Clinical and etiological profile of the pediatric population with upper respiratory tract infection in Ubaldo Laya evacuation center, Iligan city, Philippines

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Abstract

Upper Respiratory Tract Infections (URTIs) especially in children are very common following natural disasters. Incidence of URTI among 146 children with ages 5 to 12 years old was determined through a field survey in an evacuation center in Iligan City. Predisposing factors such as age, sex, educational attainment of mothers and lack of measles immunization were correlated with URTI symptoms using Fisher's Exact Test. Aerobic plate count for bacterial colonies was also compared with the rise of new cases of URTIs in the evacuation center. Results showed that educational attainment among mothers and ages of children (5 to 8 years) were significant factors in URTI symptoms. Linear regression analysis for aerobic plate count in five selected sites suggests positive correlation of bacterial population with occurring new cases of URTIs in the area. Crowding in room sites was also found as important factor contributing to the faster rate of URTI transmission among children confined in these areas. Result suggests the importance of raising awareness on the predisposing factors of URTI.

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Introduction
Upper respiratory tract infection is a nonspecific term used to describe acute infections involving the nose, paranasal sinuses, pharynx and larynx, and resulting from interplay between microbial load (viral and bacterial) and immune response (Bentivegna et al., 2012). It is caused by viruses (Hersh et al., 2013) such as rhinovirus, parainfluenza virus, coronavirus, adenovirus, respiratory syncytial virus, coxsackie virus and influenza virus accounting for most cases (Kshirsagar et al., 2010). It is considered as the most common infectious illness in the general population, with rates of infection highest among children below five years of age (Meneghetti, 2014), especially those who attend day care centers (Bentivegna et al., 2012).

Most commonly dealt in primary care, URTI is considered to be the “bread and butter” of daily practice (National Institute for Health and Clinical Excellence, 2008). The clinical syndrome of URTI comprises a variety of symptoms, cough which is usually the main symptom; others are nasal blockage, obstruction, congestion, discoloured nasal discharge, fever and headache (Bentivegna et al., 2012). Most adults experience two to four URTIs per year, while most children experience six to eight URTIs per year (Bernardo-Ocampo, 2012) comprising as many as 50% of all illnesses in children less than 5 years old and 30% in children aged 5 – 12 years (Goh et al., 1999). Although viral respiratory infections are often considered relatively harmless, in developing countries they are an important cause of mortality especially among the pediatric population, more so when followed by bacterial complications. Several factors contributing to the widespread occurrence of URTIs may be attributed to breathing of contaminated air, direct contact with infected people, over-crowded places, cigarette smoking and exposure to pathogens (Rohilla et al., 2013).

In Australia upper respiratory tract infections account for three to four million visits to general practitioners (GPs) each year that represents more than 6 per 100 of all GP consultations (The Lung Australian Foundation, 2007). In a study conducted in the Philippines, the respiratory tract infection specific mortality rate (caused by virus and/or bacteria) is 8.9 per 1000 in children less than four years of age. A respiratory virus is associated with one-third of acute respiratory infections, but a bacterium is identified in only 10% of cases (Gonzaga et al., 1990). In a study of Hong et al., (2001) the mortality rate was six percent among apparently healthy children who were hospitalized because of adenoviral lower respiratory tract infection.

Many studies of URTI in children have already been carried out in various settings. However, this study is rather different as it is a rapid post-disaster assessment of URTI among children who sought temporary lodgings in one of the biggest evacuation sites in Iligan City, following the Typhoon Sendong (Storm Washi) devastation of December 2011. Despite the large evacuation area in the Ubaldo D. Laya Memorial Central School (UDLMCS), crowding was apparent and high incidence of localized illnesses was reported. The specific aims of the study were to determine the following: the distribution of evacuees in UDLMCS; the number of pediatric population with URTI, and their symptoms; the treatment and management therapies employed in the study population; the risk factors in the spread of URTI; the short time trend of URTI incidence among the members of the study population; and the air quality in the evacuation center which could be a factor for the trend of URTI cases.

Materials and methods
This study was conducted in Ubaldo D. Laya Memorial Central School (UDLMCS) (Fig. 1) in Brgy. Ubaldo Laya, Iligan City. It was one of the 13 established major evacuation centers that served to cater to the displaced individuals of Iligan City after the Typhoon Sendong devastation in December 2011. This designated transient shelter is one of the largest with 1,298 evacuees from Barangay Hinaplanon, Iligan City.

The whole area of the UDLMCS was utilized fully as an evacuation area. An ocular survey was done in December 2011 and in the first week of January 2012
to determine the specific areas used as temporary shelters. Additional ocular survey in January was done to ascertain possible changes in the lodgings of the evacuees as brought about by the resumption of classes in January 2012.

The number of open areas, buildings, specific rooms as well as the corresponding floor areas was noted. The official number of evacuees for the entire site as well as the number of individuals assigned per area was retrieved from the records of the Department of Social Welfare and Development of Iligan City. Although the establishment of the temporary accommodation is the immediate, albeit, transitory solution for the need of shelter, questions regarding health concerns of the populace also arose. This problem was magnified with the number of individuals being cramped into a small space.

**Fig. 1.** Map of the Philippines showing the location of Iligan City and its major barangays and the general vicinity of the Ubald D. Laya Memorial Central School (www.wikimapia.org, 2015).

**Ubald D. Laya Memorial Central School as Evacuation Center**

The Ubald D. Laya Memorial Central School (UDLMCS) with a land area of 7,105 square meters (m²) is a complex of seven buildings with 30 classrooms and a gymnasium. The establishment of temporary shelters in UDLMCS was recommended and facilitated by the Iligan City Health Emergency Management Office under the arm of the Department of Health (Llaneta, 2012). A generalized sketch of the area (Fig. 2) shows that 15 of the classrooms as well as the gymnasium were utilized as temporary lodgings of the evacuees.

The City Health Office and the Department of Social Welfare and Development (DSWD) established their satellite office in the area in order to serve the health and social needs of the displaced individuals.
Incidence of communicable and other diseases was observed to be present among the many individuals in the evacuation centers where small areas and spaces such as rooms are being shared by certain number of people.

To initiate the pilot surveillance of URTI, names of registered children, of ages five to 12 years old, were taken from the representatives of the City Health Office. Only children (within the age range of five-12 years old) properly diagnosed of having URTI were included in the study. The parents or legal guardians of the identified URTI patients were requested to take part in the study and were interviewed about the personal background and medical history of the patient. Information regarding their assigned lodging areas in the evacuation site was also documented.

Daily monitoring was done on the incidence of URTI among the study populace. This was to determine the trend of frequency of URTI and its possible correlation to predisposing factors.

Microbiological Air Quality of Selected Areas of UDLMCS Evacuation Site
The areas of UDLMCS evacuation center with the most number of individuals were selected and the microbiological air quality was determined using the modified Koch Sedimentation Method. Air microorganisms were allowed to settle gravitationally directly on the 3M heterotrophic petrifilms which were exposed in sampling points for a period of 15 minutes.

The aerobic plate count 3M Petrifilm™ was used instead of the traditional nutrient agar plate. The film was hydrated with one milliliter (1 mL) of sterile distilled water at least one hour before exposure. The period of air sampling was limited only to 15 minutes which is the maximum time of exposure as suggested by the manufacturer’s guidelines. Immediately after exposure, the films were incubated at ambient room temperature and observed for any colonial growth after 24-and-48 hours of incubation. The number of colonies per film was counted for the two periods (24 and 48 hours) and the total number of microorganisms present in the area was expressed as colony-forming units per cubic meter (CFU/m³) which was estimated according to the equation:

\[ \text{CFU/m}^3 = a \cdot 10000/p \cdot t \cdot 0.2 \]

where:
- \( a \) – the number of colonies on the Petri plate
- \( p \) – the surface of the Petri plate
- \( t \) – the time of Petri plate exposure.

Microbiological air quality of selected areas was determined for 12 consecutive days from February 14 to 26, 2012 at 2000 hours when the residents of the selected areas have settled down from the day’s activities.

Descriptive analysis was used to record the prevalence of visible symptoms of URTI in the evacuation centers. To correlate the predisposing factors and the demographical data namely: age, sex, mother’s educational attainment and lack of measles immunization, Fisher’s test was used. Linear regression was used to determine the correlation of the aerobic plate count and the rise of new cases of visible symptoms of URTI in the sampling sites.

Body Mass Index
The individual weight and height of the study population was determined in order to calculate the Body Mass Index (BMI). BMI is commonly used to classify weight as “healthy” or “unhealthy” (Hiza et al., 2000) and thus predict risk factors for various diseases (Harris and Haboubi, 2005) and also an indicator of malnutrition (Nething et al., 2007). Body mass index-for-age (kg/m²) was used to evaluate the children’s health status. Children with BMI of 12.7 to 18.8 are considered to have an adequate nutrition. Those with a BMI of 11.6 to 12.7 are considered to have moderate malnutrition while severe malnutrition is defined as BMI of less than 11.6 (de Onis et al., 2007).

Results and discussion
Table 1 shows the distribution of individuals assigned per area. Among the 15 rooms in UDLMCS, rooms 1
to 4 had the highest number of occupants (35 to 65 people). A person occupying any of these four rooms’ gets lesser air space (at most 5.49 m$^3$) compared to an individual occupying any of the 11 other rooms where air space per individual was at least 5.82 m$^3$.

Table 1. Distribution of evacuees in UDLMCS evacuation site.

<table>
<thead>
<tr>
<th>Temporary Shelter</th>
<th>Room Air Space</th>
<th>Number Of Occupants</th>
<th>Air Space Per Individual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room 1</td>
<td>192 m$^3$</td>
<td>65</td>
<td>2.96 m$^3$</td>
</tr>
<tr>
<td>Room 2</td>
<td>192 m$^3$</td>
<td>42</td>
<td>4.57 m$^3$</td>
</tr>
<tr>
<td>Room 3</td>
<td>192 m$^3$</td>
<td>38</td>
<td>5.05 m$^3$</td>
</tr>
<tr>
<td>Room 4</td>
<td>192 m$^3$</td>
<td>35</td>
<td>5.49 m$^3$</td>
</tr>
<tr>
<td>Room 5</td>
<td>192 m$^3$</td>
<td>23</td>
<td>8.35 m$^3$</td>
</tr>
<tr>
<td>Room 6</td>
<td>192 m$^3$</td>
<td>29</td>
<td>6.62 m$^3$</td>
</tr>
<tr>
<td>Room 7</td>
<td>192 m$^3$</td>
<td>32</td>
<td>6.00 m$^3$</td>
</tr>
<tr>
<td>Room 8</td>
<td>192 m$^3$</td>
<td>27</td>
<td>7.11 m$^3$</td>
</tr>
<tr>
<td>Room 9</td>
<td>192 m$^3$</td>
<td>33</td>
<td>5.82 m$^3$</td>
</tr>
<tr>
<td>Room 10</td>
<td>192 m$^3$</td>
<td>29</td>
<td>6.62 m$^3$</td>
</tr>
<tr>
<td>Room 11</td>
<td>192 m$^3$</td>
<td>24</td>
<td>8.00 m$^3$</td>
</tr>
<tr>
<td>Room 12</td>
<td>192 m$^3$</td>
<td>22</td>
<td>8.72 m$^3$</td>
</tr>
<tr>
<td>Room 13</td>
<td>192 m$^3$</td>
<td>19</td>
<td>10.11 m$^3$</td>
</tr>
<tr>
<td>Room 14</td>
<td>192 m$^3$</td>
<td>14</td>
<td>13.71 m$^3$</td>
</tr>
<tr>
<td>Room 15</td>
<td>192 m$^3$</td>
<td>20</td>
<td>9.60 m$^3$</td>
</tr>
<tr>
<td>Gymnasium</td>
<td>200 (estimate)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

According to The National Building Code of the Philippines: Republic Act No. 6541 a habitable dwelling of an adult person in the Philippines would need at least 14 cubic meter (m$^3$) air space while children under 10 years of age would at least need a 7 m$^3$ air space. Rooms in the sampling area had a uniform air space of 192 m$^3$. This space can only be occupied by 14 adults. Any additional number of evacuees would be considered already as overcrowding. Rooms 1 to 4 where air space per room was at most 5.49 m$^3$ are considered non-habitable to children and adults. This situation would possibly lead to transmission of various diseases to adult and children since the rooms are considered to be overcrowded. Shelters with limited healthcare services contribute to the increase in the transmission of infections and disease together with lack of sanitary services and overcrowded living condition (Rebmann et al., 2008).

Table 2. Number of children in UDLMCS diagnosed with URTI.

<table>
<thead>
<tr>
<th>Days of Sampling</th>
<th>New Cases of URTI</th>
<th>Old Cases of URTI</th>
<th>Total Case of URTI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>14</td>
<td>19</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>15</td>
<td>22</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>23</td>
<td>27</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>24</td>
<td>26</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>26</td>
<td>34</td>
</tr>
<tr>
<td>9</td>
<td>5</td>
<td>32</td>
<td>35</td>
</tr>
<tr>
<td>10</td>
<td>3</td>
<td>33</td>
<td>38</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td>34</td>
<td>27</td>
</tr>
<tr>
<td>12</td>
<td>2</td>
<td>33</td>
<td>35</td>
</tr>
</tbody>
</table>
Pediatric Population in UDLMCS Evacuation Center Diagnosed with URTI

As a result of exposure to weather extremes during and immediately after the devastation of Typhoon Sendong, compounded with the cramped space of UDLMCS evacuation center, health concerns particularly URTIs were found to be significantly high. This observation concurs with the statement of Kouadio et al., (2012) that natural disaster including floods had secondarily described infectious diseases including respiratory infections. Table 2 shows the number of children in UDLMCS who were diagnosed with URTI during the study period. Day 1 had the highest new cases of URTI with 12 individuals affected. An increase in number of old cases of URTI suggests that there is a slow increase on cases that had been cured.

Table 3. Medications prescribed for children with URTI.

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Medication</th>
<th>Number of Individuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coughing</td>
<td>1.) Dextromethorphan</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>2.) Dextromethorphan and Guaifenesin</td>
<td></td>
</tr>
<tr>
<td>Cough and Rhinorrhea (Some having fever)</td>
<td>1.) Acetaminophen/Chlorpheniramine/Dextromethorphan/Phenylephrine</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>2.) Diphenhydramine</td>
<td></td>
</tr>
<tr>
<td>Rhinorrhea (Includes Sternutation)</td>
<td>1.) Chlorpheniramine, Paracetamol (acetaminophen), Phenylephrine</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>2.) Acetaminophen/Chlorpheniramine/Dextromethorphan/Phenylephrine</td>
<td></td>
</tr>
<tr>
<td>Pharyngitis</td>
<td>1.) Antibiotic</td>
<td>7</td>
</tr>
</tbody>
</table>

UDLMCS Evacuation Center was able to provide shelter for approximately 281 families. Although the need for temporary shelter was addressed in the establishment of this evacuation center, there was a significant increase in terms of number and diversity of social contacts between the displaced individuals in a relatively small area. Diverse social contacts are generally associated with better health; however, diverse contacts can increase exposure to infectious agents and this increases the risk of diseases particularly among stressed individuals (Hamrick et al., 2002).

Table 4. Colony-forming units of bacteria in the selected sampling sites.

<table>
<thead>
<tr>
<th>Day of Sampling</th>
<th>Sampling Rooms</th>
<th>Number of Bacteria (Cfu/Cm²)</th>
<th>Day of Sampling</th>
<th>Sampling Rooms</th>
<th>Number of Bacteria (Cfu/Cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>Room 1</td>
<td>1.96 x 10⁴</td>
<td>Room 1</td>
<td>2.63 x 10⁴</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Room 2</td>
<td>2.21 x 10⁴</td>
<td>Room 2</td>
<td>2.41 x 10⁴</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Room 3</td>
<td>9.83 x 10³</td>
<td>Room 3</td>
<td>1.20 x 10⁴</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Room 4</td>
<td>9.50 x 10³</td>
<td>Room 4</td>
<td>1.17 x 10⁴</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gymnasium</td>
<td>3.08 x 10⁴</td>
<td>Gymnasium</td>
<td>2.98 x 10⁴</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>6.50 x 10³</td>
<td>Control</td>
<td>7.16 x 10³</td>
<td></td>
</tr>
<tr>
<td>Day 2</td>
<td>Room 1</td>
<td>2.21 x 10⁴</td>
<td>Day 8</td>
<td>Room 1</td>
<td>2.55 x 10⁴</td>
</tr>
<tr>
<td>Sampling Site</td>
<td>Linear Correlation P-Value</td>
<td>Interpretation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------------</td>
<td>----------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Room 1</td>
<td>0.025</td>
<td>Significant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Room 2</td>
<td>0.01</td>
<td>Significant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Room 3</td>
<td>&lt;0.01</td>
<td>Significant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Room 4</td>
<td>0.01</td>
<td>Significant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gymnasium</td>
<td>0.48</td>
<td>Not Significant</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 5. Correlation of Microbial load and number of cases of URTI.**

Symptoms of the Recruited Children

Cough was the most common complaint as reported by 57% of the study population (Fig. 3). URTI can be associated with a dry unproductive cough that serves no useful function and may cause loss of sleep and exhaustion (Eccels, 2009). This is in conformity with
the published studies that cough occurs spontaneously with URTI and is a common symptom associated with this syndrome (Eccels, 2005). Aside from its commonality, it is highly possible that this symptom was manifested by most children during the study period for cough associated with URTI may persist for as long as three weeks. Furthermore, the presence of productive (with mucosal discharge) apparently occurs in the later stages of URTI.

![Fig. 2. Sketch of the Ubaldo D. Laya evacuation center showing the study sites.](image)

Rhinorrhea or commonly known as runny nose was experienced by 43% of the recruited children and, (Eccels, 2005; Kotur, 2006) is one of the common symptoms of URTI. The nasal discharge associated with URTIs is a complex mix of elements derived from glands, goblet cells, plasma cells, and plasma exudates from capillaries, with the relative contributions from these different sources varying with the time course of the infection. A watery nasal secretion is an early URTI symptom and is often accompanied by sneezing (Eccels, 2005). Sneezing, on the other hand, was experienced by a minority of the population (4%) and may be indicative that the recruited individuals were already on the later stages of the infection.

![Fig. 3. Symptoms common among children with URTI.](image)

Only 36% of the children were reported to have experienced fever in the course of URTI. Most of the patients who had sore throat further suffered from having a hoarse voice (13%). A scratchy sensation of throat irritation is often the first symptom of an URTI (Eccles, 2005) causing inflammation and infection (Rohilla et al., 2013) and may develop into full-blown pharyngitis (Eccles, 2005). This is a painful
inflammation of the mucous membranes lining the pharynx and was experienced by 14% of the recruited patients.

The symptoms of URTI are in response to the infection of the upper airway and the immune response to infection may be the main factor in generating the symptoms (Eccles, 2005). The prototype illness of URTI is known as the common cold (Naik et al., 2014) and thus, the associated symptoms of the hallmarks of common cold are congestion, runny nose, cough and sore throat (Pappas and Hendley, 2011). On physical examination, the patients typically have a low-grade fever, macerated skin over the nostrils, and inflamed mucosa (Mossad, 2013).

Fig. 4. Medical history taken from children with URTI.

Treatment and Management Therapies Employed in the Study Population

Children who were diagnosed with URTI by the on-site health care providers in UDLMCS had evident manifestation of symptoms. This is important in the study as the data that were collected were correlated with the medications and therapies prescribed (Table 3).

Instead of prescribing medications specific for upper respiratory infections, protocol dictates that it is more of symptomatic management. The aim is for the relief of the symptoms and the most common are fever, nasal congestion and coughing. The medications provided will only alleviate the discomfort associated with the symptom, but there is no conclusive evidence that they shorten the duration of the symptoms (Cotton et al., 2005)

Dextromethorphan, the most common over-the-counter (OTC) antitussive (Paul et al., 2007) was used in the evacuation center to alleviate cough. According to Irwin (2007) antitussives, such as dextromethorphan, work to decrease cough by directly inhibiting the cough center in the brain and effectively elevating the threshold for coughing. However, the use of dextromethorphan (DM) for treatment of cough in childhood is not supported by the American Academy of Pediatrics or the American College of Chest Physicians (American Academy of Pediatrics Committee on Drugs 1997; Chang and Glomb, 2006). Moreover, DM is still used for cough suppressant in children in the evacuation center.

Two of the best over-the-counter medications to help alleviate cough are Robitussin DM and Mucinex-DM. Not only do these products contain a cough suppressant but also an expectorant to help break up thick secretions (Petter, 2011). These two medications are generically called Dextromethorphan and Guaifenesin, which are a combination medication used to relieve coughs. Guaifenesin is an expectorant, which works by thinning oral mucus and increasing mucus volume. Dextromethorphan works on the cough center in the brain. It disrupts sensitivity of
cough receptors and interrupts transmission of cough impulses (Ogbru, 2014).

Acetaminophens/Chlorpheniramine/Dextromethorphan/Phenylephrines are used for relieving symptoms of pain, sinus congestion, runny nose, sneezing, and cough due to colds, upper respiratory infections, and allergies. The decongestant (Phenylephrine) works by constricting blood vessels and reducing swelling in the nasal passages. The antihistamine (Chlorpheniramine) works by blocking the action of histamine, which helps reduce symptoms such as watery eyes and sneezing. The analgesic (Acetaminophen) and cough suppressant (Dextromethorphan) work in the brain to decrease pain and to reduce a dry or unproductive cough (www.drugs.com, 2015).

Antimicrobial therapy is only appropriate for a select group of patients as most URTIs are of viral origins (Meneghetti, 2014). However, it has already been documented that health care practitioners frequently prescribe antibiotics to treat URTI symptoms, even though there is no proof of benefit of this therapy (Mainous and Hueston, 1998; Ware, 2000). This has also been shown elsewhere, such as the United States, Canada, Turkey, Taiwan and Spain where URTIs account for most antibiotic prescriptions (Fendrick et al., 2001).

All 56 children recruited for this study were all prescribed an antibiotic (Fig. 4) which concurs with the study of Hersh et al., (2011) that more than 1 in 5 pediatric ambulatory visits to a physician result in an antibiotic prescription. Protocol dictates that clinicians should be able to distinguish bacterial infections from viral infections and, (Hersh et al.,
2013) thus decision-making is necessary about whether to prescribe antibiotics for a patient with URI symptoms. However, due to the overlapping of nonspecific symptoms, the differentiation between viral and bacterial URTI usually takes time and would necessitate laboratory tests. No delineation from the two types of URTI per patient was done during the course of this research.

Risk Factors in the Spread of URTI
All of the recruited children in the study were with the general symptoms associated with URTI and were diagnosed by the on-site clinicians of having the medical condition. The mean age of the children is 7.54 ± 1.83 years of age. The distribution of children in terms of gender was almost the same with 30 (54%) female recruits and 26 male patients (46%).

In the 56 recruited children, 21 (38%) had adequate nutrition while 35 (62%) children were moderately malnourished. Moreover, there were no cases reported on a severely malnourished child in the evacuation center. Although malnutrition is a predisposing factor of Upper Respiratory Infection (Rudan et al., 2008), having a lower BMI does not conclude also that the child is malnourished. Low variety of energy-dense foods and reduced energy intake could also lead to low body weight (Roberts et al., 2005). Overweight children have twice the high risk for URTI (Jedrychowski et al., 1998) which concurs with the observation of Hiza et al., (2000) that overweight or obese people are more likely than those at normal weight to have medical problems. Several studies have shown that parental educational attainment is linked with their children’s health. Parents with lower educational attainment typically face greater obstacles—including lack of knowledge, skills, time, money and other resources—to creating healthy home environments and modeling healthy behaviors for their children (Robert Wood Johnson Foundation, 2011). Thus poor parental health may simply be a proxy for low parental educational levels (Boardman et al., 2012). However, the mothers have greater influence on the health outcomes of the children due to the fact that the mothers typically spend more time than fathers taking care of children and consequently play a more important role in decisions about child health and nutrition (Maïga, 2010).

Almost half (43%) of the mothers in the study population finished only elementary education. Thirty percent had secondary schooling, and only 27% were able to pursue a tertiary education: 2 percent went to a vocational school and 25% had a college education. This finding is supported by Mbonye (2004) who reported that in Uganda, Africa URTI prevalence (58.2%) was also high among children whose mothers have only finished primary education. Parent education is among the effective strategies in preventing URTIs in children in industrialized and developed countries. Factors contributing to the importance of parent education for URTI prevention included the knowledge of the parent to normal prevalence of URTI, familial predisposition, risk factor modification, and the roles played by antimicrobials on URTIs (Schaad, 2005).

Short Term Trend of URTI Incidence among the Members of the study Population
Fig. 5 shows the trend of incidence of URTI where area/room 3 has the greatest difference of number of cases of URTI and room 2 having the least difference. Room 3 having the greatest difference in terms of number of cases on a day to day basis may be due to the fact that the disease had just started to be transmitted to the individuals. The Gymnasium had more or less stable trend compared to the other rooms.

Crowding in rooms versus percent URTI incidence was directly proportional at rooms 1, 3, and 4 but not room 2. Room 1 which was the most crowded had the greatest percent incidence, not less than 40% at day 10 and 12. Room 3 and the gymnasium had no less than 35% incidence in days 9 to 11. Room 2, although the second most crowded site only got at least 25% percent incidence peak which is lower compared to room 4, the least crowded site, having not less than 30% peak. While the rest of the areas are having at
most 25% to 35% URTI incidence, the general trend for URTI in all the areas sampled is increasing, especially in enclosed areas such as the rooms. This means that URTI cases had increased as days passed suggestive of fast rate of URTI transmission and more obvious increasing trend to enclosed areas such as rooms. The positive correlation between URTI cases and microbial load count was almost consistent in the room sites. This suggests that crowding in enclosed areas such as rooms would heighten URTI cases as microbial load would also increase. This result concurs with the fact that URTI is a transmittable disease from person or patient (Desai et al., 2008) which can be obtained in crowded environments or places that favor the colonization and spread of pathogens that cause these infection/ disease (Schaad, 2005).

The space allotted per person in the temporary shelter areas in UDL MCS was significantly less than what is considered to be appropriate. One room should only accommodate 14 adult evacuees. Crowding has been documented to increase respiratory infection by increasing the opportunity for cross infection. The agents of such infections are readily transmitted, usually through air by droplets or aerosols, in crowded and ill-ventilated rooms where people are sneezing, coughing or simply talking. A number of epidemiological studies, using different measures of crowding such as total number of residents in the home, number of siblings, number of persons sharing the bed, room occupancy, and population density, have reported an association between crowding and respiratory diseases (Cardoso et al., 2004).

Microbiological Quality of Indoor Air of Select Temporary Shelters in UDL MCS

Table 4 summarizes the collected data upon the employment of the traditional settle plate method. According to current Swedish requirements, the number of 500 colony-forming units (cfu) of bacteria and 300 cfu of fungal spores in 1 m³ can be accepted in an indoor environment (Abele et al., 2002). Berk et al., (1980) reported that in 1979 exposure of 20 cfu/m³ to over 700 cfu/m³ has no harmful effect.

Average cfu/m³ on the five selected areas in UDL MCS was 1.797x10⁴ cfu/m³ which is almost 35 times higher than the normal bacterial population in an indoor environment compared to the findings of Abele et al., (2002).

Day 10 was the common peak of colony-forming units of bacteria in the four areas at UDL MCS (13,833 – 31,833 cfu/m³) particularly at rooms 2, 3, 4, and the gymnasium. Room 1 had its peak on Day 7 (26, 333 cfu/m³). Comparing this to the height of URTI incidences in the areas, day 10 was also found as among the day having the highest number of URTI cases. This means that bacterial colonies became more numerous and directly proportional during the peak of URTI incidence in the area.

The unit of colony-forming bacteria was lowest in four areas (rooms 1, 2, 4 and the gymnasium) which occurred within Day 1 to Day 3 while room 3 had its lowest value on Day 12. This means that colonies of bacterial population was still less numerous during the earlier days of sampling when URTI incidence was also at its lowest value.

The gymnasium had the highest average unit of colony-forming bacteria (30,500 cfu/m³) while among the room sites, room 1 had the highest average count (23,430 cfu/m³). These two areas were the top two most occupied sites. The result suggests that the more crowded the areas are in indoor sites, the more colony-forming bacterial units are formed. Room 3 had the lowest average count for colony-forming bacterial unit (11,708 cfu/m³). This value is very close to room 4 (11,972 cfu/m³). Comparing the values to the number of occupants in these areas, room 3 only had 38 people occupying while room 4 had 35. This indicates that the less crowded the room site is, the less is the count of colony-forming bacterial unit.

Count for colony-forming unit of bacteria was beyond the normal range in all the areas sampled in UDL MCS. Values were highest in the later days of URTI transmission (7th to 10th day) and seem to be influenced by the crowding of occupants in the area.
The more crowded the areas were, the greater were the values. Count for colony-forming unit of bacteria increases as URTI transmission was found increasing and as the days of URTI transmission went by.

Related studies also supported the current findings. In Hong Kong, good microbiological class air should include less than 1000 cfu/m$^3$ of bacteria. If it includes less than 500 cfu/m$^3$ – air is classified as excellent (Sekulska et al., 2007). In Singapore requirements for indoor air quality strictly describe concentration of bacteria on the maximum level of 500 cfu/m$^3$ (Obbard and Fang, 2003). All of the sampling sites in this study had exceeded the good microbial class air which is 500 cfu/m$^3$; even the control site exceeds the excellent cfu in air.

A correlation between microbial load count and URTI cases in the sampling area (Table 5) showed that all room sites have significant values (p-value: ≤0.01) while the gymnasium had no significant p-value. This means that URTI transmission among children is very evident in closed, overcrowded areas.

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**Conclusion**

Thirty eight percent of the 146 children in the evacuation center in Ubaldo D. Laya, Iligan City were affected with upper respiratory tract infections (URTIs). Age of children particularly 5 to 8 years old and educational attainment of mothers were significant factors to URTI prevalence. URTI transmission was at a faster rate for children occupying crowded rooms. There is positive correlation of bacterial population to occurring new cases of URTIs in the area. Higher URTI cases were observed when more bacterial colonies were counted.

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