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Acute Respiratory Infections in Northern Pakistan: An Epidemiological Approach

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Abstract

Acute respiratory infections (ARIs) are mostly infections of the upper respiratory tract which consists upper airways. Common Acute Upper Respiratory Infections (AURIs) are common cold, acute inflammation of upper respiratory tract i.e., larynx, pharynx, mucus membranes, sinuses and middle ear. Most common bacteria are *Streptococcus spp., Haemophillus spp.* and *Staphylococcus spp.* etc. While, *Parainfluenza virus, Rhinovirus, Coxsackievirus, Coronavirus, Respiratory Syncytial, Adenovirus* and *Influenza virus* are the common AURIs causing viruses. They are leading cause of mortality and morbidity worldwide with 1.9 million deaths of children annually. In Pakistan, estimated 20-30% of the total childhood deaths >5 is caused by ARIs. The current study analyzed the epidemiology of ARIs in different facility types between Jan 2017- Dec 2019 of District Abbottabad. During the 3 years study period, 4,66,048 cases were reported with Primary health facilities having highest proportion of ARIs and prevalence was highest during 2018 (84.46%). Moreover, Highest (35%) frequency of ARIs occurred during winter with peak in December (12%). While, Tehsil Abbottabad showed high prevalence (68%) as compared to Havelian (32%). This fluctuation may be due to Risk factors that might be low humidity, indoor crowding, illiteracy and low-socioeconomic status. The current findings may help the government in making infrastructure for the health-care system development in future.

Keywords: Acute respiratory infections (ARIs), Common Acute Upper Respiratory Infections (AURIs), Bacterial and Viral Etiology, Northern Pakistan

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1. INTRODUCTION

Infections that interfere with respiration and have short incubation period are called acute respiratory infections (ARIs). They are categorized into two groups, depending upon the respiratory region involved, upper respiratory tract infections (URTIs) and lower respiratory tract infections (LRTIs). URTIs are mostly self-limiting and contagious. Frequently occurring URIs involve nasal cavity (Common cold), larynx (acute laryngitis), pharynx (acute pharyngitis/ tonsillitis), mucus membranes (Acute Rhinitis/Rhino sinusitis) and middle ear(acute otitis media)[1,2]. URTIs are considered as inflammation of air passages without pneumonia [3]. They are caused by bacteria, numerous viral families like rhinoviruses, adenoviruses and respiratory

syncytial viruses and fungi like zygomycetes. The risk of fungal infections is higher in immunocompromised patients [4-6].

Acute respiratory infections are one of the leading causes of childhood morbidity and mortality globally. According to an estimate they have caused *1.9 million* child deaths throughout the world in the year 2000, about 70 % were from the developing countries of Africa and Southeast Asia [7]. While in 2010, these mortalities trolled to 5.8 million [8]. In a general hospital of India, ARIs accounted for 20-40 % and 12-35 % of total outpatients and inpatients cases respectively [9]. Although data of ARI in Pakistan is imperfect, but according to estimates mortality rate is about 20-30% of total child deaths under age 5 [10]. Data has shown that one in five there with age less than 2 years is suffering from the infection [11].

URIs occurrence in the northern and southern parts of hemisphere is high and reaches to peak in winter [12]. Studies have shown, cold regions people are at high risk for ARIs. In Greenlandic children, the incidence rate of URTIs was 1.6 episodes per 100 days which is higher as compared to the developing countries [13]. Risk of incidence of URTIs increases with decrease in temperature and is considered as seasonal fluctuation [12]. It is observed that URIs are at peak in winter, followed by the odds in autumn (baseline) and least during summer [14]. October to November ARIs reporting is highest while in August it decreases to lowest. This seasonality is attributed to high precipitations, higher relative humidity, lower minimum temperatures and high rains [15]. A recent study states that 1° decline in temperature, increases the risk of URTIs by 4.3% and 1 g/m−3 decrease in absolute humidity also results in 10% increased risk [16].

Distinguishing the URIs is difficult due to similar symptomatic image. Some of the common symptoms include runny nose or nasal congestion, low-grade fever, sneezing, clear or mucus containing discharge from the nose, sometime facial pain and pressure with headache and fatigue [17,18].

Aerosols and droplets are a source of respiratory pathogens include positive pressure ventilation, endotracheal intubation, airway suction, high frequency oscillatory ventilation, tracheostomy, chest physiotherapy, nebulizer treatment, sputum induction, and bronchoscopy [19].

Commonly ARIs are diagnosed by the symptoms. Lab diagnosis of ARIs include direct immunofluorescence assays, immuno-chromatographic antigen testing, Indirect fluorescent antibody test (IFAT), Rapid Antigen Detection Tests [20-22 23]. The first Rapid antigen detection tests was latex agglutination test [24].

Different risk factors are identified in the acute respiratory infections such as age, sex, poor breast-feeding, overcrowding, malnutrition, poor socio-economic status, lack of mother's education and passive smoking [25,26].

The big problem throughout the world is the use of antibiotics [27] and the broad spectrum antibiotics are overused for treatment of bacterial infections [28,29] promote antibiotic resistance [27].

ARIs are self-limiting but can result in severe complications which include fever onset, earache, bacterial otitis media, orbital cellulitis, acute sinusitis epistaxis, dysfunctioning of eustachian tube, inflammation of conjunctiva and pharynx [30]. Others are orbital and intracerebral abscess, empyema, Pott's puffy tumor, Meningitis, Cavernous sinus thrombosis, mastoiditis and acute petrositis [31-33]. AURIs can be prevented by practicing physical interventions like regular hand washing, using disposable handkerchiefs, wearing face masks and gargeling [34]. Probiotics (like *Lactobacillus spp.)*, use of herbs and Zinc are also found to be fruitful preventions [35-38].

The study aimed to determine the period prevalence and seasonal variation of acute (upper) respiratory infections in district Abbottabad, Pakistan, from 2017 to 2019.

2. MATERIALS AND METHODS

Study Area

The study was conducted in Abbottabad, Pakistan. Abbottabad is a district of Khyber Pakhtunkhwa province of Pakistan. It is about 135 km to the north of Islamabad (Capital of Pakistan) and 130 km east of Peshawar. It is found at altitude of 34.18 and longitude of 73.26. District Abbottabad is surrounded by District Mansehra at the North, Distt. Haripur at the West and Southwest and District Muzaffarabad of Azad Kashmir on the east. An area of about 1,969 km² is covered by the Distt. Abbottabad and is part of Hazara

division. District Abbottabad is divided into two Tehsils i.e., Havelian and Abbottabad. According to the 2017 census, population of Abbottabad is 1,332,912 (981,590 of Tehsil Abbottabad and 351,322 of Tehsil Havelian). It is known to have humid subtropical climate. Annual rainfall of the region is about 1262mm and total precipitation is about 81.6 MM.

Study Period:

Study period for the acute respiratory infections in the District Abbottabad is 3 years. It includes the data from January 2017 to December 2019.

Study Design:

Retrospective studies of acute respiratory infections reported during the study period was carried out. This study is conducted to assess the morbidity of acute respiratory infections in different health facilities of Distt. Abbottabad.

Study Population:

Study population includes all acute respiratory infections patients visited any of the 110 health care facilities distributed all around the rural, urban as well as sub-urban areas of the Distt. from January 2017 to Dec 2019.

Data Collection:

Data is taken from the regional office of district health information system. Data contained the reported cases from 53 basic health units (43 from Teh. Abbottabad, 18 from Hvn), 43 civil dispensaries, 4 civil hospitals, 1 DHQ, 1 MCH, 7 RHC, 1 TBC and 1 SHC.

Ethical Clearance:

The study was conducted after ethical approval. For permission from the District Health Officer, affidavit and other documents were submitted in the office. Permission letters from the Abbottabad University of Science and technology and District health office were obtained in order to describe the retrospective ARIs morbidity data.

Data Analysis:

Collected data was analyzed by using Microsoft Excel. Data was analyzed to find morbidity in different facility types, morbidity distribution in both the Tehsils of the district and seasonal variation of acute respiratory infections.

3. RESULTS

During the 3 years study period from Jan 2017 to Dec 2019, total 4,66,048 cases of ARIs were reported in all the health units of Distt. Abbottabad. In which 315,185 cases were from Tehsil Abbottabad and 1,50,863 from Tehsil Havelian. Prevalence of ARIs during the study period was higher in Teh. Abbottabad (68%) as compared to Havelian (32%). BHU-Nawan Shehr holed the highest prevalence (6.51%) while least prevalence was reported in NSD Channali (0.02%). With regard to time, prevalence in 2017 was 30.66%, in 2018 increased to 35.85% and reported to be highest while in 2019 again declined to 30.66% (Figure 1 & 2).

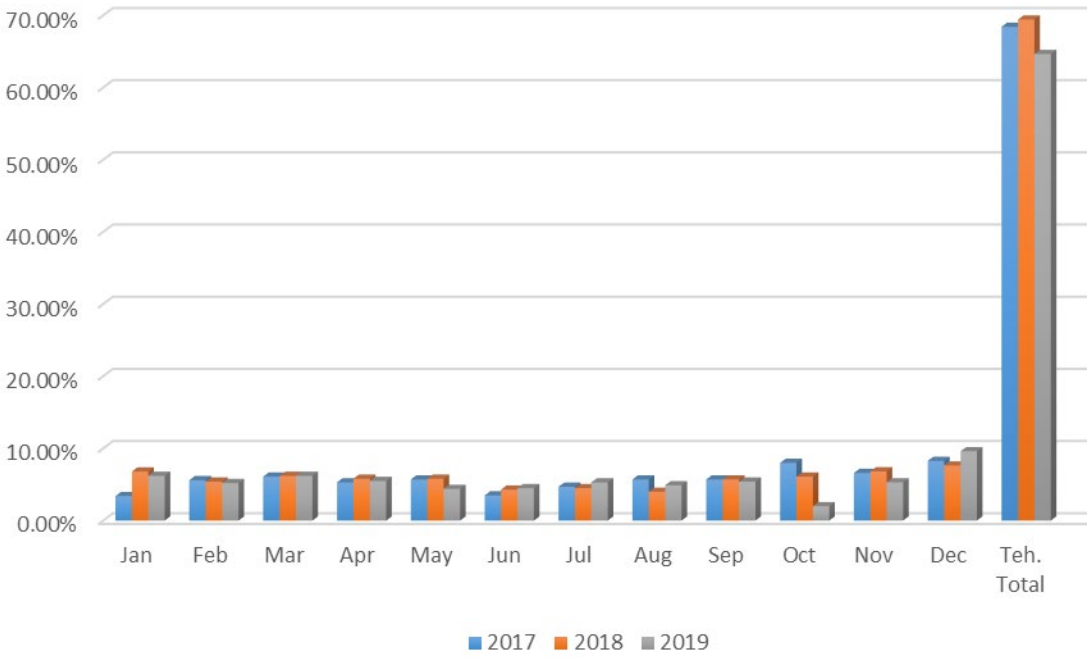

Figure 1: *Trend of reported ARIs cases in Tehsil Abbottabad during the study period*

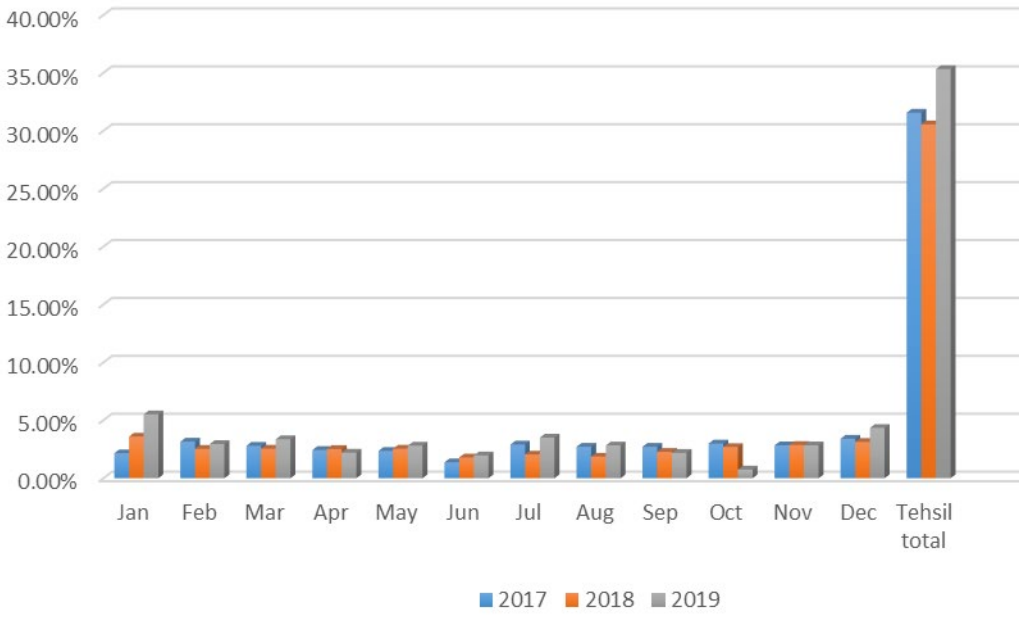

Figure 2: *Trend of reported ARIs cases in Tehsil Havelian during the study period*

Prevalence of ARIs in Distt. Abbottabad was highest (35%) in winter, November to February. During spring, March and April, it declined to 17% and was still higher than the remaining seasons. This high prevalence in spring might be due to allergic reactions caused by pollens of Populus ciliata. In summer (May-June) prevalence was least (14%). In Monsoon (Jul-Aug) prevalence increased to 15% which kept increasing and reached 16% in Autumn (Sep-Oct) (Figure 3).

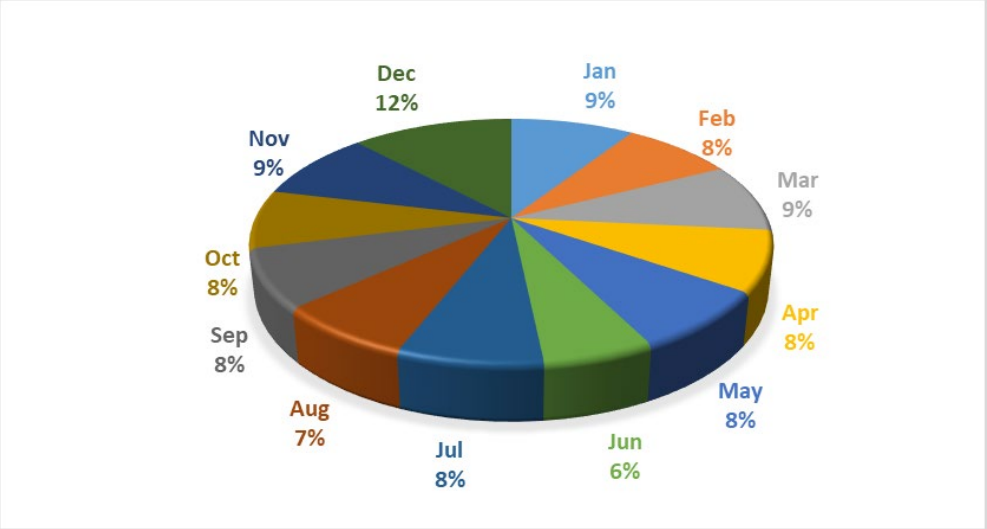

Figure 3: *Monthly (Seasonal) morbidity of ARIs in Distt. Abbottabad*

Proportion of ARIs reported during the study period was more in Primary health facilities (84.46%) as compared to Secondary and Tertiary health facilities (13.54%). Highest prevalence was observed in the Basic health units of both Tehsils, Abbottabad (48.73%) and Havelian (18.82%). Followed by Civil dispensaries (7.42%) in Tehsil Abbottabbad and civil hospitals (7.32%) in Tehsil Havelian. MCH (0.37%) in Teh. Abbottabad while SHC (0.19%) in Havelian reported least ARIs prevalence (Table 1 & 2).

Table 1: No. of reported ARIs in Tehsil Abbottabad

Facility Type	Jan-Dec	Jan-Dec	Jan-Dec
BHU	84977	79457	62670
CD	10814	11734	12038
CH	2383	3024	3841
DHQ	980	14595	4205
MCH	314	371	1042
RHC	6709	5586	7817
TBC	770	1088	770

Table 2: *No. of Reported ARIs in Tehsil Havelian*

Facility Type	Jan-Dec	Jan-Dec	Jan-Dec
BHU	30385	31274	26059
CD	5575	7062	8145
CH	11093	9899	13103
RHC	2257	2363	2756
SHC	41	404	447

It is also observed that most of the patients with ARIs in the area go for home remedies. Commonly used home remedies include use of honey, joshanda, tea, eggs and soanf water. Moreover, people also try to keep themselves warm for the management of ARIs. Self- medication with antibiotics and anti-pyretic drugs is also common in some areas.

4. DISCUSSION

Acute respiratory infections (ARIs) are mostly infections of the upper respiratory tract which consists upper airways. Common Acute Upper Respiratory Infections (AURIs) are common cold, acute inflammation of upper respiratory tract i.e., larynx, pharynx, mucus membranes, sinuses and middle ear. Most common

bacteria are *Streptococcus spp., Haemophillus spp.* and *Staphylococcus spp.* etc. While, *Parainfluenza virus, Rhinovirus, Coxsackievirus, Coronavirus, Respiratory Syncytial irus, Adenovirus* and *Influenza virus* are the common AURIs causing viruses. They are leading cause of mortality and morbidity worldwide with 1.9 million deaths of children annually. In Pakistan, estimated 20-30% of the total childhood deaths >5 is caused by ARIs.

Our study ascertains number of reported ARIs cases in different facility types, their prevalence at tehsil level and the seasonal variation in the Distt. Abbottabad. The purpose of finding morbidity of both the Tehsils was to find out the relation between ARIs and the rural and urban areas. Moreover, it also determines whether lifestyle of the population affects prevalence or not.

This study evaluated the no. of cases reported from January 2017-December 2019. In this study 80.46% cases were reported in the primary health care centers which include, BHU, RHC, MCH services etc. Similar proportion (65.8%) of ARIs in primary health facilities is reported in northern Saudi Arabia [39]. Another studies showed 25% ARIs visits per day in Saudi Arabia [40], 25-40% in Poland [41]. High frequency in our study as compared to others is due to different study design and study population. Moreover, primary healthcare facilities are from rural areas and people visiting these facilities mostly have low-socioeconomic status. Most population of such areas is illiterate and also use low quality fuels which increases the risk of ARIs [25,42]. Our study showed least proportion (13.54%) in secondary and tertiary healthcare facility which is less than 36.37% reported in Tehsil Headquarter Hospital Khwazakela, Swat [43].

With regard to tehsil, frequency of reported ARIs was higher in Abbottabad which is administrative Tehsil of the Distt. This might be due to the larger area coverage which means more healthcare centers reporting. Along with this most of the secondary and tertiary healthcare facilities are also located in this tehsil. Moreover, most of the primary health facilities of Teh. Atd. A high prevalence 35.85% was observed due to normal rainfall while in 2017 and 2019 it was below and close to normal respectively and prevalence was 30.66%. In 2018 normal rainfall increased the humidity which in turn increased the risk of ARIs. Increase in humidity results in stability of the pathogens in air and can cause infections more frequently. Moreover, Murray and Natalie Pica reported that rainfall may increase risk of ARIs by increasing indoor crowding [44,45].

The proportion was highest (30%) with peak at 12% in December during winter. This high proportion was due to low temperature of the region. Other studies also support the results by reporting high values of ARIs occurrence. They include 54.7% in Cameroon [46], 62.3% in Nepal [47], 64.7% in Kenya [48] and 70% in Bangladesh [49]. Cold temperature, low socioeconomic status, mother's illiteracy, use of low quality fuel for cooking, improper ventilation, and parental smoking history can be the risk factors for the high prevalence in this study and above mentioned studies [50]. Indoor overcrowding during winter is another common risk factor for increased prevalence, as it increases the transmission of viruses [45]. Eccles in the review put forward the idea that inhalation of cool air during winter may increase the risk of URTIs by decreasing the nasal defense [12]. A sudden decline to 17% in spring observed, which may be due to increase in outdoor activities. Still, it was higher than the remaining seasons and the reason might be allergic reactions caused by pollens of Populus ciliate, because it is second largely found tree in the region. Monto also found high prevalence during spring which is in accordance with our results [51]. In our study least prevalence (14%) was reported in summer, which gradually increased in Moonsoon (15%) and Autumn (16%) which is opposite to the trend reported by Wang et al. in China [52]. This difference might be due to different study populations with different climate, different study period and different study settings.

Antibiotic resistance in case of ARIs is a global issue. In our study it is observed that most people rely on home remedies for ARIs management instead of allopathic drugs. These findings are similar to the previous studies conducted in India and Pakistan. Around 66.3% of the mothers in India were practicing home remedies for ARIs [53]. While in Pakistan the ratio was higher (71.2%) for mothers using home remedies for the treatment of their children [54].

5. CONCLUSION

After analyzing three years trend of ARIs in the Distt. Abbottabad, it is recommended that Government should give primary health-care centers more facilities, as reporting in these facility types are higher than secondary and tertiary one. Government should also start ARIs awareness programs in Teh. Abbottabad

where most of the population is rural and do not have enough knowledge regarding the issue. This will upgrade the lifestyle resulting in decline of ARIs. The problem faced during the study was lack of general information (age, gender etc.) and symptoms of the ARIs. So, Information storage department should sort out some solution, this will help the researchers in analyzing the epidemiology of disease more perfectly. Along with these Regional forests department should start a campaign for removing Populus ciliate and planting fruits or some other trees. This will decrease ARIs, allergic reactions during spring and will also reduce economic burden. In conclusion, this study will facilitate the government in making infrastructure for the development of health system in future. Moreover, it will also provide data regarding estimation of ARIs to researchers, health-care workers and different NGOs at national as well as international level. Our study will help different pharmaceutical companies and suppliers in distribution of their products. It will also facilitate surveys, nationally and internationally.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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