PREVALENCE OF ASTHMA AND ASSOCIATED RISK FACTORS AMONG CHILDREN AGED 2 MONTHS TO 5 YEARS IN ILALA MUNICIPALITY, DAR ES SALAAM.

By

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CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by the Muhimbili University of Health and Allied Sciences a dissertation entitled: ***Prevalence of asthma and associated risk factors among children aged 2 months to 5 years in Ilala municipality, Dar es Salaam*** in partial fulfillment of the requirements for the degree of Master of Medicine, (Paediatrics and Child Health).

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Jacqueline Geoffrey Shoo, declare that this dissertation is my own original work and that it s not been presented and will not be presented to any other University for a similar or any other gree award.

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DEDICATION

To My dear husband Dr Bamuhimbisa Richard and our loving daughters Phoebe Katusiime and Abigail Atuhaiire.

My lovely parents, Stella and Geoffrey.

My sister Hannah Lulu.

My brothers Humphrey and Isaac.

ABSTRACT

Background: Asthma is a common chronic respiratory disease in childhood. While many studies on prevalence of asthma have been conducted in school aged children, a few have been done in children aged five years and below.

Objective: To determine the prevalence of asthma and associated risk factors among children aged 2 months to 5 years in Ilala Municipality, Dar es Salaam.

Study design and setting: Cross sectional, community based study was conducted at Ilala municipality Dar es Salaam from Mid April 2006 to end of June 2006.

Subjects: A total of 890 children were recruited into the study.

Methodology: Interviews of parents/guardian were conducted using a modified ISAAC questionnaires and a thorough physical examination was done. Main outcome measures included the prevalence of asthma (current wheeze) and associated risk factors. Using the chi-squared test; a p-value < 0.05 was regarded significant and relative risk was used to assess the risk.

Results: The prevalence of current wheeze (asthma) was 15.3%. Children with current wheeze had more exercise induced wheezing (RR = 17.3, 95% C.I 8.3-35.7) and dry night cough (RR = 5.61 95% CI 4.4-7.1). Significant risk factors for asthma were a maternal (RR. = 7.9 95% CI 4.3-14.6) or paternal (RR. = 3.9 95% CI 2.0-7.5) history of asthma, child's history of allergic rhinitis (RR = 2.8 95% CI 2.8-3.8) or. eczema (RR = 3.2 95% CI 1.4-7.4), high birth weight >4.5kgs (RR = 4.2 95% CI 1.5-12.1) and household pets (RR = 4.8 95% CI 1.6-13.9). Age, sex, breastfeeding, parental/guardian level of education and presence of a smoker in the household were not associated with asthma.

Conclusion and Recommendations: Prevalence of asthma is high among children in Ilala municipality, Dar es Salaam. Health workers should have a high suspicious index for diagnosing asthma in wheezing children especially when risk factors for asthma are present. Studies involving rural areas should be conducted.

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ABBREVIATIONS

ISAAC	International Study of Asthma and Allergies.
RSV	Respiratory syncitial virus.
IL	Interleukin.
U.K	United Kingdom.
IL	Interleukin

DEFINITION OF TERMS

For the purpose of this study, the following terms were defined or classified as follows:

Wheeze – A high-pitched musical or whistling sound heard from the chest during expiration without a stethoscope.

Ever wheeze – Any history of wheezing in a lifetime.

Current wheeze – A positive history of wheeze in the past 12 months.

Asthma case definition – Any child with current wheeze.

Asthma related symptoms-any history of dry night cough not associated with colds, or history of wheezing after exercise.

Frequent wheeze – Occurrence of three or more episodes of wheezing in the past 12 months.

Atopy – Allergic tendency that presented as rhinitis or eczema.

Rhinitis- Two positive responses to the following questions from ISSAC questionnaire.[72] (1) Has your child ever had a problem with sneezing or a runny, or a blocked nose when he/she DID NOT have common cold or flu? (2) In the past 12 months has your child had a problem with sneezing, or a runny, or a blocked nose when he/she DID NOT have a cold or the flu?

Eczema - Having an itchy skin rash in the past 12 months plus (i) Onset under the age of 2 years (ii) a history of flexural involvement and (iii) visible flexural dermatitis.

Exclusive breastfeeding – Receiving only mother's breast milk without any other feeds including water, in the first six months of life.

Level of education-

-Low if one had no formal education or had primary level of education.

-High if one had secondary, college or higher institution level of education.

Domestic animals

Pets – Either a dog and or a cat kept at home.

Maternal asthma – Having a mother known to have asthma.

Paternal asthma – Having a father known to have asthma.

Doctor diagnosed asthma- having a history of a previously diagnosed asthma in a health facility.

INTRODUCTION AND LITERATURE REVIEW

1.1 Background

Asthma is a chronic inflammatory condition of the lung airways resulting in episodic airway obstruction.[1, 2] It is a common chronic illness of childhood presenting with visits to health facility, admissions, missed school days and limitation of activity.[3, 4]

The aetiology of childhood asthma has not yet been pinpointed, however research implicates interplay between genetic predisposition and environmental factors.[1] Asthma affects all age groups however, and the greatest incidence of childhood asthma is among children younger than 5 years of age and in males. It also decreases with increase in age.

The natural history of asthma is unpredictable, many young children wheeze, but remission is common especially in non-atopic children without a family history of allergy or asthma, whose wheezing relates more to infections and environmental tobacco smoke exposure. About two thirds of wheezy children will become symptom free as adults.[5]

Diagnosing asthma in infants and young children is a difficult undertaking and can be a challenging task; hence underdiagnosis and undertreatment are key problems in this age group.[2, 6, 7]

Underdiagnosis and inappropriate therapy play a major role contributing to asthma morbidity and mortality. These can largely be prevented with improved knowledge regarding the factors associated with asthma and a timely, correct institution of medical management.[2]

1.2 Epidemiology

Asthma is a worldwide problem, its prevalence is estimated to be 7.2% of the world's population (6% in adults, 10% in children).[8] Higher prevalence's are reported in urban compared to rural areas.[9, 10] Male gender and children younger than five years of age are more affected by asthma.[5, 11, 12] World wide, it is estimated that one in every 250 deaths in general population is due to asthma and asthma was responsible for 164 deaths of children in the united states in 1998.[1, 13]

The prevalence of asthma is reported to be higher in English speaking countries compared to non English speaking countries; however it varies in different countries and even within different areas of the same country.[8, 14]

In United States (USA), it has been reported that 6 million children have asthma and annually, asthma accounts for 12 million primary care visits, 1.6 million emergency department visits, 11 million missed school days, 200,000 hospital admissions, and 150 pediatric deaths.[15] A surveillance study of asthma found that asthma was increasing in USA, the increase was (160%), from 22.2 per 1,000 to 57.8 per 1,000, from year (1993-1994), mainly among children aged 0-4 years.[4] A prospective study in Tucson Arizona reported that among children who were followed up from birth to 6 years of life, 19.9% had transient early wheezing, 15.0% had wheeze of late onset and 13% had persistent wheezing. From the above mentioned study it was concluded that most children with asthma symptoms during early life will outgrow their symptoms later in childhood, however about 40% will develop persistent asthma.[16] In Britain Luyt et al. reported that 15.6% of preschool children had ever wheezed; of these, 13% had current wheeze, 21.8% had recurrent night cough without colds and 11% had doctor diagnosed asthma.[17]

A study conducted in Iran in 2001 among preschool children reported the prevalence of ever wheeze was 21.9%, of these, 19.4% had current wheeze. In the same study among children with current wheeze, 79.1% reported to have 1-3 attacks, 11% had 4-12 attacks and 9.24% more than 12 attacks of wheezing in the past 12 months. Frequent wheeze was reported more in younger children less than 9 months (25%), compared to the older group (18.2%).[18] In another study among preschool children in Kota Bharu Malaysia, it was reported that prevalence of ever wheeze was 9.4%; of these children 6.2% had current wheeze, 10.2% had night cough and 7.1% had a previous doctor diagnosed asthma.[19] M B Salem in a community based study involving children 5 years and younger in Iraq, found that the prevalence of recurrent wheeze in the past 12 months was 15.8%.[20]

The prevalence of childhood asthma in Africa is reported to be low compared to that of the developed countries. A study involving 56 countries worldwide reported high rates in South Africa and lower rates in Ethiopia.[14] Nriagu1 J from Durban city, reported a 37-40% prevalence of wheeze in children aged 0 to 17 years.[21] A study done in rural and urban Ethiopia reported a 3.4% prevalence of current wheeze among children aged 1-5 years.[10]

From Kenya, Macharia WM in a hospital based study found that, among asthmatic children below 14 years, 21.3% experienced initial asthmatic attacks before the age of six months and 55.1% before 2 years.[22] In year 2000 a cohort study done in Ifakara Tanzania, reported the prevalence of current wheeze among children aged 4 years to be 14%.[23]

1.3 Aetiology

The precise aetiology of childhood asthma has not been identified. However research implicates interplay between genetic and environmental factors.[24, 25]

Viral illnesses have been related to an increased predisposition and to the development of asthma especially RSV predominating in children younger than two years of age and rhinovirus in older preschool children.[26, 27]

1.4 Pathogenesis

The pathologic changes in asthma are linked to persistent airways inflammation and hyperesponsiveness in the small airways. Airflow in small bronchioles is regulated by smooth muscle encircling the airways lumen; constriction of these muscular bands restricts airflow. In children with asthma, the tissues lining the airways have increased number of mast cells, activated eosinophils, and activated helper T cells. The latter produces proallergic, proinflammatory cytokine (e.g., interleukin 4, interleukin 5, and interleukin 13) and chemokines (e.g. RANTES, eotaxin) that mediates the inflammatory process. Eosinophils and basophils may also produce the same effects.

During an asthmatic attack, a cellular inflammatory infiltrate by eosinophils and other inflammatory cell types (neutrophils, monocytes, lymphocytes), fill the airways and induce epithelial damage and desquamation into the airways lumen. There is excess production of mucus into the airways and oedema of the surrounding tissues which also contribute to blockage of airways.[1]

The airway remodeling underlie the chronic functional and pathologic abnormalities of asthma. This includes the intermittent and episodic clinical manifestations of

asthma symptoms. It is characterized by thickening of basement membrane, sub epithelial collagen deposition, smooth muscle and mucus gland hypertrophy and hyperplasia.[1]

Inhaled allergen challenge studies have revealed two phases of airway obstructive processes in asthma. (1)An early phase which set in within 15 -30 min consisting of bronchoconstriction.and (2) a late phase occurring within 4-12 hrs after allergen exposure consisting of tissue inflammation and immune cellular infiltration into the airways, in addition to airways edema and excess mucus production. It is also associated with airways hyper responsiveness that can persist for several weeks.[1]

1.5 SPECIAL MECHANISMS

1.5.1 Exercise induced asthma

Physical activity is an important trigger of asthma symptoms for most asthma patients, and for some it is the only trigger. The mechanism whereby exercise induced asthma occurs is thought to relate to the consequences of heating and humidifying large volumes of air during exercise.[2, 11]

Exercise-induced bronchoconstriction typically develops within 5-10 minutes after completing exercise and in some, during exercise. Patients experience typical asthma symptoms, or sometimes a troublesome cough, which resolve spontaneously within 30-45 minutes.[11] Children with asthma may present only with exercise induced symptoms.[2, 11] Studies have also reported exercise induced wheezing or exacerbation of symptoms of asthma during exercise in young children.[18, 28] Rapid improvement of post-exertional symptoms after inhaled β_2 agonist use, or their

prevention by pretreatment with an inhaled β_2-agonist before exercise, supports a diagnosis of asthma.[11]

1.5.2 Nocturnal asthma

Nocturnal symptoms or awakening as a result of shortness of breath is a common occurrence in asthma than in other airway diseases.[2] The mechanisms accounting for the worsening of asthma at night are not completely understood but may be driven by circadian rhythms of circulating hormones such as epinephrine, cortisol, and melatonin and neural mechanisms such as cholinergic tone. An increase in airway inflammation at night has been reported. This might reflect a reduction in endogenous anti-inflammatory mechanisms.[29]

1.6 Clinical presentation of asthma in children

The clinical manifestations of asthma are associated with variable degrees of airway obstruction that is generally reversible either spontaneously or with treatment.[1] The common symptoms are: recurrent wheeze, intermittent dry or recurrent coughing, expiratory wheeze and shortness of breath

Recurrent coughing and wheezing occur in 10–20% of children younger than four years of age.[30] Cough which is non-productive and nonparoxysmal may be the only symptom of asthma.[2] Children with asthma tend to cough after midnight, during the early hours of morning.[2, 31]

Wheezing is one of the most common symptoms of asthma. It is described as a high-pitched musical or whistling sound coming from the chest during breathing out.[2]As severity increases, the wheeze lasts throughout expiration however during severe attacks, wheezing is also present during inspiration. During a very severe episode,

wheezing may be absent because of the severe narrowing of the airway and respiratory muscle fatigue or when obstruction involves predominantly the small airways. Thus, absence of wheezing may not necessarily rule out the diagnosis of asthma.[11] Furthermore, wheezing can be associated with other causes of airway obstruction, such as bronchiolitis, gastroesophageal reflux and foreign body aspiration.[2, 11]

1.7 Classification of wheezing in childhood

Martinez et al described 3 characteristic groups of wheezing in preschool children.[16]

- Transient early wheeze (41%). Children who have at least one episode of wheezing in the first 3 years of life but not at age six years.
- Persisting wheeze (28%). These children wheezed during the first 3 years of life and continue to wheeze at age of six years.
- Late-onset wheeze (31%). Those who developed wheezing after the first 3 years of life and continue to wheeze at the age of six years.

Persisting wheezing and late onset wheezing were found to be associated with atopy and asthma. Martinez also described three other groups of wheezers:[16]

- Group 1: *Low Lung function* –Children who wheezed in their first three years of life, were found to have low lung function. These were children with transient wheezing.
- Group 2: *Non-Atopic, viral-induced Asthma*: Children who will outgrow asthma after a longer period of time, these are children with non atopic wheezing.

- Group 3: *Atopic Asthma*: these are children who will go on to develop persistent wheezing beyond infancy and early childhood. Usually these children have a family history of asthma and allergies and present with allergic symptoms very early in life that is atopy-associated asthma.

2.0 RISK FACTORS FOR ASTHMA

Risk factors for asthma/wheezing have been studied extensively in school age children but there is little information about younger children.[18, 20, 32] Strong factors have been found to be, parental history of asthma, history of allergy in the child (atopic dermatitis, allergic rhinitis, inhalant allergen sensitization e.g. animal dander) and having a serious respiratory infection in the first 2 years of life. Others included in this study are breast feeding, birth weight, environmental tobacco smoke exposure, male gender, parental/guardian level of education, exposure to domestic animals, and exposure to domestic source fuel.

2.1 Parental asthma

Having a parent with history of asthma has been associated with increased risk of asthma.[12, 28, 32, 33] The risk is high with maternal asthma compared to paternal asthma and is high when both parents have asthma compared to if only one parent has asthma.[34] Children with persistent and late onset wheezing are more likely to have mothers with asthma compared to those without wheezing.[23, 27]

2.2 Atopic dermatitis (Atopic eczema)

Atopic dermatitis is a highly pruritis relapsing or chronic skin disease affecting more than 10% of children. Symptoms typically begin during infancy; approximately 50% develop the illness as early as within the first 6 months of life.[35, 36] Clinically patients have intense pruritu and cutaneous reactivity mostly facial, flexural or extensor skin rash.[35, 36] Diagnosis is based on clinical presentation; the acute form presents with intense pruritis, erythermatous papules associated with excoriation and serous exudates. In sub acute form, there is erythermatous, excoriated scaling papules and the chronic form is characterized by lichenification and fibrotic papules.[35] On the basis of The United Kingdom(UK) working party's diagnostic criteria for atopic dermatitis II, in order to qualify as a case of atopic dermatitis; an individual must have an itchy skin condition plus three or more of the following: (1) history of flexural involvement (2) a family history of asthma/hay fever (in children 4 years or younger) (3) a history of a generalized dry skin (4) onset of rash under the age of 2 years (5) visible flexural dermatitis. [37] The criteria have been validated in patients (including infants) attending dermatology outpatient clinics. Based on subgroup analysis in their own validation study, the U.K. Working Party state that there is evidence for the validity of the criteria in the first year of life with most children in this age group being correctly classified.[37] Gustafson et al followed up children with dermatitis to age of seven years, among them, 43% developed asthma.[38] Studies have found that history of eczema in a child is significantly associated with asthma.[16, 18, 28, 36]

2.3 Allergic rhinitis

Allergic rhinitis is a common allergic condition of childhood. In affluent societies it affects 20-40% of children. The diagnosis is generally established by age 6 yrs and may be made in infants. It is characterized by frequent sneezing and a runny or stuffy nose sometimes accompanied by watery eyes.[39] Studies have found that; rhinitic children compared to non-rhinitic children presented a significant increase of asthma and persistent wheezing.[16, 18, 40, 41]

2.4 Respiratory tract infections

Respiratory tract infections in early life have been related to the development of asthma in later childhood.[26, 42] A study in Tunisia found that among children with asthma aged less than 30 months, asthma began by acute bronchiolitis in 90% of cases.[43] In Tanzania, children with a hospital visit for lower respiratory tract infection (LRTI) had more wheezing compared to others.[23]

2.5 Breastfeeding

Exclusive breastfeeding in the first six months of life is reported to be protective against wheezing in early life by its protection against allergic diseases.[44] Compared to never breast-fed children, ever breast-fed children have significant reduced risk of being diagnosed with asthma regardless of duration of breastfeeding.[32, 45]

Early weaning has been associated with asthma while exclusive breastfeeding protects against severe asthma.[33, 46] However in one study, prolonged breastfeeding more than 12 months was reported to increase risk of wheezing in children.[10] Other studies did not find any association between breastfeeding asthma.[12, 20]

2.6 Birth weight

Different findings have been reported regarding birth weight and asthma. Several studies have reported a high birth weight [47, 48, 49] and other low birth weight [50, 51] as a risk for asthma and yet other studies found no association.[52, 53] Literature suggests that obesity is a proinflammatory state. Biomedical studies indicate that increased levels of leptin, IL-6, and IL-1 (all proinflammatory cytokines) may contribute to and up regulate inflammation in the airway, independent of an allergic mechanism.[54] Adipocytes may also increase the production and activation of mast cells in large airways, predisposing airways to bronchospasm.[55]

2.7 Environmental tobacco smoke exposure

Tobacco smoke contains more than 4000 chemical toxins or intoxicants, exposure to which causes various respiratory illnesses. The most common and well-known tobacco toxins are nicotine, carbon monoxide, formaldehyde, hydrogen cyanide, sulfur dioxide, nitrogen oxide, ammonia, polycyclic aromatic hydrocarbons, and the nitrosamines. These substances produce both irritant and immunologic effects on the respiratory tract.[56] Maternal smoking has significantly been associated with the risk of transient early wheezing and asthma in childhood.[16, 28, 56] Other studies have reported the association of passive smoking and asthma in children.[10, 33, 46] Some studies however, did not find the association between asthma and exposure to cigarette smoking.[12, 18, 19, 20]

2.8 Gender

Male sex has shown to have increased risk for childhood wheezing and asthma compared to females.[12, 16, 57] Although the exact mechanism is not known, studies suggest that during early infancy females have proportionately larger airways relative to their lung size than do male neonates, resulting in increased expired flow rates and airway conductance.[58] Some studies however did not find the association.[10, 18, 20, 32,

2.9 Parental/guardian level of education

Several studies have assessed the association of parental level of education and the occurrence of wheezing in childhood. A study in Ethiopia found that wheezing tended to increase with a corresponding increasing in the level of parental education. However this finding was not statistically significant.[10] In another study, it was reported that most of the wheezy children had parents with low level of education compared to non wheezy children but the difference was statistically not significant.[20] A study in Durban reported no association between level of education of parents and asthma in children.[21]

2.10 Exposure to domestic animals

All warm-blooded pets, including small rodents and birds, produce dander, urine, feces, and saliva that can cause allergic reactions and initiate asthma symptoms. Animal dander, hair, and saliva from cats and dogs are the most common source of allergens.[59] Studies have identified FEL d 1 a highly charged protein as the major cat allergen.[59] Different studies of exposure to pets and risk of asthma have yielded

conflicting results. A study in Ethiopia reported that, exposure to animal was associated with an increased risk of current wheeze in rural areas and was protective in urban areas.[10] Increased risk of asthma with exposure to farm animals has also been reported. [25] However in other studies exposure to pets did not show significant association with asthma.[20, 21] A systematic review concluded that exposure to pets increased the risk of asthma and wheezing in older children (> 6 years) but not younger children (< 6 years), however the protective effect in young children was thought to be due to a selection bias.[60]

2.11 Exposure to domestic fuel gases

Combustion of wood liberates nitrogen dioxide, carbon monoxide, sulfur dioxide, and particulate matter which have been significantly associated with lower respiratory tract diseases and asthma diagnosis before 5 years of age.[61, 62] A study on environmental risk factors for asthma found that, children who were ever exposed to wood or oil smoke were at 1.6-fold higher risk for asthma. The association was stronger when exposure occurred in the first year of life.[62] Evidence from a limited number of studies in children suggests that the use of biomass fuels (wood/coal) may be associated with a lower risk of atopy.[63] In some studies, use of modern fuel such as kerosene but not electricity has been found to increase number of wheezing in children.[10, 63] However a study in Basra Iraq did not find the association.[22]

3.0 DIAGNOSIS OF ASTHMA

Diagnosis of asthma in children is established based mainly on clinical presentation through taking a thorough history from parents/guardians and additional findings

from physical examination.[2] Although it is often difficult for parents to define symptoms precisely, history may exclude some conditions mimicking asthma.[28]

3.1 Medical History

A detailed medical history of a new patient known or thought to have asthma should help: (1) Identifying the symptoms likely to be due to asthma. (e.g recurrent wheezing, cough ,particularly worse at night) (2) Support the likelihood of asthma (e.g patterns of symptoms, family history of asthma or allergies) (3) Assess the severity of asthma (symptom frequency and severity, exercise tolerance, hospitalizations, current medications) (4)Identify possible precipitating factors (e.g., viral respiratory infections; exposure at home, work, day care, or school to inhalant allergens or irritants such as tobacco smoke).

3.2 Physical Examination

The upper respiratory tract, chest, and skin are the focus of the physical examination for asthma. Physical findings that increase the probability of asthma include (1) hyperexpansion of the thorax, especially in children; use of accessory muscles; appearance of hunched shoulders; and chest deformity. (2) Rhonchi on auscultation, sounds of wheezing during normal breathing, or a prolonged phase of forced exhalation (typical of airflow obstruction). Wheezing during forced exhalation is not a reliable indicator of airflow limitation. In mild intermittent asthma, or between exacerbations, wheezing may be absent. (3) Increased nasal secretion, mucosal swelling, and nasal polyps. (4) atopic dermatitis/eczema or any other manifestation of an allergic skin condition.

3.3 Lung function tests

They include; Spirometry, peak expiratory flow (PEF) monitoring and bronchoprovocation challenges. However these tests are generally valuable in children over 6 years of age where children are able to cooperate.[1]

3.4 Screening tool for asthma

Currently no non-invasive method for assessment of the presence and nature of airway inflammation has yet proven to be helpful in the diagnosis and follow-up of asthma in young children.[2] However, studies have found that, using written questionnaires, symptom history still forms the basis for defining asthma in epidemiological settings.[64, 65, 66] Using spirometry or bronchiohyperesponsive (BHR) tests, only marginally increased the diagnostic accuracy after symptom history had been taken into account.[64]

4.0 PROBLEM STATEMENT, RATIONALE AND OBJECTIVES OF THE STUDY

4.1 Problem Statement

Respiratory conditions impose an enormous burden on society. Asthma, a common chronic respiratory condition in childhood is a disease of public health importance in both developed and developing countries.[67] In developing countries however, chronic respiratory diseases including asthma, represents a challenge to public health because of their frequency, severity, projected trends, and economic impact.[68] According to World Health Organization (WHO), world-wide the economic costs associated with asthma are estimated to exceed those of Tuberculosis and Human immunodeficiency virus infection/Acquired human immunodeficiency syndrome combined. [67] However, because of other priorities in many developing countries, chronic respiratory diseases such as asthma are not receiving the attention and services necessary despite of their reported increase in childhood.[69]

Because most cases of asthma begin during the first years of life, identification of young children at high risk of developing the disease is an important public health priority. Until recently, the earliest stages of asthma in young children have not been studied in detail in developing countries in general and in Tanzania specifically.

There are many reports on the prevalence of asthma and its risk factors among school age children, however only a few studies have been done among children aged 5 years and under. This community based study aimed at answering the following research questions:

1. What is the prevalence of asthma in children aged 2 months to 5 years in Tanzania

2. What is the proportion of known risk factors of asthma among children with asthma compared to those without asthma?

The study will provide more information on the magnitude of childhood asthma in our setting, and the potential risk factors closer to the time of disease inception. On the other hand, in order to plan for effective interventions we needed a better understanding of asthma, related symptoms and the risk factors for asthma in this age group specific for our country.

4.2 Rationale

In Tanzania, there are few documented reports on the prevalence of asthma and associated factors in children aged five years and below. In Dar es Salaam specifically, there are no previous documentation on prevalence of asthma in young children. A better understanding of asthma and its associated factors in young children is imperative because of the therapeutic benefits. This study therefore gives us an insight on the prevalence and risk factors for asthma in an urban area Dar es Salaam.

4.3 OBJECTIVES

4.3.1 Broad objective

To determine the prevalence and risk factors for asthma among children aged 2 months to 5 years in Ilala municipality, Dar es Salaam.

4.3.2 Specific objectives

1. To determine the prevalence of asthma among children aged 2 months to 5 years by age and sex.
2. To compare the prevalence of doctor diagnosed asthma and asthma as determined by current wheeze among children aged 2 months to 5 years.
3. To determine the frequency of wheezing and proportion of children with nocturnal wheezing in the past 12 months, among children with asthma by age and sex.
4. To determine the association between asthma and asthma related symptoms and sign (night cough, exercise induced wheezing and rhonchi) among children aged 2 months to 5 years.
5. To determine factors associated with asthma among children aged 2 months to 5 years.

5.0 METHODOLOGY

5.1 Study design;

This was a cross sectional, community based study.

5.2 Study Setting

This study was conducted in, Ilala municipality, Dar es Salaam. Dar es Salaam city is located on the East Coast of Tanzania. It is divided into three municipalities, Ilala, Temeke and Kinondoni. The climate is typically tropical with hot weather throughout the year with temperature ranging from about 26° C to 35° C. There are two rainy seasons; short rains in November to December and long rains in March to May. The estimated population of Dar es Salaam is around three million. [70]

Ilala is an old planned part of the city whose inhabitants are largely urbanized. It is divided into 22 wards. Its population is approximately 630,000 people, the under five population is approximately 73,593 with a female to male ratio of 1: 1.02.[71]

5.3 Study population

The eligible study population was children aged 2 months-5 years residing in Ilala municipality.

5.3.1 Inclusion criteria

1. Children aged 2 months to 5 years residing in Ilala municipality who were available during the study period.
2. Children whose parents/guardians gave informed consent.

5 3.2 Exclusion criteria

1. Children with a known congenital heart disease

5.4 Sample size;

The minimum sample size (n) was calculated using the following formula

$n = Z_{\alpha}^2 P (100 - P) / e^2$

Where;-

- n= Estimated Sample size.
- Z_{α}=Standardized normal deviate corresponding to significant level α
- P = Prevalence of wheeze in the community taken to be 14% a proportion reported in Ifakara Tanzania.[23]
- e = Margin of error on estimated p to be 2.5%

In this study, the level of significance, α, was taken to be 0.05 giving $Z_{\alpha} = 1.96$

Hence the minimum required sample size of 739 children was obtained.

However on adding 20% in order to take care of non response the sample size was estimated to be 890 children.

5.5 Sampling technique

A three stage cluster sampling procedure was used;

First stage: Ilala municipal was selected randomly from the three municipalities of Dar es Salaam using a simple random sampling technique.

Second stage: Two wards (Ilala and Buguruni) were selected randomly from a list of 22 wards of Ilala municipal, through simple random sampling.

Third stage: Two streets were selected randomly from a list of streets from each ward. Thereafter households in each of the selected streets provided the study units until when the sample size was reached.

5.6 Duration of the study

The study was conducted from mid April 2006 to end of June 2006 (10 weeks)

5.7 Data collection techniques and tools

A modified questionnaire adopted from the International Studies of Asthma and Allergy in Childhood (ISAAC) questionnaires was used.[72] The questionnaire looked at the presence of past (wheeze ever) and current wheeze (wheeze in the past 12 months), wheezing frequency and sleep disturbance due to dry night cough and wheezing. There were questions on history of atopy in a child, symptoms of exercise induced wheezing, and if a child has ever had a doctor diagnosed asthma. Social demographic characteristics included sex, age if possible by date of birth, parental or guardian level of education, etc (Appendix I). The questionnaire was first translated into Kiswahili language and thereafter data collection was done by trained assistants who were medical doctors.

5.8 Piloting the study

This was done two weeks prior to actual data collection so as to test the practicability of the questionnaire. Some questions were adjusted as the parents/guardians initially misunderstood them. Thereafter, the questionnaire was easily administered and brought up the intended information from parents/guardians.

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5.9 Physical Examination

The investigator with the assistance of the trained assistants did a thorough physical examination to all children. Clinical features that were noted included visible flexural skin lesions typical of eczema, added sounds on respiratory system (rhonchi/crackles) and heart murmurs.

Under a broad day light, the flexural surfaces of the skin (the folds of the elbows, behind the knees, in front of the ankles, under the buttocks, around the neck, ears or eyes) were examined for evidence of skin lesions typical of eczema.

Examination of the respiratory system documented the following features; the presence of chest deformity, features of abnormal chest movements, and added sounds (crackles/rhonchi).

The precordial area was examined, assessment of heart sounds and murmurs were done. The responses were filled in the space provided in the questionnaire, (Appendix I).

5.10 Ethical considerations

Ethical clearance to carry out this study was obtained from the College Research and Publication Committee of Muhimbili University College of Health Sciences. Permission to conduct the study at Ilala municipality was requested from the appropriate authorities. The permission was granted.

The aim of the study was explained to the parents/guardians who gave informed verbal consent. Children who were either wheezing; had eczema or found to have other medical conditions on the day of interview, their parents/guardians were advised to take them to a nearby health facility as soon as possible for further

evaluation and management. Health education on asthma was given to parents and guardians.

Findings from one child where not disclosed to other households in the study.

5.11 Quality control

Each questionnaire was checked for accuracy and completeness before leaving the interviewee. This was done on daily basis by the principle investigator to ensure that the data collected was free of errors.

5.12 Data Analysis

The investigator and a computer programmer, who was familiar with research, carried out data entry and analysis using EPI INFO version 6 computer program. Age was grouped into two categories based on the literature; as in young children most wheezing occurs during the first 36months of life after which it decreases as some children outgrow their symptoms.[16] Frequency distribution tables were used to determine the prevalence of asthma; asthma related symptoms and doctor diagnosed asthma. Chi square test was used to compare proportions and Fishers exact Test was used when the expected value was less than 5. Relative risk was used to asses the risk of one group of children to have a certain characteristic (e.g. parental history of asthma). Association between variables was considered statistically significant if p-value was < 0.05.

6.0 RESULTS

A total of 890 children aged 2 months to 5 years were included in this study. Of these 447 (50.2%) were males and 443 (49.8%) were females. Majority of the children were aged 36 months and below (61.8%). The mean age was 31.6 (± 18.8) months.

Table 1: **Socio-demographic and clinical characteristics of study subjects.**

Characteristic	Total(n = 890)	Percent
Sex		
Male	447	(50.2)
Female	443	(49.8)
Age (months)		
≤36	550	(61.8)
>36	340	(38.2)
Ever wheeze	167	(18.8)
Current wheeze	136	(15.3)
History of atopy in a child		
Eczema	22	(2.5)
Rhinitis	140	(15.7)
Exclusive breastfeeding	34	(3.8)
Parent/guardian level of education		
Low	778	(87.4)
High	112	(12.6)
Presence of a smoker in the household	237	(26.6)
History of asthma in the parents	73	(8.2)
Keeping pets*	13	(1.5)
Domestic fuel used at home		
Kerosene	243	(27.3)
Charcoal	641	(72.0)
Electricity	6	(0.7)

* includes a dog and or a cat

The prevalence of asthma defined as current wheeze was 15.3%. Doctor diagnosed asthma was reported in 67 (7.5%) of children in the study.

Asthma was reported more in males 72 (16.1%) than females 64 (14.4%), ($p > 0.05$).

Eighty nine (16.2%) of children aged 36 months and below had asthma compared to 47 (13.8%) of those aged above 36 months, ($p > 0.05$). Table 2.

Table 2: **Prevalence of asthma by age and sex**

Characteristic	Asthma n (%)	p-value
Sex		
Male	72 (16.1)	0.49
Female	64 (14.4)	
Age (months)		
≤ 36	89 (16.2)	0.30
>36	47 (13.8)	

Among all 136 children with asthma, 97 (71.3%) children had ≤ 3 episodes of wheezing and 39 (28.7%) had more frequent attacks in the pasts 12 months.

Children above 36 months of age had more frequent wheeze 17 (36.1%) compared to those aged 36 months and below 22 (24.7%), ($p > 0.05$).

Eighty children (58.8 %) with asthma had sleep disturbance due to nocturnal wheezing. Fifty six (62.9%) of nocturnal wheezing was reported in children aged 36 months and below compared to 24 (51.1%) reported in the older age group ($p > 0.05$). Table 3.

Table 3: **Characteristics of wheezing attacks in the past 12 months among children with asthma by sex and age.**

Characteristics	Wheezing > 3 times in the past 12 months n (%)	p-value	Nocturnal wheeze in the past 12 months n (%)	p-value
Sex				
Male	20 (29.7)	0.83	44 (61.1)	0.56
Female	19 (27.8)		36 (56.3)	
Age (months)				
≤ 36	22 (24.7)	0.10	56 (62.9)	0.18
>36	17 (36.1)		24 (51.1)	

In the analysis of symptoms reported, dry night cough without colds was reported in 173 (19.3%) of all children in the study. Children with asthma reported significantly more symptoms of dry night cough without colds 87 (64%) compared to those with no asthma 86 (11.4%), ($p < 0.01$).

Wheezing during or after exercise was reported in 37 (4.2%) of children in the study. Children with asthma 28 (20.6%) were significantly more likely to report having wheezing during or after exercise compared to those with no asthma 9(1.2%), ($p < 0.01$). Table 4.

Table 4: Distribution of asthma symptoms and rhonchi by asthma.

	Asthma (current wheeze)			
Variable	Present (%)	Not present (%)	RR (95% CI)	p- value
Dry night cough without colds	87 (64.0)	86 (11.4)	5.61 (4.4,7.1)	<0.01
Exercise induced asthma	28 (20.6)	9 (1.2)	17.3 (8.3,35.7)	<0.01
Rhonchi	14 (10.3)	11 (1.5)	7.1 (3.3,15.2)	<0.01

Children with asthma 23 (16.9%) were significantly more likely to have mothers with asthma compared to children with no asthma 16 (2.1%), ($p < 0.01$).

Similarly children with asthma 14 (10.2%) compared to those with no asthma 20 (2.6%), were more likely to have fathers with asthma, ($p < 0.01$).

Eczema was present significantly more in children with asthma 8 (5.9%) compared to 14 (1.9%) of those with no asthma, ($p < 0.05$).

Forty seven (34.6%) children with asthma had rhinitis compared to 93 (12.3%) children who had no asthma, ($p < 0.01$).

Children with asthma 6 (4.4%) were more likely to have had a high birth weight (> 4.5 kg) compared to those without asthma 8 (1.1%), ($p < 0.05$).

Children with asthma 6 (4.4%) were significantly more likely to have pets at home compared to those with no asthma 7 (0.9%), ($p <0.01$).

Exclusive breastfeeding was more in children with no asthma 31 (4.1%) compared to children with asthma 3 (2.2%). The difference was statistically not significant, ($p > 0.05$). Table 5.

Table 5: **Asthma among children aged 2 months to 5 years according to risk factors.**

Risk factor	Asthma present N=136 (%)	Asthma not present N=754 (%)	RR(95% CI)	p-value
Asthma in mother	23 (16.9)	16 (2.1)	7.9 (4.3,14.6)	<0.01
Asthma in father	14 (10.2)	20 (2.6)	3.9 (2.0,7.5)	<0.01
History of eczema in a child	8 (5.9)	14 (1.9)	3.2 (1.4,7.4)	0.01
History of rhinitis in a child	47 (34.6)	93 (12.3)	2.8 (2.8,3.8)	<0.01
Birth weight (kg)				
2.5 -4.5	116 (85.3)	684 (90.7)	1	
<2.5	14 (10.3)	62 (8.2)	1.3 (0.7,2.2)	0.35
>4.5	6 (4.4)	8 (1.1)	4.2 (1.5,12.1)	0.01*
Keeping pets at home	6 (4.4)	7 (0.9)	4.8 (1.6,13.9)	<0.01
Presence of a smoker in the household	42 (30.9)	95 (25.9)	1.2 (0.9,1.6)	0.22
Parent/guardian level of education High	17 (12.5)	195 (12.6)	1 (0.6,1.6)	0.97
Domestic fuel use at home				
Electricity	1 (0.7))	5 (0.7)	1	
Kerosene	35 (25.7)	208 (27.6)	1 (0.9,1.0)	0.88
Charcoal	100 (73.5)	541 (71.8)	1(0.9,1.0)	1.00*
Ever breastfed	135 (99.3)	750 (99.5)	1.0 (1.0,1.0)	0.56*
Exclusively breastfed	3 (2.2)	31 (4.1)	0.5 (0.2,1.7)	0.28
Breastfeeding duration ≥24 months	92 (67.6)	504 (66.8)	1 (0.9,1.2)	0.85

* Fisher's exact test

7.0 DISCUSSION

The prevalence of asthma (current wheeze)

The main objective of this study was to establish the prevalence of Asthma in children aged 2 months to 60 months (5 years). The study used a core question of the ISAAC questionnaire, the presence of current wheeze (wheeze in the last 12 months) as an indication of the presence of asthma.[72] The ISSAC questionnaire has been extensively used and validated in older school aged children and has been used in African and other countries to determine the prevalence of asthma.[66, 72] Studies in younger children aged 5 years and below have also been using the same questionnaire with good results.[10, 18, 23]

The overall prevalence of current wheeze (Asthma) in Ilala Dare es Salaam urban was found to be 15.3%. This was almost similar to a study conducted in Ifakara Tanzania (a rural setting) in 1995, using a similar definition of Asthma. The prevalence of current wheeze at age of 4 years in the Ifakara study was found to be 14%.[23] The difference in methodology used between the two studies may have influenced the findings as well as the differences in sample size (528 in Ifakara study versus 890 in our study). However, similarities between urban and rural areas have been reported elsewhere, a study involving preschool children in Basra Iraq reported no significant urban/rural differences.[20]

Our findings were similar to those reported by Luyt et al in Britain [17] where the prevalence of current wheeze, among children aged five years and below was 13%. The two studies from Tanzania in contrast to studies done elsewhere [21, 24] had very high prevalence rates. There was no immediate explanation for the possible

differences between these studies however; different geographical and environmental factors may have influenced these prevalence rates.

Sex

The prevalence of asthma was slightly higher in males (16.1%) than in females (14.4%), however the difference was not statistically significant. Similarly other studies found no association between sex and asthma (current wheeze).[10, 18, 20] In some studies however, the prevalence rate was reported to be higher in males.[12, 57] The exact mechanism for this sex difference is not clearly known, although factors such as larger airway calibers relative to the lung size has been observed in females during infancy compared to males. This may predispose males to wheeze more than females during early childhood.[58] There is evidence to suggest that prevalence of other allergic diseases is as well higher in young boys than in young girls.[40]

Age

Apart from gender, other factors that were noted to influence the prevalence of wheeze included age. Asthma (current wheeze) was reported more in children of age 36 months or less, (16.2 %) compared to (13.8%) in older children. Current wheezing is reported to be more common among younger children than older children [17], perhaps due to proportional increase in airway diameter with age.[16] Most children in the younger age group (≤36 months) had wheezed at least once in the past 12 months. Frequent wheezing for those who had current wheeze was reported more in the older age group (>36 months) (36.1%) than the younger group (24.7%).

The lack of impact of age on asthma (current wheeze) has been reported in other studies.[18]

Symptoms associated with wheeze

Nocturnal symptoms

Nocturnal symptoms of asthma in this study were present in 58.8% of children with asthma and seemed to be more in the young as well as in males; this however was not statistically significant. Our findings suggest that most of children with asthma have nocturnal symptoms which are not age or sex related. Nocturnal symptoms or awakening are more common in asthma than in other airway diseases.[2] The nocturnal symptoms vary, however ,and differentiating among them may assist the clinician in making a diagnosis as well as in determining disease severity. For example, nocturnal symptoms that results in the child's awakening may indicate more severe disease, whereas coughing or wheezing at night with no awakening is less severe disease.[2, 28]

A similar study in Iran among children younger than 5 years of age reported nocturnal symptoms in only 8.3% of children with current wheeze and symptoms were more in children aged more than 9 months (18.5%) and in males. (18%).[18] The difference between this study and our study on nocturnal symptoms among children reported to have asthma is big and we do not have explanation for the difference.

Dry night cough

The overall prevalence of dry night cough not associated with any other know factor that cause a cough such as colds was 19.4%, the finding which was more in children in general, however more so in children with asthma 64% compared to those with no

asthma 11.4%. There was a strong association between dry night cough and asthma. Our findings were close to the one reported in Leicester by Luyt D K et al 21.8%.[17]However other studies reported a much lower prevalence of 11.8% [18] and 3%.[32]

Cough that is dry and not associated with colds may indicate occult asthma, and could be the only symptom of asthma especially in children with exercise induced and nocturnal asthma.[29, 31, 76] Our findings supports the hypothesis that dry night cough not associated with colds is a significant symptom of asthma. However it should also be noted that apart from asthma, other possible causes of dry night cough or persistent cough include post nasal discharge, esophageal reflux and tuberculosis. For reliable data on this symptom, parents should be asked on duration of cough and medication used to relieve the cough and what was the response to the medication given especially in our society where infectious causes of chronic or recurrent cough may be prevalent.

Exercise induced Asthma

Exercise induced wheezing was found in 4.2% of individuals seen, this was higher than what was reported from a study done in South Wales where they reported a prevalence of 1.5%.[32] A study in Tehran reported a much higher figure, 18.9% among children older than 18 months but younger than 5 years of age.[18]

Twenty eight (20.6%) of the children who reported having current wheeze (asthma) in this study had symptoms of wheezing during or after exercise compared to those with no asthma (1.2%), the difference which was statistically significant. However other studies have reported even higher levels of exercise induced wheezing among

children reported to have asthma; a study in children younger than 3 years found that 60% of children with asthma had exercise induced wheezing.[28] Exercise has been identified as an exacerbating factor for asthma.[2] It is important to note that in a toddlers or infants, excitement, giggling and crying are equivalent to exercise.[28] In these individuals exercise acts as a trigger which causes air way bronchoconstriction by initiating an inflammatory like response producing asthma symptoms.[78] Exercise in young children is simply playing and not a defined activity, therefore some parents/guardians may have interpreted panting as wheezing after exercise despite the fact that we were careful to explain the symptoms to the interviewees. In order to improve understanding and improve uniformity in responses to the question on whether the child had exercise induced asthma or not, the ISAAC video questionnaire would have been useful. The video shows the actual presentation of exercise induced wheezing to the parents/guardians. Our study did not use this video questionnaire something that generally can not be used in clinical practice in most developing countries.

Doctor diagnosed asthma

During this study of all children seen, 7.5% had asthma that had been diagnosed in a health care setting by clinicians. This is almost similar to the one reported in Kota Bharu (7.1%) [19]. Other studies have reported slightly higher prevalence rates of doctor diagnosed asthma than in this study (11%) [17] and (10.5%) [32] and another study however reported a lower prevalence of 3.8%.[18]

It has previously been reported that asthma is under diagnosed.[2, 6, 7] The difference in the prevalence of doctor diagnosed asthma and the one obtained from this and

other studies is probably due to the different diagnostic criteria's used by clinicians in diagnosing asthma. The present study findings suggest that there may be under diagnosis of asthma in our health care facilities, which on the other hand has implication on treatment of asthma in these young children. Determining the knowledge of medical practitioners/physicians on how to diagnose asthma in young children is required and may help to improve the diagnosis and management of asthma in children.

Auscaltatory findings associated with asthma

Rhonchi was present in 25 (2.8%) of children in the current study. Of these 10.3% had asthma compared to 1.5% of those with no asthma. Children with asthma were more than 7 times likely to have rhonchi during examination compared to those with no asthma. Other studies did not examine for the presence of rhonchi in their study populations.[18, 32] Because asthma symptoms are variable, the physical examination of the respiratory system may be normal. The most usual abnormal physical finding is rhonchi on auscultation, a finding that confirms the presence of airflow limitation. However, in some people with asthma, rhonchi may be absent or only detected when the person exhales forcibly, even in the presence of significant airflow limitation. Occasionally, in severe asthma exacerbations, wheezing/rhonchi may be absent owing to severely reduced airflow and ventilation. However, patients in this state usually have other physical signs reflecting the exacerbation and its severity, such as cyanosis, drowsiness, difficulty speaking, tachycardia, hyper inflated chest, use of accessory muscles, and intercostals recession.[2, 11]

Family History of Asthma

In this study parental history of asthma was significantly associated with asthma (current wheeze). We found that maternal history of asthma conferred more risks for child's asthma (RR = 7.9, 95% CI = 4.3 to 14.6) than paternal asthma (RR = 3.9, 95% CI = 2.0 to 7.5). A cohort study reported that, among the children younger than 5 years of age, the risk for childhood asthma associated with maternal asthma (OR =5.0, 95% CI = 1.7, 14.9) was greater than the risk associated with paternal asthma (OR =1.6, 95% CI = 0.5, 5.9).[34] Several studies have reported an association between (current wheeze) and parental asthma.[20, 23, 77] Our results confirms this finding. Maternal atopy is the main risk factor for the development of persistent sensitization in the child, which in turn increases the risk of asthma.[73] Thus asthma is at least partly caused by the interaction between genetic susceptibility and exposure to allergens.[74]

Rhinitis

The presence of rhinitis was found to be a risk factor for asthma in children. There was a strong association between rhinitis and asthma. Rhinitis is actually considered a significant independent risk factor for asthma.[41] It may appear as the first manifestation of a common allergic airway disease, leading eventually to the onset of asthma.[41] Several studies have reported coexistence of rhinitis and asthma in children.[16, 18, 40] To identify children with rhinitis we used the same ISAAC questionnaire. It represents a low-cost, easily applicable method and has good sensitivity and specificity.[72, 75]

However, because of difficulty in explaining symptoms of rhinitis in children and the need for translation of the questionnaire, we might have overestimated the real prevalence of the disease.

Eczema (Atopic dermatitis)

History of eczema was present in 2.5% of the children in the study. Eczema was present significantly more in children with asthma (current wheeze) compared to those with no asthma. Asthma has been reported as the commonest respiratory allergy symptom in patients with eczema.[36] Several studies have reported the association between asthma (current wheeze) and eczema.[18, 28, 38] There is also evidence that children who develop eczema during infancy, tend to have persistent wheezing in later childhood.[16]

Birth weight

High birth weight was found to be a significant risk factor for asthma (current wheeze). A cohort study reported that children with high birth weight (> 4.5kg) were more likely to have asthma which was indicated by having more emergency visits for asthma compared to those with normal birth weight.[47] Findings from a meta analysis study showed that, children with high body weight, either at birth or later in childhood, are at increased risk for future asthma.[49] Another study reported similar findings where children with high birth weight had an increased risk of hospitalization for asthma.[48] The proinflammatory state related to obesity may contribute to the asthma burdens in the obese population. Biomedical experiments have demonstrated that adipocytes up-regulate the production of various

proinflammatory cytokines, including leptin, interleukin 6, and tumor necrosis factor α, that can localize to the pulmonary system and exacerbate airway inflammation.[54] Adipocytes may also increase the production and activation of mast cells in large airways, predisposing airways to bronchospasm.[55] Although studies have suggested that obesity is a proinflamatory state, further researches might identify the causal pathway, which could improve our understanding of the pathophysiology of asthma and perhaps lead to knowledge of potential preventive interventions.

Breastfeeding practices

Although not statistically significant in this study, asthma was more common in children who were given supplementary feeding or were bottle fed in the first 6 month of life compared to those who were exclusively breastfed for six months. Duration of breast feeding was not associated with the presence or absence of asthma in this study. The relationship between breast feeding and asthma is unclear. The Tucson's study showed that the relationship between breast-feeding and repeated wheezing and asthma differs according to age, the presence or absence of maternal asthma and the presence or absence of atopy in the child. Thus, breast-feeding protected against recurrent wheezing before the age of 2 years but had the opposite effect in children over the age of 6 years, especially in those genetically at risk.[76] Another study reported that breastfeeding is protective against respiratory tract allergies.[44] Other studies however did not find this protective effect.[10, 12, 20] In one study it was found that prolong breastfeeding may actually even increase the risk of asthma (current wheeze).[20] Conversely according to Habby et al.[32] breastfeeding reduces the risk of asthma in young children, regardless of its

duration. In a study done in Kenyan children, exclusive breastfeeding was found to protect against severe asthma but not the age of onset of asthma.[46]

Animal keeping

Keeping domestic animals was shown to be associated with increased risk of asthma in this study. The risk was high in families keeping pet animals (a dog and or a cat). Similar findings were also reported in the Ethiopian study, where keeping cats was significantly associated with increased risk for current wheezing in young children.[10] Allergens from dogs and cats have been previously associated with increased risk of allergy.[59] A systematic review done to establish the effect of pets on asthma found that pets conferred more risk to the development of asthma in older children above 6 years but had a protective effect on younger children.[60] In this study we did not look into the duration of exposure of the individual to the pets or other animals therefore we could not ascertain the effect of duration of exposure to the development of wheeze in these children.

Exposure to tobacco smoke

Exposure to cigarette smoking was not associated with wheezing in this study. Probably this was because of low prevalence of smoking in population. Other studies have reported a significant association of cigarette smoking and asthma.[10, 46, 57] and others specifically with maternal cigarette smoking.[16, 28] Similar to our study, some studies did not find the association between asthma (current wheeze) and cigarette smoking.[18, 20, 76] Passive smoking may not necessarily induce wheezing in

an individual, but may perpetuate wheezing episodes due to its irritant and immunological effects on respiratory tract.[56]

Exposure to domestic fuel gases

We found no impact of kerosene on asthma. This agrees with a study done in Basra Iraq.[20] Most families in our study were using either biomass (coal/wood) alone or a combination of biomass and modern fuel (kerosene) for cooking. This might have biased our findings.

Parental/guardian level of education

Majority of parents or guardians in the study had low level of education. Parental/guardian level of education between children with asthma and those with no asthma was almost similar. There was no association between parental/guardian level of education and asthma. This is supported by findings from other studies.[10, 20, 62]

8.0 Conclusions

- Prevalence of asthma (current wheeze) is high among young children in Ilala Dar es Salaam.
- Asthma (Current wheeze) was associated with parental history of asthma, history of rhinitis or eczema in the child, presence of pets at home, and high birth weight (>4.5 kg).
- Age and sex had no influence on asthma (current wheeze).

9.0 Recommendations

- Health workers attending young children should have a high suspicious index for diagnosing asthma in wheezing children especially when factors associated with asthma are present.
- Follow up studies on asthma should be done to identify those children who have a transient wheezing condition from those with persistent wheezing and their risk factors.
- Studies to identify health seeking behavior and medication used for treating asthma in young children should be conducted.

10.0 Study limitations

- There could be recall bias in reporting symptoms of asthma.
- There could be other causes of wheeze besides asthma that could not be picked up by the questionnaire.

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