Review Article

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Prevention of Acute Respiratory Infections in the Health Care Facilities

Gaude Gajanan
Department of Pulmonary Medicine, KLE University's J. N. Medical College, Belgaum – 590010

Nicasia Fernandes
Department of Internal Medicine, Goa Medical College, Goa.

Chaudhury Alisha
Department of Pulmonary Medicine, KLE University's J. N. Medical College, Belgaum – 590010.

Abstract

Acute respiratory infections (ARIs) are the leading cause of morbidity and mortality from infectious disease worldwide, particularly affecting the youngest and oldest people in low and middle-income nations. These infections, typically caused by viruses or mixed viral–bacterial infections, can be contagious and spread rapidly. Although knowledge of transmission modes is ever-evolving, current evidence indicates that the primary mode of transmission of most acute respiratory diseases is through droplets, but transmission through contact or infectious respiratory aerosols at short range can also happen for some pathogens in particular circumstances. In modern medicine, infection prevention and control (IPC) measures in health-care settings are of central importance to the safety of patients, health-care workers and the environment, and to the management of communicable disease threats to the global and local community. Application of basic IPC precautions, such as Standard Precautions, is a cornerstone for providing safe health care. In an era of emerging and re-emerging infectious diseases, IPC in health care is as important now as ever. The management of ARIs is no exception. Because many symptoms of ARIs are common and nonspecific, the application of IPC measures for ARIs in health care can be fraught with difficulty and confusion, especially in outbreaks where resources may be strained. Yet these measures, including early identification, prompt isolation precautions, proper patient placement and adequate ventilation, are essential to contain and mitigate the impact of pathogens that may constitute a major public health threat.

Keywords: Acute respiratory infections; Health care settings prevention; Treatment; Vaccinations.

Introduction

Respiratory infections are among the principal causes of morbidity, mortality and of demands on health resources at a global level. Apart from the direct and indirect costs, what is of major concern is the associated high consumption of antimicrobial drugs and the consequent increased growth in resistance to this class of medicines, which could affect the use of some types of antibiotics in the near future. They are the most common illness resulting in missed work or school. They can happen at any time, but are most common in winter. They're usually caused by viruses, but can be caused by bacteria. The common cold is the most widespread acute respiratory infection (ARI). Healthcare professionals generally make a distinction between: upper respiratory tract infections – which affect the nose, sinuses and throat; and lower respiratory tract infections – which affect the airways and lungs. ARIs can spread in several ways. If you have an infection such as a cold, tiny droplets of fluid containing the cold virus are launched into the air whenever you sneeze or cough. If these are breathed in by someone else, they may also become infected. Infections can also be spread through indirect contact. For example, if you have a cold and you touch your nose or eyes before touching an object or surface, the virus may be passed to someone else when they touch that object or surface.

Common upper respiratory tract infections include common cold, tonsillitis, sinusitis, laryngitis and flu.

Corresponding Author: **Gajanan S. Gaude,** Professor, Department of Pulmonary Medicine, KLE University's J. N. Medical College, Belgaum – 590010. Karnataka.
E-mail: gsgaude922@gmail.com

A cough is the most common symptom of an upper respiratory tract infection (RTI). Other symptoms include headaches, a stuffy or runny nose, a sore throat, sneezing and muscle aches. Common lower RTIs include: flu, bronchitis, pneumonia, bronchiolitis and tuberculosis [1]. As with upper RTIs, the main symptom of a lower RTI is a cough. However, it's usually more severe and it results in expectoration and breathlessness. Other possible symptoms are chest tightness, increased rate of breathing, breathlessness and wheezing. Some common risk factors for upper respiratory infection are physical or close contact with someone with a upper respiratory infection; poor hand washing after contact with an individual with upper respiratory infection; close contact with children in a group setting, schools or daycare centers; contact with groups of individuals in a closed setting, such as, traveling, tours, cruises; smoking or second-hand smoking (may impair mucosal resistance and destroy the cilia); health care facilities, hospitals, nursing homes; immune-compromised state such as, HIV, organ transplant, congenital immune defects, long term steroid use; and anatomical abnormalities as in facial trauma, upper airway trauma, nasal polyps.

ARIs that may constitute a public health emergency of international concern

Severe acute respiratory syndrome

SARS is caused by the SARS corona virus (SARS-CoV) that can infect animals and humans. The disease was first reported in Asia in February 2003, and spread to people in over 24 countries in Asia, Europe, North America and South America before the outbreak was contained. SARS is currently not known to be circulating among people, but it could still be circulating in animal hosts and may thus re-emerge in humans. Human-to-human transmission of SARS occurs mainly through droplets or direct contact, although transmission through infectious respiratory aerosols of various sizes may occur at short range [2].

New influenza virus causing human infection

Influenza viruses can infect many species, including humans, birds, pigs, horses and seals. Birds, in particular, are the main reservoir for influenza A viruses. Influenza viruses tend to infect people sporadically or in seasonal epidemics; occasionally, when a new human influenza virus emerges, it can cause a worldwide pandemic. When an influenza virus with the capacity to infect humans first emerges in another species, it is not yet adapted to humans and may circulate in animal hosts, generating sporadic human infections. Because it may subsequently evolve the ability for sustained human-to-human transmission, any new influenza virus that generates sporadic cases of human infection may present a pandemic risk. Thus, early detection, isolation and warning of sporadic infections are crucial to minimize the risk of serious public health impacts from new influenza viruses [3]. Direct transmission of avian influenza viruses – including H5N1, H7N9, H7N2 and H9N2 – to humans has been described on numerous occasions, and often results in a high fatality rate. The most important avian virus infecting humans in recent years has been avian influenza A (H5N1), which can be highly pathogenic. In the potential cases of human-to-human transmission, infection was associated with close, extensive unprotected contact, suggesting that the virus might have spread through respiratory droplets or contact [4]. Pandemic influenza A (H1N1) 2009 virus resulted from genetic re-assortment of swine, avian and human viruses, and it is efficiently spread through human-to-human transmission. First recognized in North America in April 2009, A (H1N1) subsequently spread around the globe, causing a pandemic during June 2009 until August 2010.

Novel acute respiratory infections with potential for a high public health impact

Infectious diseases have spread across populations and regions throughout history, and it is likely that newly emerging infectious diseases will continue to be identified. Many infectious diseases with animal reservoirs can sometimes infect humans. Two examples that occurred after the 2009 influenza pandemic are human cases of influenza A (H7N9) which first occurred in 2013, and of Middle East Respiratory Syndrome (MERS) corona virus from 2012. The following factors have been associated with the emergence and spread of infectious diseases [5] changes in human demographics and behavior; impact of new technologies and industries; economic development and changes in land use; increased international travel and commerce; microbial adaptation and change; poor implementation of public-health measures; and sharing an environment with domestic or wild animals, including birds. When a new infectious disease is identified, the modes of transmission are not well understood. The epidemiological and microbiological studies needed to determine the modes of transmission and identify possible IPC measures may be protracted. It is

essential to maintain close surveillance of health-care workers from the very beginning of an outbreak with a novel pathogen, and during the outbreak, since this could offer important information about means of transmission, both for community and health-care associated transmission [6].

Surveillance and Reporting of Respiratory Infections

All health care settings should adopt and maintain appropriate surveillance and infection prevention and control practices to protect against respiratory infections. These measures should be practiced as routinely as other health and safety measures in the workplace. Surveillance and reporting of acute respiratory infection (ARI) will: (i) prevent transmission of droplet-spread respiratory infection to other clients / patients / residents and to HCWs, (ii) help the health care setting quickly detect and contain clusters and outbreaks of common respiratory infections, and (iii) help the health care setting detect and contain any new or virulent microorganism causing ARIs.

Annual Risk of Infections can be introduced into a health care setting by clients / patients / residents, HCWs and / or visitors [7]. The purpose of case finding / surveillance is to identify individuals with ARI who may pose a risk to others in order to put preventive measures in place to reduce or eliminate transmission. The steps required for case finding / surveillance may be incorporated into an algorithm to assist health care providers in directing the client / patient / resident's movements and to ensure that preventive measures are taken to protect HCWs and others.

Case Finding for ARI in Health Care Facilities

There are two types of case finding / surveillance – active and passive (Table 1). Each health care setting should develop surveillance systems based on these types. Some health care settings use both active and passive approaches: signage that directs clients / patients / residents who have symptoms to take certain precautions, together with follow-up questions by the first health care provider contact in the health care setting that confirm that the client / patient / resident has read and understood the sign [8]. This is particularly important where age, language or disability may be a barrier to a client / patient / resident reading a sign and following instructions. The decision to conduct active or passive case finding / surveillance will depend on the physical set up of the office / clinic or department, the type of care provided and the risk of transmission (e.g., a setting where HCWs have little direct face-to-face contact with clients / patients / residents may choose to use passive case finding / surveillance). Some health care settings may choose to use a passive approach when there are no travel health notices or community influenza activity, and shift to a more active approach during times when there is more ARI activity. Health care facilities should be aware of respiratory virus activity in their local communities.

Table 1: Types of case finding / surveillanc

Active Case Finding/Surveillance	Passive Case Finding/Surveillance
• Clients/patients/residents and HCWs are asked about possible respiratory symptoms on arrival at the health care setting. • The individual asking the initial questions should maintain at least a two meter distance from the client/patient/resident or be protected by a glass or other solid, transparent barrier. • On inpatient and residential units in health care facilities, patients/residents are checked daily for respiratory symptoms and a summary report of symptomatic individuals is kept.	Signage directs the client/patient/resident or HCWs to self-assess and self-identify themselves if they have respiratory symptoms.

Surveillance for Respiratory Infections in Health Care Facilities

It is necessary to assess each client / patient / resident on initial encounter with the health care setting for symptoms of an ARI and to document that the assessment has been completed. It is not necessary to maintain a separate paper document. Surveillance intensity may increase at different times of the year, depending on ARI activity in the community. Health care facilities must develop a process for ongoing assessment of admitted patients / residents according to the Routine Practices risk assessment, to identify

new onset of ARI [9]. Infection surveillance / reporting tool will simplify the identification and follow-up of patients / residents with ARI. Other case finding methods include reports from nursing staff, chart review, face-to-face rounding by ICPs on nursing units / floors, use of surveillance tools on nursing units / floors, laboratory or radiology reports, treatment review and clinical observations. Each new acquisition of ARI within the health care facility should prompt an investigation. When a new case of ARI is first identified in a patient / resident, a determination should be made as to whether the infection was acquired in the facility and appropriate steps should be taken to contain the infection and to look for additional cases.

Reporting client/patient/residents with ARI

Physicians and facility administrators / superintendents must notify public health about clients / patients / residents who have, or may have, a reportable disease as well as outbreaks of ARI. 39 New cases of ARI in inpatients / residents should be reported to Infection Prevention and Control by nursing / resident care units. If a health care facility experiences a respiratory outbreak, surveillance information must be communicated internally and externally whenever a patient / resident is transferred to another health care setting [10]. Public health must be notified early when any of the following occur in a health care setting: unusual clusters of ARI, single cases of ARI with recent travel to a country with a travel health notice for ARI, single cases of ARI who have had contact with a person with ARI who has recently travelled to a country with a travel health notice for ARI, and an effective communication with public health can assist in early identification of an outbreak. The health care setting must ensure that all HCWs who provide care for a client / patient / resident with symptoms of an acute respiratory infection are aware of the need to initiate and maintain droplet and contact precautions. Each health care setting should have a policy authorizing any regulated health care professional to initiate the appropriate additional precautions at the onset of symptoms and maintain precautions until laboratory results are available to confirm or rule out the diagnosis [11].

Precautions for Acute Respiratory Infection

Clients / patients / residents who arrive in a health care setting with symptoms of an ARI should be managed using routine practices, droplet and contact precautions to protect health care workers, clients / patients / residents and others. It should be kept in mind that not everyone with an ARI will exhibit fever, which is dependent on host and pathogen factors [12]. Health care providers should maintain an increased awareness that, during influenza season, individuals presenting with acute, apparently non-infectious cardiopulmonary illnesses (e.g., congestive heart failure, exacerbations of chronic obstructive pulmonary disease or asthma) may have influenza and only half of patients admitted to hospital for influenza exhibit classic symptoms [13]. Specific measures for routine practices and droplet and contact precautions include: provide alcohol-based hand rub, masks and tissues at the point(s) of reception, ask the client / patient / resident to perform hand hygiene (i.e., apply an alcohol-based hand rub to his / her hands), advise the client / patient / resident to practice respiratory etiquette when coughing or sneezing, turn the head away from others, cover the nose and mouth with tissue, discard tissues immediately after use into waste, perform hand hygiene immediately after disposal of tissues. have the client / patient / resident wear a mask, if tolerated, to protect other clients / patients / residents and HCWs in common waiting areas, not all clients / patients / residents will be able to tolerate masks (e.g., children, people with chronic breathing problems, those with cognitive impairment), if masks are not available or not tolerated, clients / patients / residents should be encouraged to use another method to cover their mouth and nose when coughing or sneezing (e.g., tissue).

Duration of Precautions

Additional precautions should remain in place until there is no longer a risk of transmission of the microorganism or illness. Where the periods of communicability are known, precautions may be discontinued at the appropriate time. If no etiology is determined, reassess daily and discontinue precautions when patient is from a facility with a respiratory outbreak, is asymptomatic and the incubation period for the outbreak organism has passed since their last exposure, patient has a diagnosis other than respiratory infection that accounts for symptoms (e.g., bacteremia, confirmed urosepsis), respiratory symptoms are improving (e.g., cough, breathlessness, oxygen requirements, wheezing, sputum production), fever has been <38°C for 48 hours. Given this high prevalence of respiratory infections in the society, there is a general consensus about the necessity for a rapid implementation of measures to prevent respiratory infections in adults [14]. These preventive measures against respiratory infection cover

general measures and specific measures: vaccination against influenza and antipneumococcal.

General measures for prevention of acute respiratory infections are: In the general measures, related to host defenses, the following are recommended [15]: smoking cessation; control of chronic illnesses (diabetes mellitus, COPD, congestive heart failure, chronic renal failure, chronic liver disease, HIV / AIDS infection, etc.); judicious use of immunosuppressive therapies (including corticosteroids); alcohol counseling (including acute intoxication and chronic alcoholism); advice about dealing with cases of drug addiction; adequate nutritional status; gamma globulin immunotherapy in selected patients (IgG deficiency, multiple myeloma, chronic lymphocytic leukemia, transplant patients).

Influenza vaccination

Influenza is a serious disease that can lead to hospitalization and sometimes even death. Every flu season is different, and influenza infection can affect people differently. Even healthy people can get very sick from the flu and spread it to others. An annual seasonal flu vaccine (either the flu shot or the nasal spray flu vaccine) is the best way to reduce the chances that one can get seasonal flu and spread it to others. Flu vaccines cause antibodies to develop in the body about two weeks after vaccination. These antibodies provide protection against infection with the viruses that are in the vaccine. The seasonal flu vaccine protects against the influenza viruses that research indicates will be most common during the upcoming season. Traditional flu vaccines (called trivalent vaccines) are made to protect against three flu viruses; an influenza A (H1N1) virus, influenza A (H3N2) virus, and an influenza B virus [16]. In addition, there are flu vaccines made to protect against four flu viruses (called "quadrivalent" vaccines). Since it takes about two weeks after vaccination for antibodies to develop in the body that protect against influenza virus infection, it is best that people get vaccinated so they are protected before influenza begins spreading in their community. A flu vaccine is needed every season for two reasons. First, the body's immune response from vaccination declines over time, so an annual vaccine is needed for optimal protection. Second, because flu viruses are constantly changing, the formulation of the flu vaccine is reviewed each year and sometimes updated to keep up with changing flu viruses. Influenza vaccine effectiveness can vary from year to year and among different age and risk groups [17].

Pneumococcal Vaccination

In India, two pneumococcal vaccines are available for adults aged 18 and above, a pneumococcal polysaccharide vaccine 23-valent (Pulmovax 23) with 23 serotypes (1, 2, 3, 4, 5, 6B, 7F, 8, 9N, 9V, 10A, 11A, 12F, 14, 15B, 17F, 18C, 19A, 19F, 20, 22F, 23F, 33F) and a pneumococcal conjugate vaccine 13-valente (Prevenar 13) with13 serotypes (1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, 23F). Both vaccines are intramuscular and conjugated vaccine can also be administered subcutaneously [18]. For adults, vaccines are indicated for the prevention of invasive pneumococcal diseases by the serotypes included in the vaccine. The bacteraemia secondary to pneumonia is the main manifestation of invasive pneumococcal disease in adults, representing about 75% of cases of invasive disease in the adult population [19] and more than 80% in those greaterthan equal to 65 [20].

Table 2: Recommendations for anti-pneumococcal vaccination in specific circumstances

Condition	Vaccination Recommendation
HIV/AIDS	Early, preferably with lymphocytes TCD4+ ≥ 200/mm3; if TCD4+ < 200/mm3, vaccinate without waiting for immune reconstruction and consider revaccination after TCD4+ ≥ 200/mm3
Surgical splenectomy	In elective surgery, at least 2 weeks before surgery; in unplanned surgery, vaccinate 2 weeks after surgery
Autoimmune diseases	Early and before starting immunosuppressive therapy
Waiting for a solid organ transplant	Early, at least 2-4 weeks before transplant
Solid organ transplant	Start vaccination 6 months after transplant
Transplant of hematopoietic cells	Start vaccination 3-6 months after transplant
Neoplastic diseases in chemotherapy and/or radiotherapy	10-14 days before treatment or 3 months after finishing chemotherapy or radiotherapy. If the vaccine is administered during the course of chemotherapy consider whether to revaccinate 3 months after finishing treatment

Epidemiological surveillance programs on invasive pneumococcal disease and its serotypes at a national level are crucial for the evaluation of the effectiveness of anti-pneumococcal vaccines and recommendations for their utilization. Table 2 presents reco-mmendations for anti-pneumococcal vaccinations according to the risk of invasive pneumococcal disease. Revaccination with conjugated vaccine is not recommended and in the case of polyvalent vaccine, revaccination should only be done only once [19]. Pneumococcal vaccines should be administered at the most propitious time for the immune system to respond. The influenza and pneumococcal vaccines can be given at the same time, preferably in different arms.

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