_15	Atrovent (Inhaled Ipratropium bromide)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q12A_16	Spiriva (Inhaled tiotropium bromide)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q12A_17	Injectable Biologics (Xolair, Nucala, Fasenra)	<input type="checkbox"/>	<input type="checkbox"/>	Number of injections received in the LAST 12 MONTHS: _____
Q12A_18	Bronchothermoplasty procedure	<input type="checkbox"/>	<input type="checkbox"/>	Number of procedures performed in LAST 12 MONTHS: _____
Q13	Have you used any alternative medications/therapies (e.g. Homeopathy, Traditional Medicine, Acupuncture) to treat your symptoms in the <u>LAST 12 MONTHS</u>?			
	<input type="checkbox"/> 1	Yes		
	<input type="checkbox"/> 2	No		

[If Q13 is NO, participant will SKIP to Q14.]	
Q13A (If Q13=1) Over the LAST 12 MONTHS , roughly how much money have you spent, out of your pocket, on alternative medications/therapies (e.g. Homeopathy, Traditional Medicine, Acupuncture) to treat your symptoms (EXCLUDING any money that insurers, your employer or other third parties may have paid)? <input type="text"/> SGD	
Q14 Have you undergone any diagnostic, lab, blood or other tests related to your symptoms in the LAST 12 MONTHS ?	
<input type="checkbox"/> 1	Yes
<input type="checkbox"/> 2	No
[If Q 14 is NO, participant will SKIP to Q15.]	

Q14A	(If Q14=1) Below is a list of medical / lab tests that you may have undergone for the evaluation of your symptoms. If you have taken any of the following tests in the <u>Last 12 MONTHS</u>, please enter the number of tests taken.			
	<i>Please type in your response in the text box to automatically select that option.</i>			
		Yes (1)	No (2)	If yes, please state the number of tests taken in the <u>LAST 12 MONTHS</u>.
Q14A_1	Spirometry	<input type="checkbox"/>	<input type="checkbox"/>	_____
Q14A_2	Provocation Test (e.g. Methacholine Challenge, Irritant Challenge, Exercise Challenge)	<input type="checkbox"/>	<input type="checkbox"/>	_____
Q14A_3	Peak Flow Test	<input type="checkbox"/>	<input type="checkbox"/>	_____
Q14A_4	Exhaled Nitric Oxide Test (FeNO Test)	<input type="checkbox"/>	<input type="checkbox"/>	_____
Q14A_5	Sinus X-Ray	<input type="checkbox"/>	<input type="checkbox"/>	_____
Q14A_6	Chest X-Ray	<input type="checkbox"/>	<input type="checkbox"/>	_____
Q14A_7	Blood Test	<input type="checkbox"/>	<input type="checkbox"/>	_____
Q14A_8	Skin Prick Test	<input type="checkbox"/>	<input type="checkbox"/>	_____
Q14A_9	Other tests	<input type="checkbox"/>	<input type="checkbox"/>	_____
	If other, please specify: _____			
Q15	In the <u>LAST 12 MONTHS</u>, have you made any visits to a Hospital Emergency Department (ED) that did not require an inpatient admission because of your symptoms? (Spent less than 1 night in the hospital)			
<input type="checkbox"/>	1	Yes		
<input type="checkbox"/>	2	No		
	[If Q 15 is NO, participant will SKIP to Q16.]			
Q15A	(If Q15= 1) Please enter the number of visits you have made to a Hospital Emergency Department that did not require an inpatient admission due to your symptoms in the <u>LAST 12 MONTHS</u>.			

	<input type="text"/> visits
Q16	In the <u>LAST 12 MONTHS</u>, have you required hospitalisation because of your symptoms? (Spent 1 or more nights in the hospital)
<input type="checkbox"/> 1	Yes
<input type="checkbox"/> 2	No
[If Q16 is NO, participant will SKIP to G14.]	
Q16A	(If Q16= 1) Please enter the number of days you were hospitalized due to your symptoms in the <u>LAST 12 MONTHS</u>. <input type="text"/> Days

DEMOGRAPHIC QUESTIONS

Finally, this section asks a few more questions about your education, employment, and housing status. Please select a box that BEST describes your current status.

GI4 What is your highest education level completed?			
<input type="checkbox"/> 1	No formal education	<input type="checkbox"/> 5	Junior College / Polytechnic / Diploma (including A Levels)
<input type="checkbox"/> 2	Primary	<input type="checkbox"/> 6	University and above
<input type="checkbox"/> 3	Secondary (including O Levels)	<input type="checkbox"/> 7	Don't know
<input type="checkbox"/> 4	Vocational / ITE		
GI5 Which category best describes your occupation? <i>If other, please type in your response in the text box and "other" will automatically be selected.</i>			
<input type="checkbox"/> 1	Manager (e.g. retail sales manager, advertising manager)	<input type="checkbox"/> 7	Craftsman or Related Trade Worker (e.g. electrician, plumber, foreman)
<input type="checkbox"/> 2	Professional (e.g. accountant, engineer etc. with little/no managerial capacity)	<input type="checkbox"/> 8	Plant and Machine Operator or Assembler (e.g. bus driver, machine operator in a plant)
<input type="checkbox"/> 3	Associate Professional (e.g. assistant accountant, assistant engineer) or Technician (e.g. lab technician, telecommunications technician)	<input type="checkbox"/> 9	Cleaner, Labourer or Related Worker (e.g. janitor, watchman)
<input type="checkbox"/> 4	Clerical Support Worker (e.g. data entry clerk, bank teller)	<input type="checkbox"/> 10	Self-employed
<input type="checkbox"/> 5	Service or Sales Worker (e.g. postman, cook)	<input type="checkbox"/> 11	Other, please specify: _____
<input type="checkbox"/> 6	Agricultural or Fishery Worker (e.g. gardener)		
GI6 What is your typical monthly employment income from all sources?			
<input type="checkbox"/> 1	Less than \$1000	<input type="checkbox"/> 6	\$5000 - \$5999
<input type="checkbox"/> 2	\$1000 - \$1999	<input type="checkbox"/> 7	\$6000 - \$6999
<input type="checkbox"/> 3	\$2000 - \$2999	<input type="checkbox"/> 8	\$7000 - \$9999
<input type="checkbox"/> 4	\$3000 - \$3999	<input type="checkbox"/> 9	\$10,000 and over
<input type="checkbox"/> 5	\$4000 - \$4999	<input type="checkbox"/> 99	Prefer not to answer
GI7 What type of housing are you living in? <i>If others, please type in your response in the text box and "others" will automatically be selected.</i>			

<input type="checkbox"/> 1	HDB/ JTC Flat (1-2 room)	<input type="checkbox"/> 5	Condominium/ Private flat
<input type="checkbox"/> 2	HDB/ JTC Flat (3 room)	<input type="checkbox"/> 6	Bungalow/ Semi-detached/ terrace house
<input type="checkbox"/> 3	HDB/ JTC Flat (4 room)	<input type="checkbox"/> 7	Shop house
<input type="checkbox"/> 4	HDB flat (5 room and above/ Executive)	<input type="checkbox"/> 8	Others, specify

[If participant answered YES to S3, they will be shown the child screener.]

[If participant answered NO, they will terminate the survey here: “Thank you for completing the survey. The protocol title for this study is Economic Burden of Asthma in Singapore.”]

SCREENER PART 2Refuse to
answer

S10	
<p>You indicated above that you have at least one child between the ages of 4 and 20. Based on your consent and responses to a short screener, you may be eligible for an online survey about your child's medical conditions that will take about 15-20 minutes to complete.</p> <p>Would you like to continue?</p>	
<input type="checkbox"/> 1	Yes
<input type="checkbox"/> 2	No
<p>[TERMINATE if NO.]</p> <p>[Thank you for participating. Unfortunately, you are not eligible for this particular study. However, we appreciate that you took the time to participate. We look forward to inviting you to a future study.]</p>	
S11	
<p>How many children between the ages of 4 and 20 do you have?</p> <p><input type="text"/></p>	
S12	
<p>Have any of these children EVER been diagnosed with asthma by a physician?</p>	
<input type="checkbox"/> 1	Yes
<input type="checkbox"/> 2	No
S12A	<p>(If S12=Yes) How many of your children have been clinically diagnosed for asthma?</p> <p>[If "yes", skip to Introduction (direct inclusion in study).]</p> <p><input type="text"/></p>

S13			
Have any of your children EVER been diagnosed with having long-term cough or excessive mucus (phlegm) by a physician?			
<input type="checkbox"/>	1	Yes	
<input type="checkbox"/>	2	No	
[If 'yes', end survey.]			
[TERMINATE: Thank you for participating. Unfortunately, you are not eligible for this particular study. However, we appreciate that you took the time to participate. We look forward to inviting you to a future study.]			
S14			
Have any of you you're your children experienced any of the following symptoms over the LAST 12 MONTHS? Please check all that apply.			
		Yes (1)	No (2)
S14.1	Wheezing (or a whistling noise in your chest)	<input type="checkbox"/>	<input type="checkbox"/>
S14.2	Shortness of breath	<input type="checkbox"/>	<input type="checkbox"/>
S14.3	Cough	<input type="checkbox"/>	<input type="checkbox"/>
S14.4	Tightness in your chest	<input type="checkbox"/>	<input type="checkbox"/>
[If <2 "Yes", TERMINATE.]			
[Thank you for participating. Unfortunately, you are not eligible for this particular study. However, we appreciate that you took the time to participate. We look forward to inviting you to a future study.]			
S15			
Were your child's (or children's) symptoms (wheeze, shortness of breath, cough, and/or tightness in chest) often worse at night or in the early morning?			
<input type="checkbox"/>	1	Yes	
<input type="checkbox"/>	2	No	
S16			
Did your child's (or children's) symptoms vary over time and in intensity over the LAST 12 MONTHS?			
<input type="checkbox"/>	1	Yes	
<input type="checkbox"/>	2	No	

<p>[If “No” to both S15 and S16, TERMINATE]</p> <p>[Thank you for participating. Unfortunately, you are not eligible for this particular study. However, we appreciate that you took the time to participate. We look forward to inviting you to a future study.]</p>			
<p>S17</p> <p>Were your child’s (or children’s) symptoms triggered or worsened by any of the following? Please check all that apply.</p>			
		Yes (1)	No (2)
S17.1	Viral infections (colds)	<input type="checkbox"/>	<input type="checkbox"/>
S17.2	Exercise or other physical activity	<input type="checkbox"/>	<input type="checkbox"/>
S17.3	Allergies	<input type="checkbox"/>	<input type="checkbox"/>
S17.4	Changes in the weather	<input type="checkbox"/>	<input type="checkbox"/>
S17.5	Pollution or irritants (e.g. car exhaust fumes, smoke, or strong smells)	<input type="checkbox"/>	<input type="checkbox"/>
S17.6	Dizziness, light-headedness, or an abnormal tingling sensation	<input type="checkbox"/>	<input type="checkbox"/>
<p>[If S17.1 to S17.5 are ALL “no” and/or S17.6 is “yes”, TERMINATE]</p> <p>[Thank you for participating. Unfortunately, you are not eligible for this particular study. However, we appreciate that you took the time to participate. We look forward to inviting you to a future study.]</p>			

INTRODUCTION - CHILDREN

Thank you for completing the screener. Your responses indicate that you are eligible to participate in our online survey. In the above section, you indicated that your child or children experienced certain symptoms such as coughing, chest tightness, wheezing, and/or shortness of breath. The following questionnaire asks you about their symptoms and their effects on work and healthcare consumption. **If you have more than one child with the above symptoms, please ONLY consider the oldest among them when answering questions about “your child” throughout the survey.** Please answer the questions to the best of your knowledge.

PLEASE CLICK '**NEXT**' TO BEGIN THE SURVEY.

GENERAL INFORMATION - CHILDREN

G18	What is your child's gender?	
	<input type="checkbox"/> 1	Male
	<input type="checkbox"/> 2	Female
	<input type="checkbox"/> 3	Prefer not to answer
G19	Which ethnic group does your child belong to?	
	<i>If others, please type in your response in the text box and "others" will automatically be selected.</i>	
	<input type="checkbox"/> 1	Chinese
	<input type="checkbox"/> 2	Malay
	<input type="checkbox"/> 3	Indian
<input type="checkbox"/> 4	Others, please specify _____	

ASTHMA CHARACTERISTICS - CHILDREN

You have indicated that your child has previously experienced symptoms such as wheeze, cough, chest tightness and/or shortness of breath. In this section, we will ask questions that help describe their “symptoms” and how it affects how they feel and what they are able to do. To answer, please check **ONE** box that describes your answer.

Q17	In the <u>LAST 4 WEEKS</u>, has your child had daytime symptoms more than twice per week?	
	<input type="checkbox"/> 1	Yes
	<input type="checkbox"/> 2	No
Q18	In the <u>LAST 4 WEEKS</u>, has your child had any night walking due to their symptoms?	
	<input type="checkbox"/> 1	Yes
	<input type="checkbox"/> 2	No
Q19	In the <u>LAST 4 WEEKS</u>, has your child had to use a reliever for your symptoms more than twice per week?	
	<input type="checkbox"/> 1	Yes
	<input type="checkbox"/> 2	No
Q20	In the <u>LAST 4 WEEKS</u>, has your child had any activity limitation due to their symptoms?	
	<input type="checkbox"/> 1	Yes
	<input type="checkbox"/> 2	No

QUALITY OF LIFE - CHILDREN

The following questions will ask about your child's quality of life due to their symptoms (cough, wheeze, chest tightness, and/or shortness of breath). Please respond by checking ONE box that best describes how your child has been during the **LAST 4 WEEKS** as a result of their symptoms.

Q21 In general, how much of the time during the <u>LAST 4 WEEKS</u> did your child:		None of the time (1)	Some of the time (2)	All of the time (3)
Q21A	Feel short of breath as a result of their symptoms?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q21B	Feel concerned about having their symptoms?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q21C	Feel bothered by or have to avoid going outside because of the weather or air pollution?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q21D	Have difficulty getting a good night's sleep as a result of their symptoms?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q21E	Feel limited in any activity done due to their symptoms?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

COMORBIDITIES - CHILDREN

Q22	
Has your child ever been diagnosed by a physician as having any of the following? Please check all that apply:	
<i>If other, please type in your response in the text box and "other" will automatically be selected.</i>	
<input type="checkbox"/>	1 Diabetes mellitus
<input type="checkbox"/>	2 Asthma
<input type="checkbox"/>	3 High blood pressure (hypertension)
<input type="checkbox"/>	4 Congenital heart disease
<input type="checkbox"/>	5 Cancer
<input type="checkbox"/>	6 Epilepsy
<input type="checkbox"/>	7 Food allergies
<input type="checkbox"/>	8 Febrile Seizures
<input type="checkbox"/>	9 Bronchitis
<input type="checkbox"/>	10 Gastroesophageal reflux disease (GERD)
<input type="checkbox"/>	11 Atopy (the tendency to develop allergic conditions such as allergic rhinitis, eczema, etc.)
<input type="checkbox"/>	12 Other major health condition
	If other, please specify: <input type="text"/>
<input type="checkbox"/>	13 No major health condition

ABSENTEEISM AND PRESENTEEISM - CHILDREN

Q23 The following questions ask about the effect of your child's symptoms (cough, wheeze, chest tightness and/or shortness of breath) on their ability to do schoolwork and other daily activities in the **LAST 4 WEEKS**. Please do NOT include the effects of any other medical conditions when answering.

Q23A Did your child miss school due to their symptoms in the **LAST 4 WEEKS**?

<input type="checkbox"/> 1	Yes
<input type="checkbox"/> 2	No

[If S23 A is NO, participant will SKIP to Q24.]

Q23B During the **LAST 4 WEEKS**, how many hours did your child miss from school because of their symptoms?
Include hours missed on sick days, times they went in late, left early, etc. because of their symptoms.

Hours

Q23C When your child stayed home due to their symptoms, who cared for them?
Please check all that apply.

<input type="checkbox"/> 1	You
<input type="checkbox"/> 2	Your spouse or co-parent
<input type="checkbox"/> 3	Other family member or friend
<input type="checkbox"/> 4	Helper / paid caregiver

[If Q23C is no to 1, 2, and 3, participant will SKIP to Q25.]

Q24 The following questions ask about the effect of your child's symptoms (cough, wheeze, chest tightness and/or shortness of breath) on their unpaid caregiver's (you, your spouse, other family member or friend) work in the **LAST 4 WEEKS**. When answering, please **ONLY** consider the individual who provided the **most** care for your child when they were home due to their symptoms. This individual will be simply referred to as 'caregiver' in the upcoming questions.

Q24A Is this caregiver currently employed or self-employed (i.e., working for pay)?

<input type="checkbox"/> 1	Yes
<input type="checkbox"/> 2	No

[If NO, participant will SKIP to Q25.]

Q24B How many hours did this caregiver work in the **LAST 4 WEEKS?**

Hours

Q24C During the **LAST 4 WEEKS,** how many hours did the caregiver miss from work due to your child's symptoms?

Include hours missed when they came into work late or left work early because you were caring for your child (e.g. accompanied them to their doctor appointments, visited hospitals or clinics, or helped them dress, groom, eat, or take medications).

Hours

HEALTHCARE RESOURCE CONSUMPTION AND EXPENDITURE DUE TO ASTHMA - CHILDREN

The next questions will ask you about your child's healthcare resource consumption because of their symptoms (cough, wheeze, shortness of breath, and/or chest tightness).

Please DO NOT consider any other symptoms or medical conditions when answering the following questions.

Q25 Has your child been seen by a physician regarding his/her symptoms in the <u>LAST 12 MONTHS</u>?					
<input type="checkbox"/> 1		Yes			
<input type="checkbox"/> 2		No			
[If Q25 is NO, participant will SKIP to Q26.]					
Q25A (If Q25=1) Below is a list of clinics and physician types. If your child has visited any of the following in the <u>LAST 12 MONTHS</u> because of their symptoms, please enter the number of visits made. <i>Please type in your response in the text box to automatically select that option.</i>					
			Yes (1)	No (2)	If yes, please state the number of visits made in the <u>LAST 12 MONTHS</u>.
Q25A_1	Polyclinic	<input type="checkbox"/>	<input type="checkbox"/>	_____	
Q25A_2	Private General Practitioner (GP)	<input type="checkbox"/>	<input type="checkbox"/>	_____	
Q25A_3	Specialist (e.g. Allergist, Immunologist, Respiratory specialist, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	_____	
Q25A_4	Alternative Practitioner (e.g. Accupuncturist, Chiropractor, Biofeedback Therapist, Tradition al Medicine (TCM, Ayurvedic), Homeopathy etc.)	<input type="checkbox"/>	<input type="checkbox"/>	_____	
Q26 Has your child taken any medication for their symptoms in the <u>LAST 12 MONTHS</u>?					
<input type="checkbox"/> 1		Yes			
<input type="checkbox"/> 2		No			

[If Q 26 is NO, participant will SKIP to Q27.]

Disclaimer - This survey is only for data collection purposes. Any content mentioned herein should not be treated as Medical Advice/Treatment/Prescription or related terms. Data collection company and NUS cannot be held liable for any medical or non-medical consequences.

Q26A	(If Q26=1) Below is a list of medications and medical devices commonly used to treat your child's symptoms. Please check all that your child has taken in the <u>LAST 12 MONTHS</u> to address their symptoms and check how often they take these medications:			
		Yes (1)	No (2)	If yes, <u>how often does your child take these medications</u>
Inhaled Relievers				
Q26A_1	Blue inhaler/Ventolin (Salbutamol or other brands)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Inhaled Corticosteroids				
Q26A_2	Flixotide (Fluticasone)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q26A_3	Pulmicort (Budesonide)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q26A_4	Giona (Budesonide)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q26A_5	Becllo-asma (Beclomethasone)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Inhaled Corticosteroids with long-acting beta-agonist				
Q26A_6	Seretide (Fluticasone/Salmeterol)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q26A_7	Symbicort (Budesonide/Formoterol)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q26A_8	Relvar (Fluticasone/Vilanterol)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed

Q26A_9	Foster/Fostair (Beclometasone/Formoterol)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q26A_10	Flutiform (Fluticasone/Formoterol)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Other medications				
Q26A_11	Oral steroids (prednisolone, dexamethasone, hydrocortisone)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q26A_12	Singulair (Montelukast or other leukotriene antagonists such as Zafirlukast)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q26A_13	Oral Salbutamol (tablet or suspension)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q26A_14	Theophylline	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q26A_15	Atrovent (Inhaled Ipratropium bromide)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q26A_16	Spiriva (Inhaled tiotropium bromide)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 1x/day <input type="checkbox"/> 2x/day <input type="checkbox"/> 3x/day <input type="checkbox"/> 4x/day <input type="checkbox"/> >4x/day <input type="checkbox"/> as needed
Q26A_17	Injectable Biologics (Xolair, Nucala, Fasentra)	<input type="checkbox"/>	<input type="checkbox"/>	Number of injections received in the LAST 12 MONTHS: _____
Q26A_18	Bronchothermoplasty procedure	<input type="checkbox"/>	<input type="checkbox"/>	Number of procedures performed in LAST 12 MONTHS: _____

Q27		Has your child used any alternative medications/therapies (e.g. Homeopathy, Traditional Medicine, Acupuncture) to treat their symptoms in the <u>LAST 12 MONTHS</u>?
<input type="checkbox"/> 1	Yes	
<input type="checkbox"/> 2	No	
[If Q27 is NO, participant will SKIP to Q28.]		
Q27A	(If Q27=1) Over the <u>LAST 12 MONTHS</u>, roughly how much money have you spent, out of your pocket, on alternative medications/therapies (e.g., Homeopathy, Traditional Medicine, Acupuncture) to treat your child's symptoms (EXCLUDING any money that insurers, your employer or other third parties may have paid)?	
	<input type="text"/> SGD	
Q28		Has your child undergone any diagnostic, lab, blood or other tests related to their symptoms in the <u>LAST 12 MONTHS</u>?
<input type="checkbox"/> 1	Yes	
<input type="checkbox"/> 2	No	
[If Q 28 is NO, participant will SKIP to Q29.]		

<p>Q28A (If Q28=1) Below is a list of medical / lab tests that your child may have undergone for the evaluation of their symptoms. If your child has taken any of the following tests in the <u>Last 12 MONTHS</u>, please enter the number of tests taken.</p> <p><i>Please type in your response in the text box to automatically select that option.</i></p>					
			Yes (1)	No (2)	If yes, please state the number of tests taken in the <u>LAST 12 MONTHS</u> .
Q28A_1	Spirometry	<input type="checkbox"/>	<input type="checkbox"/>	_____	
Q28A_2	Provocation Test (e.g. Methacholine Challenge, Irritant Challenge, Exercise Challenge)	<input type="checkbox"/>	<input type="checkbox"/>	_____	
Q28A_3	Peak Flow Test	<input type="checkbox"/>	<input type="checkbox"/>	_____	
Q28A_4	Exhaled Nitric Oxide Test (FeNO Test)	<input type="checkbox"/>	<input type="checkbox"/>	_____	
Q28A_5	Sinus X-Ray	<input type="checkbox"/>	<input type="checkbox"/>	_____	
Q28A_6	Chest X-Ray	<input type="checkbox"/>	<input type="checkbox"/>	_____	
Q28A_7	Blood Test	<input type="checkbox"/>	<input type="checkbox"/>	_____	
Q28A_8	Skin Prick Test	<input type="checkbox"/>	<input type="checkbox"/>	_____	
Q28A_9	Other tests	<input type="checkbox"/>	<input type="checkbox"/>	_____	
	If other, please specify: _____				
<p>Q29 In the <u>LAST 12 MONTHS</u>, has your child made any visits to a Hospital Emergency Department (ED) that did not require an inpatient admission because of their symptoms? (Spent less than 1 night in the hospital)</p>					
<input type="checkbox"/> 1	Yes				
<input type="checkbox"/> 2	No				
[If Q29 is NO, participant will SKIP to Q30.]					

<p>Q29A (If Q29= 1) Please enter the number of visits your child has made to a Hospital Emergency Department due to their symptoms in the <u>LAST 12 MONTHS</u>.</p> <p><input type="text"/> visits</p>				
<p>Q30 In the <u>LAST 12 MONTHS</u>, has your child required hospitalisation because of their symptoms? (Spent 1 or more nights in the hospital)</p> <table border="1"><tr><td><input type="checkbox"/>1</td><td>Yes</td></tr><tr><td><input type="checkbox"/>2</td><td>No</td></tr></table>	<input type="checkbox"/> 1	Yes	<input type="checkbox"/> 2	No
<input type="checkbox"/> 1	Yes			
<input type="checkbox"/> 2	No			
<p>Q30A (If Q30= 1) Please enter the number of days your child was hospitalized due to their symptoms in the <u>LAST 12 MONTHS</u>.</p> <p><input type="text"/> Days</p>				

DEMOGRAPHIC QUESTIONS - CHILDREN

Finally, this section asks a few more questions about the education, employment, and housing status of your child's unpaid caregiver, such as yourself, your spouse or other family member or friend. Please **ONLY** consider the person who provided the most care for your child's symptoms (other than a helper or paid caregiver) and select a box that **BEST** describes their current status.

GI10	What is the caregiver's highest education level completed?			
<input type="checkbox"/> 1	No formal education	<input type="checkbox"/> 5	Junior College / Polytechnic / Diploma (including A Levels)	
<input type="checkbox"/> 2	Primary	<input type="checkbox"/> 6	University and above	
<input type="checkbox"/> 3	Secondary (including O Levels)	<input type="checkbox"/> 7	Don't know	
<input type="checkbox"/> 4	Vocational / ITE			
GI11	Which category best describes the caregiver's occupation? <i>If other, please type in your response in the text box and "other" will automatically be selected.</i>			
<input type="checkbox"/> 1	Manager (e.g. retail sales manager, advertising manager)	<input type="checkbox"/> 7	Craftsman or Related Trade Worker (e.g. electrician, plumber, foreman)	
<input type="checkbox"/> 2	Professional (e.g. accountant, engineer etc. with little/no managerial capacity)	<input type="checkbox"/> 8	Plant and Machine Operator or Assembler (e.g. bus driver, machine operator in a plant)	
<input type="checkbox"/> 3	Associate Professional (e.g. assistant accountant, assistant engineer) or Technician (e.g. lab technician, telecommunications technician)	<input type="checkbox"/> 9	Cleaner, Labourer or Related Worker (e.g. janitor, watchman)	
<input type="checkbox"/> 4	Clerical Support Worker (e.g. data entry clerk, bank teller)	<input type="checkbox"/> 10	Self-employed	
<input type="checkbox"/> 5	Service or Sales Worker (e.g. postman, cook)	<input type="checkbox"/> 11	Other, please specify: _____	
<input type="checkbox"/> 6	Agricultural or Fishery Worker (e.g. gardener)			
GI12	What is the typical monthly employment income of the caregiver from all sources?			
<input type="checkbox"/> 1	Less than \$1000	<input type="checkbox"/> 6	\$5000 - \$5999	
<input type="checkbox"/> 2	\$1000 - \$1999	<input type="checkbox"/> 7	\$6000 - \$6999	
<input type="checkbox"/> 3	\$2000 - \$2999	<input type="checkbox"/> 8	\$7000 - \$9999	

<input type="checkbox"/> 4	\$3000 - \$3999	<input type="checkbox"/> 9	\$10,000 and over
<input type="checkbox"/> 5	\$4000 - \$4999	<input type="checkbox"/> 99	Prefer not to answer
G113 What type of housing does the caregiver currently live in?			
<i>If others, please type in your response in the text box and "others" will automatically be selected.</i>			
<input type="checkbox"/> 1	HDB/ JTC Flat (1-2 room)	<input type="checkbox"/> 5	Condominium/ Private flat
<input type="checkbox"/> 2	HDB/ JTC Flat (3 room)	<input type="checkbox"/> 6	Bungalow/ Semi-detached/ terrace house
<input type="checkbox"/> 3	HDB/ JTC Flat (4 room)	<input type="checkbox"/> 7	Shop house
<input type="checkbox"/> 4	HDB flat (5 room and above/ Executive)	<input type="checkbox"/> 8	Others, specify

Thank you for completing the survey. The protocol title for this study is Economic Burden of Asthma in Singapore.

Appendix B – Data Quality Check

Four participants had the number of hours absent from work recoded to missing due to reporting an out of range value. Another two had their presenteeism scale reset to missing because they also indicated being unemployed. Six adults who indicated “Other tests” under questions about diagnostic tests had their observations set to missing for reporting illogical or inappropriate responses that clearly had nothing to do with asthma while two had their number of inpatient procedures set to missing for indicating illogical values. Ten parent of child surveys had values coded to missing for failing range checks due to implausible values under number of hours missed from school, number of diagnostic tests taken, number of inpatient procedures done, and the number of hours the caregiver worked or missed from work (all of which were well beyond the 99th percentile). Further, 15 adult surveys and 26 parent of child surveys were excluded for providing straight line answers for questions pertaining to healthcare resource utilization (i.e. indicating that they had taken all the different types of medications and for the same number of times each day.)

Appendix Table C1 – Healthcare Resources Unit Costs

Table C1: Unsubsidized unit cost estimates of and demand for healthcare resources excluding medications in Singapore

Retrieved between January and February 2020.

No.	Category	Unit cost ¹ (SGD)	Details	Sources	Sample Count (N=521) ²	Total demand per year ²
1	Physician Visits and Outpatient Procedure³					
1.1	Polyclinic	52	Average of non-resident prices for General Practitioner consultations.	1. SingHealth Polyclinics 2. National Healthcare Group 3. National University Polyclinics	254	1004
1.2	Private General Practitioner	24	Average of non-resident prices for private General Practitioner consultations.	1. Prohealth 24-hour 2. Central 24-hour Clinic (Woodlands) 3. Marine Parade Clinic 4. Lifelink 24-hour Clinic & Surgery	283	842
1.3	Specialist	133	Average of first and repeat non-resident consultation prices for specialist visits at outpatient clinics with a senior consultant.	1. Singapore General Hospital 2. Tan Tock Seng Hospital 3. National University Hospital	152	328
1.4	Bronchoscopy	1,605	Average price of an outpatient bronchoscopy procedure.	Singapore General Hospital	40	71
2	Diagnostic Tests					
2.1	Spirometry	93	Average non-resident price for spirometry.	1. Changi General Hospital 2. National University Hospital 3. Tan Tock Seng Hospital	56	140
2.2	Provocation Test (e.g. Mentacholine Challenge and Exercise Challenge)	203	Average non-resident price for provocation tests.	Singapore General Hospital	55	135

2.3	Peak Flow Test	0	Price of a peak flow test.	SingHealth	36	68
2.4	Exhaled Nitric Oxide (FeNO) Test	91	Price for an exhaled nitric oxide test.	Farrer Park Hospital	40	70
2.5	Sinus X-Ray	90	Non-resident price for sinus x-ray.	Tan Tock Seng Hospital	46	63
2.6	Chest X-Ray	80	Average non-resident price for a chest x-ray.	1. Singapore General Hospital 2. Tan Tock Seng Hospital	77	112
2.7	Blood Test	46	Price of a single blood test.	National Heart Centre	102	195
2.8	Skin Prick Test	110	Non-resident price for a skin prick test.	Singapore General Hospital	29	57
2.9	Other Tests	14 - 634	Non-resident prices for the assortment of tests indicated by participants. Prices are imputed individually.	1. National University Hospital, Urine Test 2. National Heart Centre, Echocardiogram	3	3
3	Emergency Department Visit	123	Average of non-resident prices for ED visits.	1. Singapore General Hospital 2. Tan Tock Seng Hospital 3. National University Hospital	73	154
4	Hospitalization	1,460	Average bill for per day hospitalized due to asthma without complications for Ward A (unsubsidized) in KK Women's and Children's Hospital. 75% of patients are charged below this amount.	Ministry of Health Fee Benchmarks and Bill Information	69	225

¹ Costs include Goods and Services Tax (GST) of 7%.

² Sample count is the total number of participants that indicated the use of each healthcare resource listed. Total demand per year is the total utilization of the respective healthcare resource for the entire cohort in the past year.

³ The cost of bronchoscopy (item 1.4) was conservatively used in place of bronchial thermoplasty as we believe survey participants had confused the two procedures.

Appendix Table C2 – Cost of Medications

Table C2: Unsubsidized unit costs of and demand for medications in Singapore

Retrieved between January and February 2020.

No.	Medication	Unit cost ¹ (SGD)	Dosage	Reference	Actuations per can ²	Actuation reference	Sample Count (N=521) ³
Inhaled relievers							
1	Salbutamol	5.35	100mcg	Singapore General Hospital	200	medicines.org.uk	230
Inhaled corticosteroids							
2	Fluticasone	72.45	125mg	Singapore General Hospital	120	medicines.org.uk	97
3	Budesonide (Pulmicort)	49.85	200mcg	Singapore General Hospital	100	medicines.org.uk	64
4	Budesonide (Giona)	44.02	200mcg	National Healthcare Group	200	MIMS Pte. Ltd.	51
5	Beclometasone	5.35	50mcg	Singapore General Hospital	200	Aldo-Unión	84
Inhaled corticosteroids with long-acting beta-agonist							
6	Fluticasone/Salmeterol	103.55	25/250mcg	Singapore General Hospital	120	medicines.org.uk	75
7	Budesonide/Formoterol	93.85	160/4.5mcg	Singapore General Hospital	120	medicines.org.uk	57
8	Fluticasone/Vilanterol	58.10	125mcg	Tan Tock Seng Hospital	60	medicines.org.uk	42
9	Beclometasone/Formoterol	133.75	100/6mcg	Personal Communication	120	medicines.org.uk	39
10	Fluticasone/Formoterol	60.31	125/5mcg	Tan Tock Seng Hospital	120	medicines.org.uk	41
Other medications⁴							
11	Oral Steroids (Prednisolone)	0.10	5mg/tab	Singapore General Hospital			63
12	Montelukast	0.40	10mg/tab	Singapore General Hospital			53
13	Oral Salbutamol (tablet)	0.10	2mg/tab	Singapore General Hospital			56
14	Theophylline	0.15	250mg/tab	Singapore General Hospital			35
15	Inhaled Ipratropium bromide	8.10	20mcg	Singapore General Hospital	200	medicines.org.uk	31
16	Inhaled tiotropium bromide	59.10	2.5mcg	Tan Tock Seng Hospital	60	medicines.org.uk	22
17	Injectable biologics (Omalizumab)	354.29	150 mg/injection	Ng Teng Foong General Hospital			24

¹ Costs include Goods and Services Tax (GST) of 7%.

² An average of two actuations (puffs) per dose of inhaled medication was assumed when assigning costs of medications for calculations. If a frequency of “greater than 4 times a day” was indicated, they were categorized as 4 times a day. If a frequency of “as needed” was indicated, they were categorized as the 25th percentile of usage.

³ Sample count is the total number of participants that indicated the use of each medication listed.

⁴ The least expensive of each category is listed.

Appendix Table D – Breakdown of annual total burden per capita

Table D: Breakdown of average total per capita costs (SGD) for adults and children by control¹

	Adult (N = 521)			Child/Parent (N = 221)		
	Uncontrolled (N = 72)	Partly Controlled (N = 114)	Well Controlled (N = 114)	Uncontrolled (N = 99)	Partly Controlled (N = 66)	Well Controlled (N = 56)
Absenteeism	\$ 4,870 (12,610)	\$ 2,400 (3,820)	\$ 430 (1,150)	\$ 4,110 (5,110)	\$ 2,610 (3,920)	\$ 1,330 (2,050)
Presenteeism	\$ 17,610 (18,150)	\$ 14,260 (15,360)	\$ 4,530 (8,360)	-	-	-
<i>Total Cost of Productivity Lost</i>	\$ 22,480 (24,880)	\$ 16,660 (17,090)	\$ 4,960 (8,550)	\$ 4,110 (5,110)	\$ 2,610 (3,920)	\$ 1,330 (2,050)
Physician Visits and Outpatient Procedure	\$ 730 (1,200)	\$ 240 (650)	\$ 90 (350)	\$ 1,100 (1,500)	\$ 680 (1,350)	\$ 130 (250)
Medications	\$ 1,660 (2,240)	\$ 440 (860)	\$ 130 (500)	\$ 2,650 (3,390)	\$ 1,580 (2,480)	\$ 260 (580)
Diagnostic Tests	\$ 230 (390)	\$ 60 (170)	\$ 30 (110)	\$ 380 (830)	\$ 290 (1,090)	\$ 30 (140)
Emergency Department Visits	\$ 40 (90)	\$ 10 (40)	\$ 10 (40)	\$ 120 (330)	\$ 30 (120)	\$ 30 (90)
Hospitalizations	\$ 480 (1,240)	\$ 250 (1,210)	\$ 10 (150)	\$ 1,750 (3,500)	\$ 1,100 (2,840)	\$ 970 (4,890)
<i>Total Healthcare Cost</i>	\$ 3,150 (3,930)	\$ 1,010 (1,870)	\$ 270 (860)	\$ 6,000 (7,410)	\$ 3,680 (5,290)	\$ 1,430 (5,020)
<i>Total Burden of Asthma per Capita</i>	\$ 25,630 (25,000)	\$ 17,670 (17,450)	\$ 5,230 (8,750)	\$ 10,110 (9,050)	\$ 6,290 (7,330)	\$ 2,760 (6,250)

¹ Standard deviations are provided in parentheses below each estimate. Productivity costs are for employed adults and parents and assumes that healthcare costs per capita are identical for those in and not in the labor force. Numbers may not add up due to rounding.

Appendix Table E – Productivity per capita

Table E.1: Annual average per capita lost productivity costs (SGD) due to asthma for employed adults¹

	Adult (N= 300)		
	Uncontrolled (N = 72)	Partly Controlled (N = 114)	Well Controlled (N = 114)
Absenteeism			
Days missed from work due to asthma	19 (49)	10 (16)	2 (6)
Absenteeism costs	4,870 (12,610)	2,400 (3,820)	430 (1,150)
Presenteeism²			
Scale of symptoms affecting productivity at work (0 - 10)	6 (2)	4 (3)	2 (2)
Presenteeism days	62 (58)	59 (61)	21 (38)
Presenteeism costs	17,610 (18,150)	14,260 (15,360)	4,530 (8,360)

¹ Standard deviations are provided in the parentheses below estimates.

² Presenteeism was measured on a scale of 0 to 10 where 0 was “no symptoms and/or symptoms had no effect on my work” and 10 was “symptoms completely prevented me from working”.

Table E.2: Annual average per capita lost productivity costs (SGD) due to child’s asthma for employed parents¹

	Caregivers of child asthmatics (N = 221)		
	Uncontrolled (N = 99)	Partly Controlled (N = 66)	Well Controlled (N=56)
Absenteeism			
Days missed from work due to asthma	16 (18)	10 (13)	6 (10)
Absenteeism costs	4,110 (5,110)	2,610 (3,910)	1,330 (2,050)

¹ Standard deviations are provided in the parentheses below estimates.