

INTRODUCTION

Acute respiratory infection (ARI) is the infection of the upper and/or lower respiratory tract, the upper respiratory tract consists of the airways from the nostrils to the vocal cords in the larynx, including the paranasal sinuses and middle ear. The lower respiratory tract covers the continuation of the airways from the trachea and bronchi to the bronchioles and the alveoli. Acute respiratory infections (ARIs) are classified as upper respiratory tract infections (URIs) and lower respiratory tract infections (LRIs). URIs include rhinitis (common cold), sinusitis, ear infections, acute pharyngitis or tonsillopharyngitis, epiglottitis, and laryngitis (*Simoës et al., 2006*). The common LRIs in children are pneumonia and bronchiolitis (*Mulholland et al., 1992*).

ARIs constitute the major causes of mortality and morbidity among underfive children of the developing world (*Johnson, 2007; Yousif and Klaheq, 2006*).

Although most of URIs are self-limiting, some of them may cause serious complications including deafness and acute rheumatic fever. Acute ear infection occurs with up to 30 percent of URIs (*Berman, 1995*). Repeated ear infections may lead to mastoiditis, which in turn may spread infection to the meninges. Mastoiditis and other complications of URIs account for nearly 5 percent of all ARI deaths worldwide (*Williams et al., 2002*).

Estimates indicate that in 2000, 1.9 million died because of ARIs, 70 percent of them in Africa and Southeast Asia (*Williams et al., 2002*). The World Health Organization (WHO) estimates that 2 million children under five die of pneumonia each year (*Bryee et al., 2005*).

The vast majority of URIs have a viral etiology. Rhinoviruses account for 25 to 30 percent of URIs; respiratory syncytial viruses (RSVs), parainfluenza and influenza viruses, human metapneumovirus, and adenoviruses for 25 to 35 percent; corona viruses for 10 percent; and unidentified viruses for the remainder (*Denny, 1995*).

The most common causes of viral LRIs are RSVs, the next most common cause are parainfluenza viruses, then Rhinoviruses and Adenoviruses. *Streptococcus pneumoniae* (*S. pneumoniae*) and *Haemophilus influenzae* type b (Hib) being the most common bacterial causes of ARI in children (*Canducci, 2008*).

The risk factors of Acute respiratory infections include age, sex, poor breastfeeding practice, overcrowding, malnutrition, poor socio-economic status, attendance to day care centers and passive smoking, etc. (*Rudan,; 2008*).

So there is a need for adequate prevention of some of these modifiable risk factors in our environment. These risk factors can be modified with simple strategies such as adequate

nutrition, immunization, avoidance of pollution, parental education, and environmental sanitation. Proper counseling of caregivers on the effects of these modifiable risk factors will help in proper patient care and prevention of further ARIs in children (*Broor et al., 2001; Savitha, 2007; Malla et al., 2010*).

The respiratory infection may be either aggravating a previously existing deficient nutritional status or triggering malnutrition through disease pathogenesis (*Borelli, 2004*).

Malnutrition has been shown to adversely affect the development of cellular, innate and humoral immunity (*Schaible et al., 2007*).

Respiratory infection cause malnutrition by suppressing appetite causing a reduction in food intake and directly affect nutrient metabolism, leading to poor nutrient utilization (*Bloss et al., 2004*).

The stimulation of an immune response by respiratory infection increases the demand for metabolically derived anabolic energy, this lead to adverse nutritional status. Moreover, a respiratory infection itself can cause a loss of critical body stores of protein and energy, minerals and vitamins (*Cunningham et al., 2005*).

Negative nitrogen balance appears to correlate with net loss in body weight; this result from reduced food intake, also infection induced increased nitrogen excretion (*Phillips et al., 2004*).

During an infection, a negative nitrogen balance occurs after fever induction and then it increases and persists for days to weeks after the febrile phase. The metabolic response to infection includes hypermetabolism, a negative nitrogen balance, increased gluconeogenesis and increased fat oxidation, which is modulated by hormones, cytokines and other pro-inflammatory mediators (*Wilmore, 1999*).

AIM OF THE WORK

Aim of the work to:

- Assess the nutritional state of infants and children presenting with ARIs.
- Assess the effect of ARIs on the feeding of infants and children.

Chapter 1

ACUTE RESPIRATORY TRACT INFECTIONS (ARIs)

ARIs can be classified into upper respiratory tract infections (URTI) and lower respiratory tract infections (LRTI), depending on the main organs affected (*Simoes et al., 2006*).

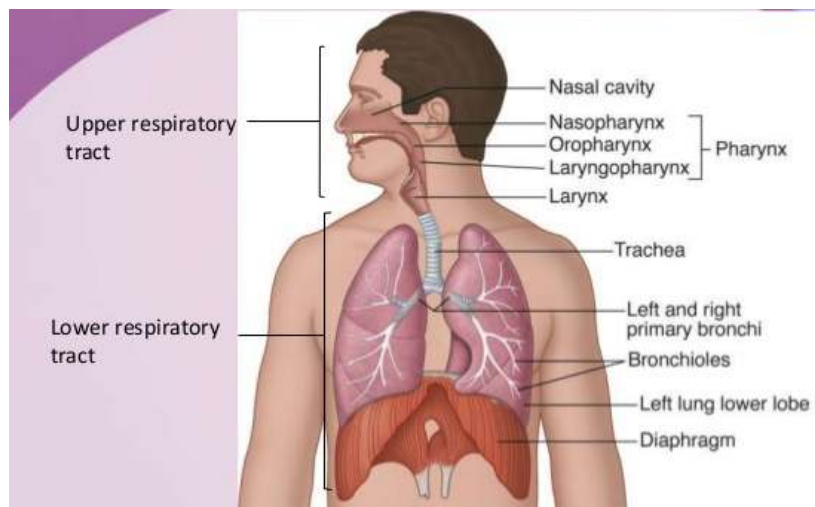


Figure (1): Anatomy of respiratory system.

The upper respiratory tract consists of the airways from the nostrils to the vocal cords in the larynx, including the paranasal sinuses and the middle ear. The lower respiratory tract covers the continuation of the airways from the trachea and bronchi to the bronchioles and the alveoli (*Wichmann and Voji, 2006*).

Acute respiratory infections (ARIs) include a new infection occurring in an individual who has been free of

symptoms for at least 48 hours and also all infections of less than 30 days duration except those of the middle ear where the duration of acute episode is less than 14 days (*WHO, 1990*).

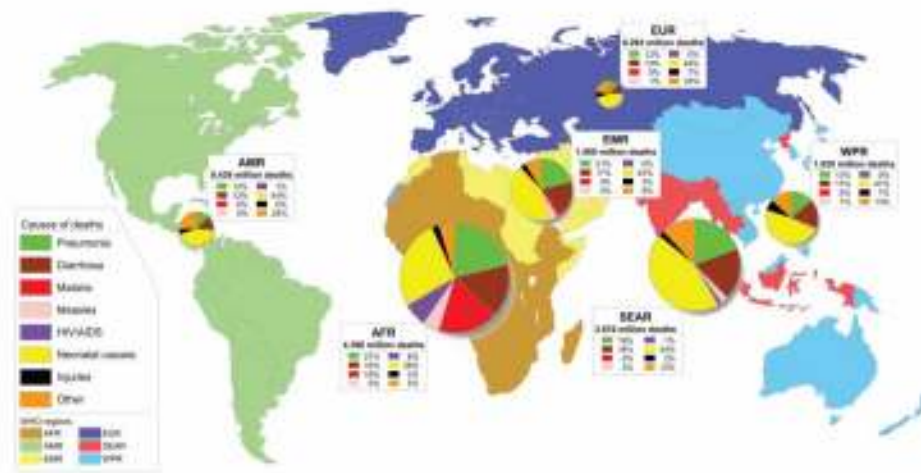
Acute upper respiratory tract infections (URTI or URIs) are the illnesses caused by an acute infection which involves the upper respiratory tract: nose, sinuses, pharynx or larynx. This commonly includes: tonsillitis, pharyngitis, laryngitis, sinusitis, otitis media, and the common cold (*Eccles et al., 2007*).

The common acute lower respiratory tract infections (LRTI or LRIs) in children are pneumonia and bronchiolitis (*Vuori-Holopainen and Peltola, 2001*).

Epidemiological view:

Acute respiratory infection (ARI) especially pneumonia are a major cause of child morbidity and mortality in developing countries, approximately 2 million children under 5 years old die from pneumonia yearly, accounting for nearly one in five child deaths globally (*Child Info, Statistics by Area, 2009*).

Child deaths due to pneumonia distributed as following 50% in Africa, 25% in Southeast Asia and 25% for the rest of the world (*Rudan et al., 2008*).



Prevalence of ARIs in Egypt:

Acute respiratory infections and diarrheal diseases represent about half of the deaths in under-five children in Egypt and are responsible for 39% and 20% of outpatient consultations at PHC (primary health care) facilities, they are also a common reason for hospital admissions (*MOHP, 2000*).

Untreated ARIs infections often lead to pneumonia, which is more serious and causes 15 percent of under-five deaths in Egypt (*UNICEF, 2008*). Early intervention and prompt treatment of ARIs and pneumonia are the easiest ways to prevent death (*WHO, 2009*).

In Egypt ARIs were significantly related to the age of the child, family size, and history of immunization. And so some recommendations must be considered in order to control the problem of ARIs such as promotion of family planning since large family size was found to be significantly associated with higher proportion of ARIs, encouragement of EPI immunizations especially against measles proper housing conditions to prevent overcrowdings, improvement of the standard of living (*Montasser et al., 2012*).

Children younger than 5 years of age experience 3 to 8 episodes of URI per year. The frequency may be as high as once a month especially if the child is attending school, day-care or has a sibling attending school. Importantly, most these

episodes are minor, short-lived and self-limiting colds or sore throats. The child should also be symptomatically well between episodes and growing satisfactorily (*Nokso-Koivisto, 2004*).

Lack of breastfeeding is other environmental factors that have been associated with increased occurrence of RTI (*Quigley et al., 2007*).

Another risk factors for RTI are host factors includes: age, immune responses and airway, anatomy (e.g. Eustachian-tube dysfunction) (*Bluestone, 1996*).

Causative pathogens of ARIs:

Bacterial Acute Respiratory Tract Infections:

The upper respiratory tract contains many normal flora that include Streptococcus species, Haemophilus species, Corynebacterium species, Staphylococcus species, Neisseria species and many anaerobes such as Bacteroides. Although, the normal bacterial flora is generally harmless and even beneficial to the host, but they can cause diseases when the host defenses are impaired (*Murphy et al., 2009*).

Some bacteria from the upper respiratory tract are washed downwards towards the lower respiratory tract, but the action of the ciliated epithelium and sticky mucus that covers the lining of the bronchial tubes keeps the lower respiratory tract free of these microorganisms (*Mizgerd, 2006*).

Streptococcus pneumoniae (pneumococcus) is considered the most common bacteria detected in pediatric airways is, it has been linked with respiratory disease (*Van der Poll and Opal, 2009*).

Another common pathogen is *H. Influenzae* type b (Hib), Together *Streptococcus pneumoniae* and *H. Influenzae* are estimated to be involved in 50% of childhood pneumonia in the developing world (*Scott et al., 2008*).

H. Influenzae is estimated to cause 371,000 childhood deaths worldwide being involved in the pathology of pneumonia and also epiglottitis (*Levine et al., 2010*).

A conjugate vaccine has been developed since the 1990s which has shown promising results worldwide. The *H. Influenza* conjugate vaccine has demonstrated to have high efficacy and be cost effective (*Madhi et al., 2008*).

Vaccination for both *Streptococcus pneumoniae* and *H. Influenzae* has been highlighted as high priorities for widespread use in the developing world in order to achieve reduction in pediatric mortality. Use of Hib vaccine is more widespread worldwide than pneumococcus (*WHO, 2012*).

Many other bacteria have been associated with ARIs especially pneumonia. Infections such as atypical bacteria; *Mycoplasma pneumoniae*, *Chlamydia trachomatis*, *Chlamydophila pneumoniae* and the fungi *Pneumocystis jirovecii*

all have been shown to be involved with pediatric ARIs with comparatively less known than the two most common pathogens (*Taneja et al., 2009*).

Viral Acute Respiratory Tract Infection:

The viral causes of ARIs worldwide include respiratory syncytial virus (RSV) (most common), parainfluenza viruses (PIVs) (second most common), influenza viruses (IFVs), enteroviruses (EVs), adenoviruses (ADVs), human rhinoviruses (HRVs), human metapneumovirus (HMPV), and human coronaviruses (HCoVs) (*Allander et al., 2005*).

HRVs and PIVs were found to be prevalent in almost all age groups, while ADVs, HCoVs, and HMPV were the least common viruses among children in all age groups. RSV and Human Bocavirus (HBoV) were found to be more prevalent in children aged less than 6 months. Incidence of RSV in children, especially young hospitalized children with LRTIs, was high (*Bicer et al., 2013*).

PIVs co-infection was prevalent in both URTIs and LRTIs, and PIV-RSV co-infection was common in LRTIs. Mixed respiratory virus infections are often seen in hospitalized children (*Richard et al., 2008*).

In children with URTIs, the incidence of co-infection with IFV has been reported to be as high as 27.6% (*Liu et al., 2009*).

The correlation between co-infection and disease severity is controversial. Children with HMPV-RSV co-infection have more severe symptoms than those with a single infection and disease severity has also been reported (*Foulongne et al., 2006*).

The viruses can lead to bacterial infections, resulting in mixed viral-bacterial infections. Mixed viral-bacterial respiratory infections are not very common, but they seem to be widespread, especially among children less than two years of age. The long period of disease associated with viral infections or antibiotic treatment failure for bacterial disease may lead to mixed viral-bacterial infections (*Nokso-Koivisto et al., 2006*).

Upper Respiratory Tract Infections:

I. Common cold and rhinitis:

Definition of common cold

The International Classification of Health Problems in Primary Care (ICHPPC) URTI; common cold, as an illness with evidence of acute inflammation of the nasal mucosa (rhinitis) or pharyngeal mucosa (sore throat) and the absence of other specifically defined respiratory conditions, like tonsillitis, laryngitis, bronchitis, pneumonia, asthma and hay fever (*ICHPPC, 1986*).

Common cold etiology:

Common cold is the most frequently illness, it caused by more than 200 known viruses. Rhinovirus causes the largest

number of viral URI's, typically a rhinovirus (30-50% of colds per year) or a coronavirus (10-15% of colds per year), but other etiologies include:

- Parainfluenza virus;
- Adenovirus;
- Coxsackievirus;
- Echovirus; and
- Respiratory syncytial virus (RSV).

In around 25% of cases, no causative organism can be identified (*Sowerby, 2004*).

Frequency of common cold:

Acute upper respiratory tract viral infections (URTIs) are the most common diseases of school children as they have 7 to 10 colds per year (*Heikkinen and Järvinen, 2003*).

Common cold is commonly regarded as a self-limiting viral illness that is experienced annually by the majority of the population (*Arroll and Kenealy, 2005*).

Common cold epidemiology:

The incidence of common cold is higher in the winter months, peaking in December and January, possibly due to increased crowding indoors during cold weather, especially among school children (*Monto, 2002*).

Common cold Pathogenesis:

Transmission of the virus is by hand-to-hand contact, with subsequent passage into the nose or eyes, or by inhalation of airborne droplets. The incubation period varies depending on the infecting virus, but can be very short (10-12 hours) and the severity of symptoms increases rapidly, peaking at two to three days after infection. The mean duration of a common cold is seven to 10 days (*Peltola et al., 2008*).

Clinical manifestations:

A common cold is characterized by sore throat, malaise, and low-grade fever at onset. These symptoms resolve within a few days and are followed by nasal congestion, rhinorrhea, and cough within 24 to 48 hours after onset of the first symptoms. Symptoms usually peak around day 3 or 4 and begin to resolve by day 7 (*Heikkinen and Jarvinen, 2003*).

Diagnosis of common cold can be more problematic in infants and young children since fever is common in children (*Hirschmann et al., 2002*) and Some of the symptoms of the common cold are the same as those associated with other upper respiratory tract infections such as acute bacterial rhinosinusitis (ABRS), allergic rhinitis, and streptococcal pharyngitis (*Pappas et al., 2008*).

A complete patient history can differentiate symptoms and facilitate the diagnosis. The primary consideration in