

# Burden of asthma, dyspnea, and chronic cough in South Asia

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**Background:** Asthma, dyspnea, and chronic cough are well-established risk factors of COPD and often associated with exacerbation of the disease, which is a leading cause of morbidity and mortality in South Asian countries.

**Objective:** The aims of this study were to, 1) measure the prevalence of asthma, dyspnea, and chronic cough, and 2) assess the relationship between these respiratory problems and self-reported health status among South Asians.

**Methods:** Data for this research came from the World Health Survey (2002–2003) conducted by the World Health Organization. Subjects were 35,929 men and women, aged 18 years and older, selected from Bangladesh, India, Nepal, Pakistan, and Sri Lanka. Crude prevalence rates of asthma, dyspnea, and chronic cough were presented as percentages, and the results of their association with subjective health status were presented as odds ratios and corresponding 95% CIs.

**Results:** Prevalence of daily smoking was highest in Bangladesh (39.9%) and lowest in Sri Lanka (14.1%). Prevalence of asthma was highest in India (6.3%), while Nepal had the highest prevalence of dyspnea (11.3%) and chronic cough (15.3%). Overall prevalence of asthma and dyspnea was higher among women, while that of chronic cough was higher among men. Significant differences were observed in the prevalence rates of all the conditions among regular, occasional, and nonsmokers. A majority of the men and women who had asthma, dyspnea, and chronic cough had higher likelihood of reporting poor health status compared to those who did not have these diseases.

**Conclusion:** Findings suggest that prevalence rates of asthma, dyspnea, and chronic cough were considerably high in all the countries and were significantly associated with poor subjective health. Being a high COPD-prone region, programs targeted to address these diseases could help reduce the burden of COPD and respiratory disease-related mortalities in South Asia.

**Keywords:** asthma, chest pain, respiratory diseases, chronic cough, dyspnea, older population, South Asia

## Introduction

Chronic respiratory diseases represent a group of diseases characterized by abnormal condition of the respiratory system such as inflammation of the airways, airflow obstruction, chest pain, dyspnea, hemoptysis, and sputum production.<sup>1</sup> Globally, respiratory diseases remain the largest single contributor to the overall burden of disease measured in terms of disability-adjusted life-years (DALYs) loss, and the overall burden has been increasing at an alarming rate, especially COPD.<sup>2</sup> According to a comprehensive report “Respiratory Disease in the World: Realities of Today – Opportunities for Tomorrow” published by The Forum of International Respiratory Societies (FIRS), the five largest contributors to the global burden of respiratory diseases include asthma, COPD, acute respiratory infections, tuberculosis (TB), and lung cancer.<sup>2,3</sup> At any point,

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an estimated 235 million people suffer from asthma,<sup>1</sup> over 200 million from COPD, and ~65 million from moderate-to-severe COPD.<sup>3,4</sup> Worldwide, asthma alone accounts for the loss of ~15 million DALYs and 180,000 annual deaths representing ~1% of the total global disease burden, and its prevalence increases by ~50% every decade.<sup>4,5</sup>

With global population aging and deteriorating environmental conditions, respiratory diseases are becoming a predominant cause of morbidity and mortality, especially in the resource-poor countries such as South and Southeast Asia and Africa.<sup>1,6</sup> Lower respiratory tract infections account for 9.1% of DALYs from all diseases in the developing countries compared with 1.5% in the industrialized countries.<sup>7</sup> This striking difference is rooted probably to the high rates of under- and incorrect diagnoses, undertreatment, poor access to quality care, exposure to environmental irritants, and genetic susceptibility.<sup>6,8</sup> In recent years, most South Asian countries have experienced rapid urbanization accompanied by increasing exposure to environmental pollutants and a rising incidence of chronic respiratory diseases, particularly COPD and asthma, as seen globally.<sup>9–11</sup> South Asian countries are particularly known for their noticeably high rates of, and higher susceptibility to, respiratory diseases such as COPD, TB, and asthma,<sup>6,12,13</sup> with an estimated one-tenth of global asthma cases living in India.<sup>6</sup> Although the burden of respiratory diseases is conventionally measured in terms of the prevalence of the disease, mortality rates, and health care expenditure, the overall impact of these diseases extends beyond these spheres and has far-reaching effects on subjective health status, well-being, and quality of life.<sup>14,15</sup>

Some of the major concerns for prevention programs of respiratory diseases in this region are high rate of tobacco smoking and widespread poverty, which are well-documented exacerbating factors for asthma and COPD.<sup>16,17</sup> In the area of respiratory diseases, most of the population-based studies in South Asian countries have focused on COPD and TB among adults and asthma among children. However, there is a paucity of evidence regarding the prevalence of asthma among adults. Other commonly encountered respiratory complaints in the primary care institutions, such as dyspnea (shortness of breath) and chronic cough, have also received very little research attention. To this end, we conducted this study by analyzing secondary data from the World Health Survey (WHS) surveys of the WHO, which covered five countries in the South Asian region. The surveys did not include COPD; however, they provided the information regarding the prognostic factors such as dyspnea and chronic cough, which are established risk factors of COPD.<sup>18</sup> The

main objectives were to provide a comparative scenario of the prevalence of asthma, dyspnea, and chronic cough and their cross-sectional association with subjective health. The results are not representative of the present scenario; however, they might provide some useful insights that can assist further research along this line in this region.

## Methods

### Data collection

Nationally representative population surveys on the prevalence of asthma, dyspnea, and chronic cough are rare in South Asia. Therefore, for this study, we collected secondary data sets from the 2002 WHS, which was implemented in 70 countries between January 2002 and December 2002. Sampling methods have been published in a prior study based on WHS data sets.<sup>19</sup> The surveys were cross-sectional in nature and covered a broad range of physical health- and mental health-related topics and risk factors among male and female adults aged 18 years and older. The questionnaires are available at: <http://www.who.int/healthinfo/survey/instruments/en/>.

### Variables

The outcome variable in this study was self-reported health. This construct has been used extensively in population-based studies as a reliable measure of a range of chronic diseases and symptoms and gains a general picture of individual health status, which is usually not attainable by clinical diagnosis. In the WHS surveys, self-reported health was measured by a single question – “In general, how would you rate your health today?” with the following options as answer: 1. very good, 2. good, 3. moderate, 4. bad, and 5. very bad. The outcome was measured in relation to the three disease conditions as main explanatory variables. For asthma, dyspnea, and chronic cough, participants were asked separately: “Have you ever been diagnosed with asthma?”, “Have you had an attack of shortness of breath that came on without obvious cause when you were not exercising or doing some physical activity,” and “During the last 12 months have you experienced cough that lasted for 3 weeks or longer?”

To adjust the analysis for potential confounders, we considered a range of covariates based on literature review and availability in the data sets: smoking habit: daily, not daily, and not at all; age: 18–29, 30–44, 45–59, 60–74, and >74 years; sex: female and male; current marital status: unmarried and married; educational attainment: no formal schooling, less than primary school, primary school completed, secondary school completed, high school (or equivalent) completed, and college/pre-university/university completed; current

job: government employee, non-government employee, self-employed, and unemployed/others; and ever drank alcohol: yes and no.<sup>6–9,11,15,18,20,21</sup>

## Data analysis

All analyses were conducted using SPSS 21 for Mac (SPSS Inc., Chicago, IL, USA). Initial checks were performed for missing values, outliers, and multicollinearity issues. Basic sociodemographic characteristics of the participants were presented as frequencies and percentages. Prevalence rates of asthma, dyspnea, and chronic cough were calculated among regular, occasional, and nonsmokers stratifying for sex. Multivariable regression analysis was run to calculate the odds ratios (ORs) of the relationship between self-rated health, asthma, dyspnea, and chronic cough. Three separate

models were run for each of the outcome variables, while adjusting for the potential confounders. All tests were two-tailed, and statistical significance was set at  $P < 0.05$ .

## Ethical review

WHS surveys were conducted under the scientific and administrative supervision of the WHO. Participants gave verbal informed consent prior to the interviews.<sup>19</sup> No additional approval was necessary for this study since the data are available in the public domain in anonymized form.

## Results

### Sample characteristics

Basic sample characteristics are presented in Table 1. Prevalence of daily and occasional smoking was highest in

**Table 1** Distribution of sample population according to demographic, socioeconomic and health behavior-related variables, WHS 2002–2003

Variables	Bangladesh (N=5,510)	India (N=9,495)	Nepal (N=8,579)	Pakistan (N=6,118)	Sri Lanka (N=6,227)
Smoking habit					
Daily	39.9	31.5	37.1	17.8	14.1
Not daily	4.8	3.0	5.5	3.7	6.5
Not at all	55.3	65.6	57.5	78.5	79.4
Age, mean (SD), years	38.48 (14.8)	38.86 (15.2)	38.84 (15.5)	38.93 (14.67)	40.82 (15.29)
18–29	30.9	31.4	32.9	34.9	26.9
30–44	38.6	34.6	42.7	36.6	35.7
45–59	19.4	20.6	15.6	18.2	24.2
60–74	8.8	11.3	7.5	8.2	10.6
>74	2.3	2.1	1.1	2.2	2.7
Sex					
Female	53.4	51.6	57.5	44.0	53.5
Male	46.6	48.4	42.5	56.0	46.5
Current marital status					
Unmarried	22.4	23.1	17.6	25.9	31.2
Married	77.6	76.9	82.4	74.1	68.8
Educational attainment					
No formal schooling	41.2	39.6	60.1	54.7	6.1
Less than primary school	18.3	9.4	10.8	5.1	7.9
Primary school completed	24.9	17.5	13.8	13.3	26.1
Secondary school completed	7.3	12.9	10.2	12.1	38.6
High school (or equivalent) completed	4.0	9.9	3.3	7.1	19.1
College/preuniversity/university completed	4.2	10.7	1.9	7.7	2.3
Current job					
Government employee	3.6	4.6	3.0	7.4	8.8
Non-government employee	6.2	10.6	2.1	10.0	11.1
Self-employed	38.0	37.9	65.2	33.5	21.9
Unemployed/others	52.4	46.9	29.7	49.1	58.1
Ever drank alcohol					
Yes	6.4	11.0	36.3	9.2	18.6
No	93.6	89.0	63.7	90.8	81.4
Subjective health status					
Poor	22.3	18.6	21.3	13.6	18.2
Fair	28.4	20.9	21.6	25.6	16.9
Good	49.3	60.5	57.1	60.8	64.9

**Note:** Data presented as percentage, unless otherwise stated.

**Abbreviation:** WHS, World Health Survey.

Bangladesh (39.9%) and lowest in Sri Lanka (14.1%), while that of occasional smoking was highest in Sri Lanka (6.5%) and lowest in Bangladesh (3%). A majority of the participants belonged to the age group of 30–44 years, were female (except in Pakistan), and were currently married. Among all the countries, the rate of literacy was highest in Sri Lanka (93.9%) and lowest in Nepal (39.9%). In Bangladesh, India, Nepal, and Pakistan, a majority of the participants had primary level qualification. The percentage of unemployment (not working for pay) was high in all the countries. Prevalence of ever drinking alcohol was highest in Nepal (36.3%) and lowest in Bangladesh (6.4%). Regarding subjective health status, over three-fifths of the participants in India (60.5%), Pakistan (60.8%), and Sri Lanka (64.9%) rated their health as good.

## Prevalence of respiratory problems

Prevalence rates of asthma, dyspnea, and chronic cough are presented in Tables 2–4, respectively. Results indicate that the prevalence of asthma was 5.2%, 6.3%, 4.2%, 3.7%, and 5.3% in Bangladesh, India, Nepal, Pakistan, and Sri Lanka, respectively, and that of dyspnea was 7.4%, 7.2%, 11.3%, 3.4%, and 6% and of chronic cough was 14.4%, 11%, 15.3%, 10%, and 5.9%, respectively, in the aforementioned order. Women were more likely to be suffering from asthma in the majority of the countries (except in India and Nepal) and from dyspnea in all the countries. However, the percentages of those suffering from chronic cough appeared to be higher among men compared to women in all the countries but Nepal (15.4% vs 15%). The tables also highlight that prevalence of asthma, dyspnea, and chronic cough was higher among those who reported smoking daily or occasionally compared with nonsmokers.

## Multivariable analysis

Results of multivariable analysis on the association between self-rated health and asthma, dyspnea, and chronic cough are presented in Tables 5–7, respectively. Reference category for self-rated health was good health status. Table 5

indicates that in all the countries, compared to those who did not have asthma, the odds of reporting health as fair or poor was significantly higher among those who had asthma. Similar trend was observed for dyspnea and chronic cough. However, the association was not significant for India. The association between self rated health with asthma and dyspnea was strongest in Pakistan and with chronic cough in Sri Lanka. For instance in Pakistan, the odds of reporting fair and poor health were, respectively, 2.4 (adjusted odds ratio [AOR]=2.43; 95% CI=1.73–3.42) and 6.4 times (AOR=6.43; 95% CI=4.658–8.895) higher among those who had asthma. In Sri Lanka, those who had chronic cough were, respectively, 2.4 times (AOR=2.5; 95% CI=1.93–3.24) and 2.4 times (AOR=2.4; 95% CI=1.86–3.10) more likely to rate their health status as fair and poor.

## Discussion

In this large-scale cross-sectional study covering the five most highly populated South Asian nations, we aimed to measure the prevalence of smoking habit along with asthma and two other rarely studied respiratory diseases, namely dyspnea (shortness of breath) and chronic cough. Additionally, we also investigated if there was any relationship between subjective health and the abovementioned conditions. Findings indicated a relatively high rate of smoking in all the countries especially Bangladesh and Nepal, where nearly two-fifths of the participants reported smoking on a daily basis. The rate of occasional smoking was considerably lower compared to regular smoking. The habit of regular smoking appeared to be lowest among Sri Lankans; however, they had the highest rate of occasional smoking. The prevalence of smoking in this study differed from the more recently conducted studies – 39.9% in the present study compared with 22% for Bangladesh (International Tobacco Control survey Wave one and two, 2010),<sup>22</sup> 34.6% in the present study vs 30% for India (Global Adult Tobacco Survey, 2009–2010), 37.1% in the present study vs 30.3% for Nepal (Nepal Demographic and Health Survey, 2006),<sup>23</sup> and 17.8 in the present study vs 21.6% for Pakistan.<sup>24</sup>

**Table 2** Prevalence of asthma stratified by sex in selected South Asian countries, WHS 2002–2003

Frequency of smoking	Bangladesh (5.2)		India (6.3)		Nepal (4.2)		Pakistan (3.7)		Sri Lanka (5.3)	
	Women (5.3)	Men (5.2)	Women (6.1)	Men (6.6)	Women (3.5)	Men (5.1)	Women (4.4)	Men (3.2)	Women (5.6)	Men (5.1)
Daily	5.9	5.2	9.6	8.4	3.8	5.3	8.9	2.7	4.5	6.7
Not daily	6.0	6.0	11.6	5.7	8.3	4.5	2.8	3.7	3.6	6.1
Not at all	5.0	5.0	5.3	4.8	3.2	5.0	4.2	3.4	5.6	4.2
P-value	0.682	0.862	<0.001	0.001	0.001	0.855	0.030	0.592	0.766	0.023

**Notes:** P-values calculated from chi-square tests. Data presented as percentage.

**Abbreviation:** WHS, World Health Survey.

**Table 3** Prevalence of dyspnea stratified by sex in selected South Asian countries, WHS 2002–2003

Frequency of smoking	Bangladesh (7.4)		India (7.2)		Nepal (11.3)		Pakistan (3.4)		Sri Lanka (6)	
	Women (8.9)	Men (5.7)	Women (7.8)	Men (6.6)	Women (11.5)	Men (11)	Women (3.8)	Men (3.2)	Women (6.5)	Men (5.5)
Daily	10.0	5.7	7.7	6.1	13.6	12.0	8.9	2.6	9.0	6.7
Not daily	17.0	3.0	11.6	6.1	16.6	9.4	5.6	5.3	14.3	6.3
Not at all	8.1	6.2	7.8	7.2	10.5	10.1	3.5	3.2	6.3	4.8
P-value	0.004	0.27	0.502	0.344	0.001	0.13	0.006	0.156	0.116	0.11

**Notes:** P-values calculated from chi-square tests. Data presented as percentage.

**Abbreviation:** WHS, World Health Survey.

**Table 4** Prevalence of chronic cough stratified by sex in selected South Asian countries, WHS 2002–2003

Frequency of smoking	Bangladesh (14.4)		India (11)		Nepal (15.3)		Pakistan (10)		Sri Lanka (5.9)	
	Women (14.3)	Men (14.5)	Women (10.6)	Men (11.5)	Women (15.4)	Men (15)	Women (8.4)	Men (11.2)	Women (5.3)	Men (6.5)
Daily	17.0	16.7	8.3	10.7	24.1	17.2	15.6	14.0	7.5	9.5
Not daily	16.0	11.4	14.5	13.2	17.6	16.5	25.0	16.9	3.6	10.0
Not at all	13.3	11.6	10.9	12.3	12.1	12.0	7.7	9.6	5.3	4.5
P-value	0.042	0.001	0.058	0.186	0.001	0.001	0.001	0.001	0.498	0.359

**Notes:** P-values calculated from chi-square tests. Data presented as percentage.

**Abbreviation:** WHS, World Health Survey.

**Table 5** Association between asthma and self-reported health among South Asians, WHS 2002–2003

Asthma	Bangladesh, AOR (95% CI)		India, AOR (95% CI)		Nepal, AOR (95% CI)		Pakistan, AOR (95% CI)		Sri Lanka, AOR (95% CI)	
	Fair	Poor	Fair	Poor	Fair	Poor	Fair	Poor	Fair	Poor
No	1	1	1	1	1	1	1	1	1	1
Yes	1.373* (1.020–1.848)	2.326* (1.757–3.079)	2.780* (2.249–3.436)	4.450* (3.648–5.430)	2.769* (2.097–3.656)	4.256* (3.295–5.497)	2.438* (1.737–3.422)	6.437* (4.658–8.895)	2.945* (2.235–3.881)	3.295* (2.533–4.286)

**Notes:** \*Statistically significant associations. Models adjusted for age, marital status, educational attainment, current job, and smoking and drinking habits.

**Abbreviations:** AOR, adjusted odds ratios; CI, confidence interval; WHS, World Health Survey.

**Table 6** Association between dyspnea and self-reported health among South Asians, WHS 2002–2003

Asthma	Bangladesh, AOR (95% CI)		India, AOR (95% CI)		Nepal, AOR (95% CI)		Pakistan, AOR (95% CI)		Sri Lanka, AOR (95% CI)	
	Fair	Poor	Fair	Poor	Fair	Poor	Fair	Poor	Fair	Poor
No	1	1	1	1	1	1	1	1	1	1
Yes	1.768* (1.363–2.294)	3.326* (2.605–4.247)	0.906 (0.736–1.116)	1.034 (0.990–1.081)	2.282* (1.929–2.699)	3.057* (2.605–3.586)	5.149* (3.545–7.478)	9.603* (6.566–14.044)	4.099* (3.117–5.389)	5.614* (4.357–7.234)

**Notes:** \*Statistically significant associations. Models adjusted for age, marital status, educational attainment, current job, and smoking and drinking habits.

**Abbreviations:** CI, confidence interval; WHS, World Health Survey.

**Table 7** Association between chronic cough and self-reported health among South Asians, WHS 2002–2003

Asthma	Bangladesh, AOR (95% CI)		India, AOR (95% CI)		Nepal, AOR (95% CI)		Pakistan, AOR (95% CI)		Sri Lanka, AOR (95% CI)	
	Fair	Poor	Fair	Poor	Fair	Poor	Fair	Poor	Fair	Poor
No	1	1	1	1	1	1	1	1	1	1
Yes	1.390* (1.156–1.671)	2.197* (1.832–2.634)	0.847 (0.716–1.003)	0.956 (0.807–1.134)	1.848* (1.598–2.138)	2.194* (1.904–2.528)	1.885* (1.553–2.288)	2.459* (2.136–3.311)	2.503* (1.932–3.243)	2.406* (1.864–3.106)

**Notes:** \*Statistically significant associations. Models adjusted for age, marital status, educational attainment, current job, and smoking and drinking habits.

**Abbreviations:** CI, confidence interval; WHS, World Health Survey.



Regarding the prevalence of the respiratory diseases, chronic cough was the most commonly (regional average 11.32%) reported complaint, followed by dyspnea (regional average 7%) and asthma (regional average 4.94%). The prevalence rate of asthma was highest in India (6.3%), and those of dyspnea and chronic cough were highest in Nepal (11.3% and 14.4%, respectively). Pakistan had the lowest rate of both asthma and dyspnea. The percentage of having all three conditions was highest at 1.2% in Bangladesh and Nepal and lowest in India at 0.1%, while having none was highest in Sri Lanka at 87.1% (not shown in the analysis). For asthma, the findings are consistent with some of the previously conducted studies. In Bangladesh, overall prevalence of asthma was found to be 5.0% among urban and 3.5% among rural populations in the south-western and south-eastern region.<sup>25</sup> In an earlier study based on data from a 1990 survey, the prevalence was found to be 5.3% among adult population and 7.3% among children.<sup>26</sup> In India, studies at subnational level reported that prevalence of asthma ranged from 2% among nonsmokers to 3.8% among smokers and that of any respiratory condition was 14%.<sup>27</sup> According to a more recent study based on the third National Family Health Survey (2005–2006), the prevalence was 1.8% among men and 1.9% among women.<sup>28</sup> Published reports on dyspnea and chronic cough are rarer compared to that of asthma. In a cross-sectional study conducted in Mysore taluk (Karnataka, India), the prevalence of chronic cough was found to be 2.5% and that of chronic phlegm was 1.2%, and it concluded that heavy smoking was strongly associated with both chronic cough and chronic phlegm.<sup>29</sup> The study conducted by Aggarwal et al among adult subjects in India reported higher burden of asthma and other respiratory diseases among smokers.<sup>30</sup> Not surprisingly, the prevalence of all three conditions was higher among those who reported smoking daily or occasionally, compared with nonsmokers.

As expected, Sri Lankans had the highest likelihood of reporting their health as good compared to the other four countries. This is understandable as they had the highest literacy rate and comparatively lower prevalence of the diseases being studied. There are no studies showing the association between asthma and subjective health for any of these countries included in this study. One Indian study on the respiratory disease burden found that asthma was the leading cause of death in the rural population.<sup>31</sup>

It should be noted that the prevalence in this study may not represent the present scenario since it was conducted a good few years ago. Despite that, our study has important implications. The findings provide useful information regarding the burden and pattern of asthma, dyspnea, and chronic

cough in the population and provide the incentives for further exploration. As a high COPD prevalent region, knowledge on the prevalence of the important risk factors especially asthma is of crucial importance. It is worth noticing that to date there are no comprehensive nationwide surveys on the respiratory diseases in these countries. Lack of evidence is a major barrier to evidence-based policy formulating, and long-term and effective addressing of the problem.

There are strengths and limitations to our study. This is the first study to focus on the measurement of the burden of asthma, dyspnea, and chronic cough – three important risk factors of COPD. Sample size was large and representative of the general population aged 18 years and older. The findings are relevant for evidence-based policy making targeting tobacco smoking and respiratory diseases in South Asian countries. However, as the data sets were secondary, we had no influence on the selection and measurement of the variables. Data on asthma, dyspnea, and cough were self-reported and were not validated by independent tests. Therefore, there remains the possibility of reporting bias. Also, as the surveys were cross-sectional, the association between self-reported health and the disease conditions cannot indicate any causal relationship. Further longitudinal studies are required to clarify the nature of this relationship.

## Conclusion

To our knowledge, this is the largest population-based study that has measured the prevalence of asthma, dyspnea, and chronic cough among adult population in South Asia. The findings highlighted a relatively high rate of these diseases, especially chronic cough. In contrast to previous statistics, the prevalence rate of asthma was comparatively low, however, those of dyspnea and chronic cough were high. There were also indications of sex difference in the prevalence rates, which requires further exploration on the factors that make women more vulnerable to these diseases. The prevalence rates were also high among daily and occasional smokers. Altogether, the findings call for programmatic efforts to reduce smoking and the prevalence of asthma, dyspnea, and chronic cough, which might help for the COPD prevention programs in the region. We also found a strong association between subjective health and asthma, dyspnea, and chronic cough. However, more in-depth studies are required to evaluate the underlying pathways of this observation.

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## Author contributions

The study was designed by GB. GB was responsible for collecting the data sets and was assisted in the analysis by ST and SY. All authors contributed substantially to the interpretation of the results, drafting the manuscript development, and made the decision to submit for publication.

## Disclosure

The authors report no conflicts of interest in this work.

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