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# Factors Influencing Influenza Vaccination Rates Among Rural Ontario Paramedics

Tonya A. Leduc
*Wilfrid Laurier University*, ledu2930@mylaurier.ca

# FACTORS INFLUENCING INFLUENZA VACCINATION RATES AMONG RURAL ONTARIO PARAMEDICS

by

Tonya A. Leduc

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## Dedication

Many heartfelt thanks and dedication of this thesis

goes to

my parents, who started me on the right path,

Drs. MacPhee, Guthrie and Tiidus who guided my way, and

to my husband Rob,

who picked me up when I fell.

## Abstract

**Introduction.** Influenza vaccination rates have traditionally been very low among health care workers (HCWs) however; very few studies have examined vaccination rates and motivators among paramedics. **Objectives.** The Health Belief Model (HBM) (Rosenstock, 1974) was used as a guideline in this study to better understand the motivators and barriers to flu vaccination among rural Ontario paramedics. This group represents a considerable proportion of the HCW community, yet it has been virtually omitted from previous research.

**Methods.** Through the use of self-report questionnaires, and using the HBM as a guideline, a graphical representation of the decision-making process regarding flu vaccination was generated. The sample included 99 independent responses received from 5 rural Ontario Emergency Medical Services (EMS): Bruce County EMS; County of Renfrew Paramedic Services; Haldimand County EMS; Haliburton County (Muskoka) EMS; and Perth County EMS. Univariate, Bivariate and Logistic Regression Analyses were conducted to evaluate data.

**Results.** Living arrangement (OR=4.80, 95%CI: 1.13-20.46) was found to directly affect vaccination rates within this group. Male gender (OR=2.50, 95%CI: 0.62-10.05), less than 5 years of service (OR=5.00, 95%CI: 0.54-46.72) and more than 20 years of service (OR=5.50, 95%CI: 0.59-51.19) trended toward higher rates of vaccination. There was no effect of age or level of education. Increased convenience has been previously cited as a way to improve vaccination rates, however; it appeared only to assist in improving rates for individuals already considering vaccination. **Conclusions.** Increased *Potential Benefits* and *Cues to Action* are two dimensions of the HBM that could affect a change in vaccination status. This increased knowledge is useful in the development of targeted vaccine uptake initiatives that could lead to increased rates of vaccination among paramedics, HCWs and the community at large.

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## 1.0 Introduction

During the past century, influenza, also known as the 'flu', has continued to plague the northern hemisphere. The result of an infection by the influenza virus, the flu is a relatively common respiratory illness. The flu, as outlined by the Public Health Agency of Canada (PHAC) (2012), has fairly predictable symptom progression, usually beginning with a fever and chills and quickly progressing to a persistent cough or sneeze, sore throat, muscle aches and occasionally in children, nausea and vomiting. Although the flu usually subsides within 8-10 days, in some high risk populations, such as with older adults or the immunocompromised, infections can last much longer and can often result in death (PHAC, 2012).

With the onset of the Spanish flu in 1918, the Asian flu in 1957, the Hong Kong flu in 1968 and the most recent outbreak in 2009 of the Swine flu, the influenza virus has gained significant notoriety. Collectively these pandemics have killed millions of people worldwide. In Canada, approximately four million people contract the flu each year and more than 3,000 die annually from the flu or its subsequent complications (PHAC, 2012). The total annual cost related to Canada's influenza epidemic has been estimated to be over one billion dollars and when paired with pneumonia it is the 8th leading cause of death in Canada (Statistics Canada, 2011). In response to this threat, the most effective method of protection is vaccination; the introduction of a weakened or inactivated virus to a body system to induce a protective immune response (Petrie, Ohmit, Johnson, Cross, & Monto, 2011).

Although vaccination against influenza (also known as "the flu shot") has been proven to be the most effective intervention in the fight against influenza transmission, particularly in high risk groups (e.g., children, older adults), its acceptance in the community at large has been somewhat slow going. The flu shot is recommended for all high-risk populations; however, recent estimates have identified older adults as the most likely to be vaccinated at a rate of

65%, followed by children at 48%, healthcare workers (HCWs) and high-risk adults at 36% and 25% respectively (Nichol & Treanor, 2006). In fact, even during the H1N1 pandemic of 2009-2010, one-half of all Canadians remained unvaccinated (Statistics Canada, 2011).

Traditionally, healthcare workers (HCWs) have had low rates of influenza vaccination despite the fact that it is recommended that all HCWs receive the seasonal vaccination annually (PHAC, 2012). Since HCWs care for those in poor health, including those sick with the flu, they are often at greater risk of acquiring the flu due to increased levels of exposure to the influenza virus (El Sayed, Kue, MacNeil & Dyer, 2011). In spite of this increased risk, less than one-half of HCWs receive their seasonal influenza vaccinations annually (Nichol et al., 2006). The most common reasons for HCWs to decline the influenza vaccination include: skepticism surrounding the effectiveness of the vaccine; the belief in the vaccine's potential for increasing the risk of certain diseases; and the idea that the individual HCWs themselves are generally 'healthy' and not susceptible to the virus (Rhudy, Tucker, Ofstead & Poland, 2010).

The majority of the research literature on HCW influenza vaccination focuses on physicians, nurses, medical assistants, medical students and hospital administration staff; essentially HCWs at risk for influenza *within* a hospital setting. Due to the nature of their profession, Emergency Medical Service (EMS) personnel (i.e., paramedics) are routinely involved with patient care *outside* of the hospital. As a result, paramedics are also at an increased risk not only of exposure to the flu virus, but they may also serve as a vector of transmission to their patients. As noted by El Sayed et al. (2011), influenza and similar infectious respiratory diseases are the 3rd most common infectious disease hazards experienced by paramedics, after meningitis and tuberculosis.

Despite both of these risk factors, very few studies have included vaccination rates among paramedics when conducting studies of HCWs. Of the research that does exist, the results reveal that only a small proportion of paramedics accept the seasonal influenza vaccine. For

example, Rueckmann, Shah, & Humiston (2009) found that EMS personnel had lower rates of influenza vaccination (21%) even when compared to Emergency Department (ED) personnel. Although both medical divisions share a quick patient turnover rate, Rueckmann, Shah & Humiston found that only 27 of 128 paramedics reported receiving annual flu vaccinations compared to 83 of 128 (65%) Emergency Department (ED) personnel. This is especially disconcerting as recent evidence has shown EDs to be the site of the lowest vaccination acceptance rates within hospitals (Bishburg, Shah, & Mathis, 2008).

Almost all of this current research has been conducted in the United States. This is fairly paradoxical as influenza is more easily spread in Canada's northern climate, with its long, dry winter season. When compared to the shorter, milder winters experienced by the majority of the United States (Hall, 2007), an extended winter season presents an increased risk to Canadian EMS personnel not accounted for in the current research.

Due to the limited amount of Canadian research on influenza vaccination rates among EMS personnel, it is difficult to identify the reasons for potential differences in vaccination rates between paramedics and other HCWs in Canada. The discrepancy between the recommendation to receive the vaccine and the low rate of vaccine acceptance is the focus of this research. By increasing the working body of knowledge with studies conducted among Canadian paramedics, identification and understanding of the reasons for this discrepancy can be ascertained.

# 2.0 Background

## 2.1 EMS in Ontario

EMS, which stands for Emergency Medical Services, are pre-hospital and out-of-hospital medical services, provided by highly trained individuals (i.e., paramedics) (Toronto Emergency Medical Services, 2012). At this time, the term 'EMS services' is currently in transition to the more accurate label, 'Paramedic Services'. As this study was conducted during this conversion, the two terms are used interchangeably throughout the document.

There are approximately 7,000 EMS personnel in Ontario who serve a population of approximately 13 million (Ministry of Health and Long-Term Care, 2012).

EMS are divided into two main categories: land ambulance services, which deliver pre-hospital and out-of-hospital medical care to over 440 municipalities, and, air ambulance services that are delivered by Ornge®. Ornge® provides acute pre-hospital medical care in an aircraft such as a helicopter or airplane. Air ambulances are used primarily in situations where patient transport originates in a highly remote area, when travelling to an acute care hospital or trauma centre, or when transporting critically ill or injured individuals from one location to another (e.g., to a hospital from the scene of an accident etc.)

These two main categories of EMS services in Ontario are further divided into two additional subcategories: paramedic operations and dispatch operations (Toronto EMS, 2012). Paramedic operations deal directly with patient care whereas dispatch operations are responsible for the coordination and communication with the outgoing land and air ambulance operators, or with other centralized ambulance communication centres (CACCs).

## 2.2 EMS Service Areas

Although there are some similarities among EMS services across Ontario, differences do exist and are largely a result of the communities they serve. In many cases, the services have adapted specifically to the needs of the communities in which they are located.. The result is several different types of EMS services: urban, suburban, rural and remote (Ministry of Health and Long-Term Care [MOHLTC], 2010).

According to Statistics Canada, an urban area is defined as an area with a population of at least 1,000 individuals with a population density of at least 400 people per square kilometre, however, the difference between urban and suburban communities is loosely defined. The most useful definition is one that incorporates both the population density and the type of housing development most prevalent in each location. In essence, urban communities consist of areas with large pockets of multi-family housing units (e.g., apartments, condominiums) with smaller single-family dwellings, whereas suburban areas consist of fewer multi-family homes with many more single family dwellings (Turcotte, 2008).

The MOHLTC (2010) has defined rural and remote communities with respect to the scope of health care services available in these areas. Rural communities are those with a low population density and a total population of less than 30,000 people who are at least 30 minutes travel time away from any community with a population over 30,000. Remote communities are those, “with year-round access to road services and must rely on a third-party (e.g., train, airplane, ferry) for transportation to a larger centre” (MOHLTC, 2010, pg. 8). As one would expect, each of these community types present different challenges for the EMS services within each area. Therefore, in order to provide adequate medical care to each type of community, EMS services and the paramedics employed within them must adapt to their surroundings in order to remain effective.

### 2.3 Ontario Paramedics and Training

Paramedics complete their training at an Ontario college or training institution with a paramedic training program certified by the Ministry of Health and Long-Term Care (MOHLTC, 2012). Once training is completed, candidates are eligible to write the Advanced Emergency Medical Care Assistant (AEMCA) Theory Examination and if successful, obtain their AEMCA paramedic level certification, also known as their 'P1'. If the training was completed outside of Ontario or Canada, they must complete an equivalency process in order to ensure that their training has provided them with the same skills required of any Ontario Paramedic Program (MOHLTC, 2012).

There are three different certification levels of paramedics in Ontario: Primary Care, Advanced Care and Critical Care Paramedics (MOHLTC, 2012). A detailed listing of each of the paramedic certifications and their associated duties can be found in Appendix A (Terms Relating to Paramedics and EMS).

### 2.4 Rural Ontario: Health Care Challenges

Although only 15% of Ontarians live in rural areas, this equates to nearly two million Ontario residents (Statistics Canada, 2013). Although rural residents comprise a significant portion on Ontario's population (16%), (Statistics Canada, 2013) they have been shown to have a lower health status than their urban counterparts. The MOHLTC (2010) outlines the indicators of rural residents' lower health status which include: a greater proportion of overweight residents; a lower life-expectancy at birth; and, a higher age-standardized mortality rate with increasing distance from an urban centre.

This is noteworthy since rural communities are by definition located away from large populations and infrastructures. Therefore, both physical and human resources are limited in these areas. As a result, rural hospitals are often small and lack diversification (Hewitt, 1989). Rural residents are subsequently left with few options to satisfy their health care needs (Ontario

Health Coalition, 2009) and are then forced to travel larger distances to receive health care services. This results in differences in the types of care that rural community members seek. For example, rural residents are less likely to travel for preventive health services (e.g., flu vaccine) (MOHLTC, 2010). To further complicate the matter, the MOHLTC (2010) also notes that this centralization of resources to the larger urban centres leaves the rural areas under-represented in times where targeted local responsiveness is crucial (e.g., epidemics).

### 2.4.1 Rural Communities and EMS

Rural communities have typically larger geographical distances between their medical care facilities (e.g., between hospitals with Emergency Departments or trauma centres) than urban areas (British Columbia Ministry of Health, 2015). This results in longer travel times experienced when using EMS services (Hewitt, 1989). In addition, public difficulty in accessing EMS services (e.g., limited cellular and phone service in rural areas) (Kasdorff & Erb, 2010) contributes to longer response times and therefore more challenging medical cases upon arrival (Hewitt, 1989). Given that rural paramedics and community members face different challenges than their urban counterparts, it is important to address these differences when investigating aspects of rural medical care practices.

# 3.0 Review of the Literature

## 3.1 The Influenza Virus

The influenza virus belongs to the viral family *Orthomyxoviridae,* a group of spherical viruses with the genetic material for replication centrally located within a surrounding capsule (Prescott, Harley & Klein, 1996). There are three main varieties of the influenza virus, A, B and C. Influenza A generally causes the most severe disease in the human population and is also the most easily spread (Racaniello, 2012). The influenza A virus was responsible for all of the influenza pandemics in recent years, including the Spanish flu of 1918 and most recently, the Swine flu of 2009 (Cann, 2012). Due to a high variability of surface protein type coupled with large host variability, influenza A has the ability to mutate asymptomatically in several species before re-emerging among the human population (Hay, Gregory, Douglas & Lin, 2001). As a result, when a new strain does emerge, it can cause significant morbidity, especially if the immune system has not encountered it previously (Hay et al., 2001).

In contrast, influenza B is less common and is also less diverse. Owing to the limitations in the potential host species, there is little genetic diversity, which also allows for individuals to hold a generalized immunity as adults (World Health Organization [WHO], 2005). Though protection is not complete, the immunoprotective effect generated from only a few infections of influenza B greatly reduces the severity of symptoms as compared to influenza A (WHO, 2005) and thus reduces the likelihood of a influenza B pandemic (Racaniello, 2012). Structurally, there are many similarities between the Influenza A and B viruses. The viruses consist of similar surface glycoproteins, neuramidase (NA) and hemagluttanin (HA) along with others that aid in ability to enter host cells (Prescott et al., 1999). Influenza A and B are the most commonly found influenza virus types during a typical seasonal outbreak and it is for this reason that the seasonal influenza vaccine contains both influenza A and B components (Racaniello, 2012).

Influenza C is the most structurally different of the three influenza viruses. Slightly less spherical, it contains only seven segments of RNA in its genetic makeup as compared to the eight found in both the influenza A and B varieties (Racaniello, 2012). A typical influenza C infection causes mild upper respiratory infections with the rare infection causing complications such as pneumonia or bronchitis (Racaniello, 2012). Of the three influenza viruses, very little is known about influenza C, as outbreaks are rarely detected due to their mild symptom severity in adults (Matsuzaki et al., 2006). Influenza C occasionally causes amplified symptom severity in young children when compared to symptoms commonly seen in adult populations (Matsuzaki et al., 2006). Since many individuals experience an influenza C infection at some time during their childhood years, the severity of symptoms is greatly reduced if contracted again as an adult (Racaniello, 2012). A table of influenza-related terms and their definitions can be found in Appendix B (Terms Relating to Influenza).

### 3.2 Transmission

Before influenza transmission was understood, the means of transmission of influenza-like viruses appeared mystical or maliceful. In fact, the origin of the word "influenza" can be traced back to the Italian "*influenza coeli*" or "*influenza di diavolo*" meaning "influence of the celestial" or "influence of the devil", respectively (Hall, 2007). Hall (2007) describes three main methods of transmission.

The first is *direct transmission* where an individual inhales large droplet particles (10-100µm) directly from another individual. For *direct transmission*, individuals must be less than one metre apart. The second method of transmission is through *self-inoculation* wherein individuals infect themselves through hand contact with contaminated environmental surfaces and then the subsequent hand contact of the mucosal surfaces of the eye, nose or mouth. The third influenza transmission method is via *small-particle aerosols,* where small virus-containing fluid filled capsules are expelled into the air through coughing, sneezing, breathing or talking.

These aerosol capsules are small in diameter (<10μm) and are capable of a distant spread, of up to two metres.

### 3.3 Shedding

In order for the influenza virus to be transferred from one individual to another, an infected individual must first release viral particles from their body system. The timeline of contagious infection, known as viral shedding, varies from person to person. Carrat et al. (2008) explains that viral shedding usually begins 1-2 days before symptom onset and may continue for several days, usually lessening over time. During this period of viral shedding, the virus can be transmitted from person-to-person, with peak transmission ability usually on or around the day that symptoms appear (Hall, 2007).

Hall (2007) reported that not only was there much variability in the amount of virus shed by one individual relative to another, but also that there are some individuals who shed enormous amounts of viral particles during an infection. These individuals are known as "super shedders" and may often shed more than 30 times more viral particles than the mean viral shedding value during an infection (Hall, 2007). As these individuals are unaware of their highly contagious nature, they may introduce a significant level of uncertainty when designing an infection control protocol.

In addition to the concept of the "super shedder", there is the notion of subclinical infection. Subclinical infection is the condition where an individual maintains an infection but not to an extent where symptoms appear. Ferguson et al. (2006) noted that during most seasonal influenza outbreaks, up to 50% of the population who are infected with influenza are unaware of their infection. These individuals experience a reduced severity of symptoms or an absence of symptoms altogether. The concept of subclinical infection may introduce additional inconsistency to an infection control protocol plan. Simply stated, how do you control the spread of a virus you can only identify in 50% of the population?

Even in cases of clinical levels of infection, most individuals reach peak viral shedding levels on or just after the day symptoms appear (Hall, 2007). Therefore, it is of the utmost importance to engage in protective measures before the onset of symptoms in order to slow transmission rates through the community. Although antiviral medications (e.g., Tamiflu®) are useful in reducing the effects of symptoms, and can lessen the timeline of symptoms by approximately one day, they do not stop viral spread or protect from infection (Canadian Medical Association [CMA], 2011). In fact, the general medical consensus is that the most effective way to prevent the spread of influenza is through the use of vaccinations and that antiviral medications should be used as a useful adjunct to the treatment of influenza (CDC, 2013).

### 3.4 The Influenza Vaccine

Influenza vaccination is the delivery of an inactivated or weakened virus into the body through intramuscular injection or intranasal spray (Nichol & Treanor, 2006). Once the destroyed or weakened virus has been successfully introduced to the body system, the immune system engages to eliminate the invader as if the live, fully active virus was invading the body.

In response to the "invading" vaccine, the immune system begins by recognizing the antigenic makeup of the surface capsular glycoproteins. Once this is complete, a highly specific immune response can be mounted against the viral invader. By elevating serum antibodies in the bloodstream (Wilde et al., 1999), the body prepares itself for a viral attack that could potentially come later. If a seasonal influenza viral assault does occur at a later time, the immune system simply moves forward with its prepared attack, thus lessening the severity of the symptoms seen in the individual (Couch, 2008). It has been hypothesized that since the viral units cannot multiply effectively after the body has been seroprotected, viral numbers are reduced. This results in a reduced number of viral units available for shedding, and a subsequent reduction in the virus' transmissibility to new, uninfected persons (Fine, 1993).

**3.4.1 Types of influenza vaccines**. There are two main types of influenza vaccines available for commercial use. The first, the trivalent inactivated vaccine (TIV), contains three different strains of destroyed influenza viruses and is delivered intramuscularly. TIV cannot produce any signs or symptoms of influenza because the virus has been deactivated through disruption by detergent (Curran & Leroux-Roels, 2010) and does not actually enter individual cells (PHAC, 2012). The convenience, low cost and reduced potential for side effects are reasons why this vaccine is recommended for the vast majority of individuals, including children (Wright, 2006).

The second vaccine type is the live, attenuated influenza vaccine (LAIV) (e.g., FluMist®) and is made of weakened virus whose protection differs from the effects of TIV, especially in adults (Ambrose, Walker, & Connor, 2009). Belshe (2004) suggested that there is increased efficacy with children, however, with adults; this has not been conclusively demonstrated. Primarily due to its painless intranasal delivery method (Ambrose et al., 2009), it serves a convenient alternative to the traditional flu shot. The LAIV vaccine, however, contains live viral particles and has the potential to create mild flu symptoms such as fever, runny nose or nasal congestion in some individuals (CDC, 2009). In addition, despite the LAIV vaccine's increased efficacy in children and its convenient and painless delivery method, there exist a large number of contraindications for specific groups (e.g., young children, immune-comprised individuals, asthmatics) (CDC, 2013). This, combined with its questionable effectiveness with adult populations (Petrie et al., 2011), are two reasons why the LAIV method is less often recommended by the medical community.

The LAIV vaccine has yet another limitation; it is more expensive than the TIV method. The acquisition cost of the LAIV is approximately $46 per dose as compared to the injectable vaccine which costs between $7-11 (Matteson, Kavanaugh, & Poland, 2003).

Recipients of the relatively inexpensive TIV method of influenza vaccination prove the most sheltered from both possible infection and adverse reaction. This is why the TIV method remains the most widely used influenza vaccination method in Canada (CMA, 2011).

**3.4.2 Limitations to vaccine protection against influenza**. The protection provided by the influenza vaccine is not complete. As with most microbes, reproduction rates are quite rapid. Thus, with only small intergenerational differences, large changes in structure, sequence and virulence can be affected in a short period of time (Prescott et al., 1999). A consequence of the dynamic quality of the influenza virus, as with many other viruses, is that different strains can cause significantly different effects.

The glycoproteins seen on the outside of viral capsules are the antigens that signal the immune response to create antibodies. If a significant change in the collection of the surface glycoproteins occurs, the immune system is required to mount a completely different response in order to be effective. This reorganization of materials into functional antibodies takes time, which results in a more involved infection than if the antigenic surface could have been easily recognized by the immune system.

Since vaccines must be created with the same specificity as the viral strain, changes in the influenza virus from one season to another can render the vaccine less effective (Couch, 2008). As a result, a yearly vaccine is recommended in areas frequented with seasonal influenza outbreaks in order to (a) improve the probability of effective seroprotection (Wilde et al., 1999), and (b) to capture as much strain correlation between the vaccine and the seasonal influenza virus as possible in order to improve vaccine efficacy (CDC, 2013). Although vaccines are created to target specific influenza strains, the potential for cross-protection does exist if the strains are similar enough (CDC, 2009).

Each season, the World Health Organization (WHO) monitors trends around the globe and predicts what strains will be the most prevalent in each area. This gives manufacturers time to

generate vaccines for their populations (Couch, 2008), however, if strains mutate more quickly than expected or if a strain is found in an area to which it is foreign or new, the effectiveness of the vaccine may be limited. Despite its limitations, the influenza vaccine has been proven many times to be the most effective method of preventing contraction of the influenza virus.

### 3.5 Influenza Vaccination and the Health Care System

Several studies in the US and Europe have focused on the attitudes and views regarding influenza vaccinations with healthcare workers (HCWs). The notion of, "do no harm" is the conceptual basis of the HCW influenza vaccination recommendation (Nichol & Hauge, 1997). In essence, HCWs should protect their patients from possible infection by becoming vaccinated. According to Weingarten, Riedinger, Bolton, Miles & Ault (1989), HCWs are at an increased risk of contracting the flu and they represent a "reservoir" of flu infection that can be directly transmitted to their patients. This is especially true since several studies have documented that many HCWs continue to care for patients despite the fact that they had developed influenza-like symptoms and could be potentially infected with the flu (Ofstead, Tucker, Beebe & Poland, 2008).

Although healthcare workers are recommended to receive the influenza vaccine based on their occupational responsibility to provide care to the sick, the rate of acceptance is traditionally very low.

Studies involving personnel directly involved in patient care of very high-risk patients have also shown similar results. Loulergue et al. (2009) discovered through a cross-sectional study involving HCWs from pediatric and internal medicine units in two teaching hospitals, that the rate of vaccine acceptance was only 41%. Despite continued direct contact with children and the immunocompromised, influenza vaccination rates still remained incredibly low.

Mah et al. (2005) observed attitudes regarding vaccination in a Canadian cancer center, an environment where many individuals are also often immunocompromised as a direct result of their treatment. Through a cross-sectional self-administered survey, it was determined that only 22% of HCWs in these departments participated in annual vaccination efforts.

This finding is not limited to those who work primarily with patients who spend longer periods of time in the hospital. In Canada, Saluja, Theakston, & Kaczorowski (2005), in a cross-sectional study of HCWs in four Emergency Departments in London, Ontario, observed the rates of influenza vaccinations in order to determine if Emergency Departments differed from long-term care facilities in their rates of HCW vaccinations. Despite the outpatient nature and quick patient turnover rates seen in Emergency Departments (EDs), only 37% of ED personnel received the vaccine. This is especially disconcerting as the nature of EDs expose HCWs in these departments to high volumes of patients and thus, increases their risk of exposure to influenza. It is important to note, however, it is not the only the risk to the HCW that is significant. Evidence suggests that patients who have been exposed to HCWs who are contagious with influenza or an influenza-like illness are also at increased risk. In a study by Vanhems et al (2011), it was found that patients in a hospital ward with an HCW who showed symptoms of influenza or an influenza-like illness were nearly twice as likely to become infected (OR=1.95, 95% CI=1.53-2.50). This highlights how critical vaccination among HCWs is, yet vaccine uptake within this group is still intermittent.

These dismal rates of vaccination lead to a very pointed question: if influenza vaccination is so widely recommended as the first line of defense against the influenza virus for HCWs and their patients, why has its acceptance been met with so much resistance?

**3.5.1 Trends regarding HCW vaccination.** There are several different studies that have examined influenza vaccination rates among hospital-based HCWs and similar trends seem to emerge among them. Most HCWs feel that the vaccine is ineffective or that its effectiveness

has been exaggerated by vaccine manufacturers in order to promote use (Mah et al., 2005). Many consider their general good health a sufficient barrier for infection (Moore, 2009) and that proper hand washing practices should be used to prevent an influenza infection (Rhudy et al., 2010). Additionally, many HCWs also believe that there are several potential side effects that are associated with inoculation. Specifically, HCWs feel there is a general increased risk for catching the flu itself (Mah et al., 2005) or that frequent vaccination results in harmful health consequences or side effects (Nichol & Hauge, 1997). Finally, there is the concept of convenience. Since many HCWs are scheduled to work rotating shifts (e.g., days, evenings, nights), they reported that it was difficult to find time to get the flu shot (Mah et al., 2005). Even when vaccination stations were made available at the workplace or hospital, many HCWs cited inconvenient scheduling (i.e., no vaccination stations during the off hours) or inconvenient distance (i.e., too far away to allow for convenient trips during shift hours) as reasons why they remained unvaccinated (Rhudy et al., 2010).

Although studies on this topic appear to include all HCWs, paramedics are overwhelmingly excluded. Despite the fact that influenza and similar respiratory diseases are the third most common infectious risk to paramedics (El Sayed et al., 2011), their representation in studies involving rates of influenza vaccinations, as it relates to their patient care duties is limited. To date, there are only three studies which look at paramedic flu vaccination rates. Thus, the question remains, is there a link between the attitudes and opinions regarding influenza vaccinations seen in HCWs in a hospital setting and those of paramedics, or are there key differences in essential standpoints on the subject of influenza vaccination?

### 3.6 Paramedics and Influenza Vaccination

Paramedics are HCWs who work in highly dynamic environments and these varied surroundings require paramedics to take additional precautions in order to prevent transmission,

illness and infection. When dispatched to a location that presents a specific infectious disease risk, a particular code is issued by the dispatcher (Region of Waterloo, 2007) Subsequently, the paramedics who respond to the call are required to wear Personal Protective Equipment (PPE) when on site (MOHLTC, 2008).

The PPE consists of a N95 face mask, a particulate-filtering respiratory mask designed to fit tightly to the face (CDC, 2006), protective gloves, safety glasses and gowns. This creates a physical barrier between the paramedic and patient, which serves to not only protect the paramedic from the possibility of contracting the flu from the patient, but to protect the patient from receiving the flu from the treating paramedic. In addition to the type of apparel used as a protection, there is also a *donning* and *doffing protocol,* which dictates the order in which items must be put on and taken off in order to prevent self-infection (MOHLTC, 2008). Lastly, paramedics employ hand washing protocols whenever possible to keep their hands clean. If water is not available, paramedics use alcohol-based hand sanitizer to ensure their hands remain clean (MOHLTC, 2008).

**3.6.1 PPE and influenza.** If the PPE is used correctly, why isn't it sufficient for protection against the flu? There are three main reasons. First, as discussed earlier, flu-infected individuals are often contagious before the onset of symptoms (Lau et al., 2010). As a result, it is difficult to recognize whether or not an individual is contagious and consequently it becomes difficult to ascertain if donning PPE is required. Second, youth and children can be contagious up to two weeks (Hall, 2007) long after symptoms have lessened or subsided. Although there is a general downward trend in viral shedding as symptoms subside, different individuals shed virus at different rates (Hall, 2007). As a result, individuals whose symptoms have lessened could potentially continue to shed significant viral numbers (Hall, 2007) and result in viral transmission to a new person. Finally, there is the concept of sub-clinical infection. Estimates suggest that nearly 50% of individuals who have contracted the flu virus show lessened

symptoms (Ferguson et al, 2006). Ferguson et al. (2006) also outlined several documented cases of individuals who tested positive for influenza who were completely asymptomatic. This introduces a significant amount of uncertainty as it is difficult to determine when such protection is necessary.

Noting this, are there certain trends regarding paramedic influenza vaccination rates that can be attributed to this increased uncertainty? There are very few studies that have examined influenza vaccination rates among paramedics and virtually all of these studies to date have been conducted in the continental United States. Despite the limited amount of data assembled on this topic, trends are beginning to emerge.

**3.6.2 Influenza vaccination and paramedics.** Rueckmann et al. (2009) discovered that there was a significant difference in the number of vaccinated individuals when comparing EMS personnel to those in a hospital ED. Traditionally, EDs hold the lowest numbers of influenza vaccinated HCWs within a hospital. Bishburg et al. (2008) determined through the use of a cross-sectional comparison of medical residents in a teaching hospital that EDs held the lowest number of vaccinated medical residents (24%). Since most medical residents are charged with patient care duties, it is interesting to note that when compared to other high-risk departments within the hospital (e.g., pediatrics [66.7%], internal medicine [56.8%], pediatric internal medicine [50.0%]), emergency medicine residents showed a significantly lower influenza vaccination rate when compared to those in the other specialties ($p = .02$).

To further emphasize this point, Rueckmann et al. (2009) discovered that there was a significant difference in the number of vaccinated individuals when comparing paramedics (21%) to HCWs within a hospital ED in the same region (65%). This cross-sectional study utilizing a self-report questionnaire maintained an impressive participant response rate (N=128, 100%) for both the ED personnel and paramedic groups. All members of both groups were involved directly with patient care and were full-time employees. Rueckmann et al. (2009) was

the first study to describe influenza vaccination rates among paramedics and thus serves a benchmark for the documentation of paramedic influenza vaccination rate research.

Paramedics have some similar reasons as for vaccine declination as HCWs. Similar to the hospital based HCWs described above, there exists a consensus among EMS personnel that they are generally healthy and feel that the vaccine is ineffective in preventing influenza (Hubble, Zontek, & Richards, 2011); however, there are some key differences between HCWs and paramedics. In reviewing the literature on the reasons for declination among paramedics, another major theme regarding vaccine refusal emerged. Rueckmann et al. (2009) discovered that a major reason for why paramedics were refusing vaccination related to a lack of a direct mandate to do so. In this study, there lacked a facility-wide mandatory vaccination protocol. It should be noted, however, that a national recommendation for HCWs did exist and indicated that paramedics should be vaccinated yearly (CDC, 2009).

**3.6.3 Mandatory influenza vaccinations and paramedics**. Hubble et al., (2011) suggested that mandatory vaccination programs within EMS stations should be established in order to increase the low rates of vaccinated paramedics, but this effort toward mandatory vaccination of paramedics has been met with much resistance in both the United States and Canada. Hubble et al. (2011) noted in a study involving North Carolinian paramedics that only 9.1% of paramedics would be in favour of such mandatory vaccination protocols.

In Canada, the debate amongst paramedics and policy makers regarding mandatory vaccination reached a heightened conclusion. Early in the last decade, Ontario paramedics won the fight to remove a mandatory influenza vaccination component to the *Ambulance Act*, in which Ontario paramedics would have been regulated to receive the seasonal flu shot in order to retain their employment (Canada News Wire, 2002). The subsequent amendment to remove this component directly reflects the attitudes against mandatory influenza vaccination shared by many paramedics in Ontario. This refusal of mandatory vaccination is not necessarily mirrored

by hospital-based HCWs. Goldstein, Gamble, & Bearman (2004) reported that nearly 50% of hospital based HCWs would be in favour of a mandatory vaccination protocol in their workplace. This shows that there are a few major differences resident in the attitudes regarding mandatory influenza vaccination between HCWs and paramedics.

Recently, one study has provided valuable insight into the trends of influenza vaccination in Ontario. In order to counteract the scarcity in applicable research, a recent cross-sectional pilot study by MacPhee & Totzke (in preparation) reviewed rates of influenza vaccination among paramedics in two urban EMS facilities in Ontario. Vaccination rates in these areas were discovered to be significantly higher than those reported in the United States; however, those who chose to remain unvaccinated had similar reasons for refusal as previously reported. Although there were a generally high number of individuals vaccinated in these areas (65%), it was difficult to ascertain the cause (MacPhee et al.). Could this have been an anomaly reflective of a small respondent sample, or did it relate directly to the nature of the urban location of these services, or an increase in the daily person-to-person interactions intrinsic to living and working in an urban community? Regardless of the cause, the finding corroborates with the findings of Hubble et al., (2011) the only other study to date that has identified trends within different types of EMS services. Hubble et al. (2011) discovered that urban EMS centres have a higher rate of influenza vaccination amongst their personnel than suburban and rural EMS services. This could be the reason for the inflated number of vaccinated urban paramedics seen in the Canadian study.

### 3.7 Rural paramedics and influenza vaccination

According to Hubble et al. (2011), rural EMS services were found to have the lowest rate of influenza vaccination amongst three community types: urban, suburban and rural. In this study, however, the rural EMS sample comprised a small fraction of the total number of

respondents involved in the study (18%) and therefore it is difficult to generate conclusions based on the results.

Of all the research that has been conducted on EMS, paramedics and influenza vaccination, there is no study to date that pertains directly to rural services. As described in the MOHLTC's *Rural and Northern Health Care Report* (2010), there are several challenges that are faced by rural health care services that are not reflected in other areas of the province and therefore deserve special attention.

The rural health care system is dynamic and the ability of rural areas to maintain their health care service level to all community residents is a constant challenge. Due mainly to the centralization of health care resources to urban areas (MOHTLC, 2010), and the difficulty of attracting and maintaining health care providers to rural areas (Hewitt, 1989), rural residents have difficulty accessing health resources that are both convenient and capable of serving their needs. Consequently, it is often the EMS service in the area that serves to bridge the gap by assuming new responsibilities that would not be normally required (Hewitt, 1989). This puts increased pressure on rural paramedics as compared to their urban counterparts.

Second, rural communities are, by definition, large geographical areas with a low population density; residents live far apart from one another and public transportation is very limited in rural areas. Usually, a visit with a family physician or to a community clinic requires travel to a central location (Kasdorff et al., 2010). As this is often over a long distance, many individuals are not inclined to visit a health care professional for non-urgent care (e.g., flu shots) (MOHLTC, 2010). Therefore, it is important to recognize that there may be fewer individuals in the community vaccinated for influenza. This coupled with the concept of sub-clinical infection (i.e., infected individuals without clinical symptom levels) subject rural paramedics to an increased risk of infection from their patients.

Health care personnel shortages are also often experienced in rural areas (Hewitt, 1989) as a result of limited physical and human resources. This, in turn, may require paramedics to work even when they are ill, which can increase the potential for paramedics to transmit the virus from one patient to another.

Third, in a study observing the use of EMS in three U.S. states where statewide, computer-analyzed, ambulance use rates were available, Hewitt (1989) found that ambulance services were used more often by older adultsin rural communities as compared to those living in urban areas. Noting that the elderly are one of the groups at high risk for complications stemming from influenza infection, it is vital that paramedic influenza vaccination be well documented in rural areas to help reduce the risk of infection to this group.

Unfortunately, little research has been conducted on this topic to assist in these goals. In fact, of 221 articles on influenza and HCWs, only three studies relating to paramedic influenza vaccination have been published to date. No study has looked directly at rural paramedic influenza vaccination. Due to the specific differences between the daily activities and challenges of rural EMS services and urban and suburban paramedics, conclusions generated via previous studies may not be directly applied to rural paramedics. Consequently, it is of utmost importance that an understanding of the attitudes, practices and opinions of rural paramedics with respect to vaccination, their rates of use and their reasons for acceptance and refusal be documented. Only then can a cohesive understanding of influenza vaccination rates, attitudes and opinions be generated. By doing so, it will be possible to begin to increase the low rates of vaccinated HCWs in Canada, regardless of their geographical location or demographic.

### 3.8 The Health Belief Model

In order to fully understand the attitudes, behaviours and opinions of rural Ontario paramedics, the results generated from this study were interpreted under the context of the

*Health Belief Model* (HBM) (Rosenstock, 1974). The HBM was originally developed in 1954 to attempt to explain predictors of behaviours related to the acceptance and utilization of medical care recommendations such as medications and vaccinations. At the time, a large component of the population resisted utilizing some of the medical preventative measures available at the time. The HBM was created in an attempt to understand why this was happening.

### 3.8.1 Dimensions of the Health Belief Model

The HBM has two main elements: (1) the perceived value an individual has to a health goal, and (2) the idea that undergoing a particular intervention will achieve that goal.

There are five main dimensions of the HBM:

***3.8.1.1 Perceived Susceptibility***. This is a measure of how vulnerable a particular individual is to a certain condition. In the case of influenza, if an individual does not believe that they are likely to contract the flu or that their circumstances would not make transmission likely, they would have a low *Perceived Susceptibility* measure.

***3.8.1.2 Perceived Severity***. *Perceived Severity* is the understanding of how disruptive contracting a condition would be on an individual's life. This varies from person-to-person and from time-to-time. Some individuals believe that contracting the flu would result in serious consequences for their day to day life; while others believe that the flu would not affect their lives at all. This measure depends on each person's evaluation of the medical or clinical severity of having the disease (e.g., discomfort, pain, disability etc.) and the possible negative social outcomes (e.g., time off of work, change in social relationships, affect on family members etc.).

The combination of *Perceived Severity* and the *Perceived Susceptibility* is known as the *Perceived Threat*, the level of threat that an individual feels relative to a specific illness.

***3.8.1.3 Perceived Benefits***. Once the *Perceived Threat* has been taken into account by the individual, they must consider what medical initiatives can be taken to avoid contracting the

disease. An individual is more likely to choose a specific intervention if they feel that that course of treatment will be beneficial. *Perceived Benefit* is a measure of the belief that a specific course of will have the desired outcome of limiting or reducing the severity of an illness.

***3.8.1.4 Perceived Barriers***. Although an individual may believe in a particular course of treatment, the accessibility of that course of treatment may be limited. In the case of the flu vaccine, although an individual may be receptive to receiving the vaccine, access to a family physician or community clinic, may serve as a barrier to getting it.

***3.8.1.5 Cue to Action.*** The *Cues to Action* are internal (e.g., symptoms, discomfort) or external (e.g., media, employer mandate) stimuli used to seek out a specific course of treatment. In the case of the flu shot, an external cue may come from several social sources (e.g., employer, family physician).

***3.8.1.6. Demographic and Sociopsychological Factors***. These are individual characteristics (e.g., age, sex, living arrangement, socioeconomic status etc.) that can modify the influence of the other factors on the decision-making process.

Strecher, McEvoy-DeVellis, Becker & Rosenstock (1986) amended the HBM to include the measure of *Self-Efficacy*, which applies mainly to health behaviours that relate to long-term or ongoing processes, such as maintaining an exercise regime to achieve weight loss. As the flu shot is a short-term, one-time health intervention, the aspect of *Self-Efficacy* does not apply in this situation has been omitted from this study.

The existing research to date has been targeted specifically at in-hospital staff, specifically physicians and nurses. This information is less helpful, however, if we wish to generate a greater understanding of pre-hospital HCWs, namely, paramedics. The HBM was used to in the current study as a guide to help better understand the motivators, barriers, opinions and attitudes that surround the decision to become vaccinated with rural Ontario paramedics.

### 3.8.2 Use of Health Belief Model

The HBM is one of the most widely used models used to study health-related behaviours and can be used as a framework to research both short and long-term health-protective behaviours (Noar & Zimmerman, 2005).

Despite the use of the HBM in many health-related research projects, there appears to be a lack of consensus about how it can be effectively applied. Traditionally, the dimensions of HBM have been depicted as a series of blocks or boxes with lines representing interactions between the dimensions. Figure 1 depicts one representation of the HBM as posited by Glanz, Rimer & Lewis (2002). Although this layout is one of the more widely used visual representations of the HBM, there are many more visual arrangements that are commonly used among researchers.

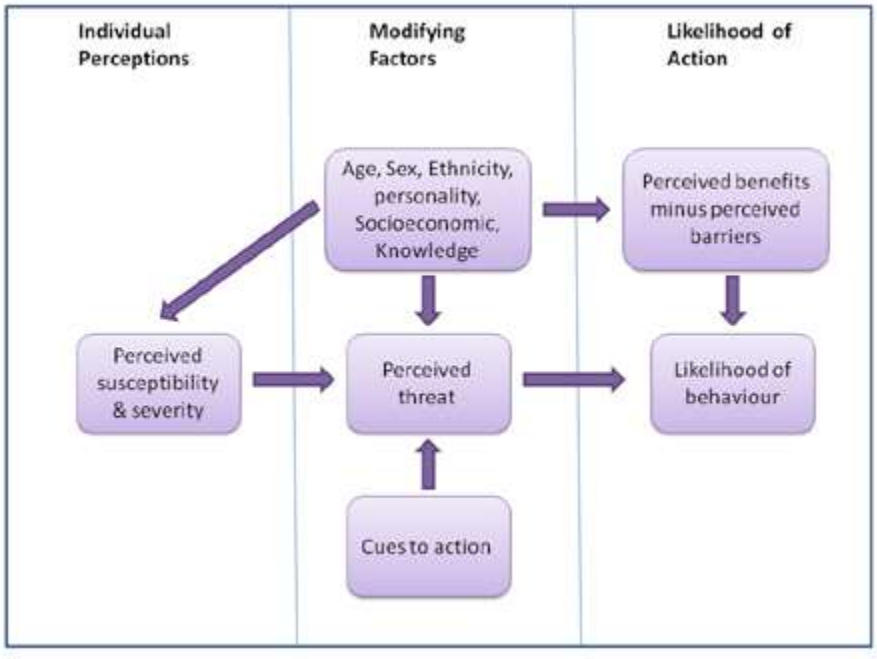


**Figure 1: The Health Belief Model as represented by Glanz et al. (2002)**

Although the dimensions of the HBM are identical in each research project, little information exists regarding the way the HBM dimensions interact, which variables are the most important or which dimensions are the most influential with respect to decision-making (Weinstein, 1993).

Noar & Zimmerman (2005) suggest that not only should additional research on these interactions should be conducted but that if a researcher feels that an existing theory is incomplete or ill-fitting, it should be extended or, if necessary, recreated altogether.

The purpose of this study was to not only use the HBM as a framework to better understand the decision-making process regarding flu vaccination among paramedics, but also to determine which, if any, dimensions appear to be more influential in increasing the likelihood of flu vaccine uptake.

# 4.0 Research Plan

## 4.1 Study Objective

The key objectives of this study were to determine influenza vaccination rates among rural Ontario paramedics, and to determine what, if any, differences exist between rural paramedics who are vaccinated versus whose who are not vaccinated. In addition, to determine which factors are included in the decision-making process of whether or not to become vaccinated.

## 4.2 Hypothesis

The MOHLTC (2010) suggested that a major limitation of rural health care services is the absence of a "unified delivery model" among them. In essence, the variation in the individual health care models employed by different rural communities results in imbalances in the consistency of care in these areas. HCWs cite (a) inconvenience and, (b) insufficient time as major reasons for refusing the flu vaccine and notably these have been cited as chief contributors to low influenza vaccination rates seen in these communities (Mah et al., 2005; Moore, 2009; Rhudy et al., 2010). According to John & Cheney (2008), however, increased convenience only serves to assist those who are already willing to undergo the health behaviour. Although convenience will be involved in the decision of whether or not to become vaccinated, it is expected that the importance of that role will be limited.

According to Vlahov, Bond, Jones and Ompad (2012) having convenient access to medical care and understanding the importance of receiving the flu vaccine are vital in increasing influenza vaccination rates in medically underserved communities. Rural paramedics may have similar patterns with respect to access to flu vaccine and it is expected that their locations of vaccination would include an increased use of community flu clinics or vaccination stations at their place of employment as opposed to with a family physician.

Vaccination to prevent infection is a type of health behaviour. As one decides whether or not to undertake a specific health behaviour, both external and internal factors are taken into account and evaluated. In accordance to Rosenstock (1974) and the *Health Belief Model*, it is expected that by these factors can be used to account for differences in the decision-making process between individuals who choose to become vaccinated and those who do not

### 4.3 Study Hypotheses

The following null hypotheses were tested:

1. There is no difference between the rates of seasonal influenza vaccinations among rural paramedics and other healthcare workers found in the existing literature.
2. There is no difference between the rates of seasonal influenza vaccinations among rural paramedics and that of urban paramedics.
3. There are no significant differences in vaccination status with respect to the characteristics described above (e.g., age, gender, type of paramedic etc.). Each will be tested individually with Spearman's rho (continuous variables) and chi-square (discrete variables).
4. The *Health Belief Model* will not be able to account for differences in the decision-making process between individuals who have chosen to receive the flu shot from those who decline the flu shot.
5. The dimensions of the *Health Belief Model* will not differ in their influence on the outcome, positive vaccination status.

### 4.4 Study Rationale

Vaccination rates among HCWs are historically low both in the United States and Canada. As vaccination has proven to be the most effective way to protect against the contracting influenza, there seems to be a general disconnect. On average, less than 40% of HCW are

vaccinated within a flu season (Bishburg et al., 2008). This poses a direct threat to the HCWs themselves and to the communities they serve.

Of the 221 studies that have evaluated influenza vaccination rates among HCWs, 218 of those studies have been confined to hospital or private-practice personnel (e.g., physicians, nurses). In fact, only three studies to date have included paramedics in studies observing influenza vaccination rates (Hubble et al., 2011; MacPhee et al., [in preparation]; Rueckmann et al., 2009).

Out of these three studies, only one study looked directly at the differences between influenza vaccination rates among the each of the three community types. In this study, it was found that there was a lower rate of influenza vaccination among rural paramedics than in the other two types of paramedic services (Hubble et al., 2011). Due to a low number of rural paramedics included in this study, however, it is difficult to determine if this reduced vaccination rate was due to an inherent difference between rural and urban paramedics or due to a small respondent sample.

Although rural paramedics have very important reasons for getting the flu shot, there is very little information as to the rates of vaccination among them as few studies have been conducted on this topic to date.

This study consisted of a cross-sectional study designed to determine the rates of flu vaccination, as well as to identify the attitudes and perceptions about the vaccine, among rural paramedics. A self-report questionnaire was distributed to selected rural EMS centres in Ontario with the intent of identifying potential trends in vaccination rates, vaccination history and attitudes and opinions regarding influenza vaccination among a sample of rural Ontario paramedics.

### 4.5 Study Implications

There are several potential implications of this research. First, this research will aid in defining the currently ambiguous rate of influenza vaccination among rural paramedics.

Second, this study will help determine which factors affect influenza vaccination status among rural paramedics. By identifying any barriers and challenges (perceived or real) to vaccination, it is possible to look toward the creation of useful interventions to increase the low rates among paramedics.

Third, this research could assist in the development of new, and the revision of, existing influenza pandemic protocols. By capturing rural EMS population, it will help EMS service providers to ensure the adequate distribution of vaccinations and PPE to not only high demand areas but areas that may express a specific need for such services.

Finally and most importantly, this research will help to gather information about rural EMS services that has not previously been captured by any other study.

# 5.0 Method

## 5.1 Procedure

**5.1.1 Initial Recruitment**. Following initial email contact through the management team of each EMS service, each paramedic employed within each rural EMS service received a participant package by means of their inter-departmental mail service. The participant package included: a letter of information (Appendix C), the questionnaire (Appendix D) and a self-addressed stamped return envelope. The participant package also included a Recruitment Advertisement (Appendix E) and a ballot and envelope for the prize draw (Appendix F). Paramedics were asked to complete their questionnaires independently and return them directly to the principal investigator at the university via the self-addressed, stamped envelope. The Recruitment Advertisement, the information letter and the questionnaire clearly stated that participation in the study was voluntary and anonymous.

The EMS management teams within each service were responsible for receipt and distribution of the participant packages throughout their respective EMS service.

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**5.1.2 Improving Response Rates**. Traditionally, achieving high levels of responses is relatively difficult when using mailed self-report questionnaires (Bird, 2009). In order to improve response rates, a modified version of the Tailored Design Method (TDM) originally specified by Dillman (1978) was used.

Participants of the study received an email invitation (Appendix G) via their EMS Chief on the same day that the participant package arrived in the mail service. Two reminder emails (Appendix H) were sent to the EMS Chiefs and Directors and distributed to each paramedic in the EMS service: one 15 days prior to the end of the study period and one on the last day of the original study period to announce that the due date would be extended.

These emails also thanked them for their participation and directed them to contact the principal investigator at the university if they had further inquiries or would like to receive a copy of the results following completion of the study. This same correspondence also served as a request for those who had yet to complete the questionnaire to do so and to return the completed consent form and questionnaire to the university following the return address information on the self-addressed envelope.

Traditionally with the TDM, non-respondents are contacted directly in order to remind them to participate. Given that the participants of the study were to remain anonymous, direct contact with the study participants was not possible.

This study used a paper-based questionnaire. Rural areas often face challenges with their communication infrastructure that may not be seen in urban areas. In many of these communities, internet service or strength can be sporadic and unreliable. This could serve as a deterrent to completing an online questionnaire. In addition, through the use of a paper-based questionnaire, participants were able to review required information, such as old calendars and memoranda when responding to questions about vaccination status, times, locations and dates. This served to limit recall bias and allowed for greater response accuracy.

**5.1.3 Study Population.** The study included currently employed paramedics within five rural Ontario EMS services.

It was important that these services were typical of the size of many of the rural Ontario EMS services. By matching the criteria outlined by the MOHLTC (2010) to define rural EMS services and combining both Random and Purposive Sampling Techniques, an accurate representation of the Ontario rural EMS population could be better approximated.

Purposive sampling techniques were used to select all EMS services (N=14) that satisfied the criteria as rural Ontario EMS services outlined by the MOHLTC (2010). The final five services included in this study were randomly selected from the list of all rural Ontario EMS

services (using the Simple Random Sampling procedure in SAS®). The services selected to be included in this study were Bruce County EMS (n=100), Haldimand County EMS (n=60), Haliburton EMS (n=38), Perth County Ambulance Service (n=90) and County of Renfrew Paramedic Services (n=70). This represented a total of 358 potential participants.

**5.1.4. Ensuring Sampling Accuracy.** Participant packages were created based on the number of paramedics employed within each service. This number was provided by the EMS Chiefs and Directors when they confirmed participation in the study to ensure accuracy.

Rural Ontario EMS services will often employ paramedics who work at more than one service. Therefore, it is not possible to know if paramedic numbers actually represent distinct individuals or hold repeat members.

When responses were evaluated, it was important to ensure that questionnaires were not completed by the same individual in another service. This was accomplished by analysis of the birth date listed on the questionnaire form. If duplicate birthdates were found, the handwriting throughout the questionnaire was evaluated to determine if similarities existed.

Although none were found in the current study, if any duplicates were found, they would have been first evaluated to determine if reliability across questionnaires was achieved. If so, one of the questionnaires would have been selected at random and the other(s) omitted from the analyses. If there existed a mismatch among responses, the questionnaire would have been examined to determine why differences existed in order to avoid potential problems during the analyses. In this case, all copies of the questionnaire from that individual would have been omitted from the analysis.

## 5.3 Materials

**5.3.1 Self-Administered Questionnaire.** The self-administered questionnaire tool (Appendix D) used in the study was a modified version of the assessment tool originally piloted by MacPhee et al. (2011). A 12-page questionnaire was distributed that requested the following information: (1) demographic characteristics, level of paramedic certification, employment status, years of employment, EMS service location; (2) vaccination status from 2009 to 2013, location of vaccination, method of vaccination; (3) motivating factors for both accepting and rejecting vaccination in the previous flu seasons (2010-2013) along with recent previous pandemic flu seasons (including the H1N1 influenza A outbreak of 2009-2010); (4) knowledge and attitudes regarding the flu vaccine, (5) severity of contact with patients or fellow employees with flu-like symptoms, (6) incidence of self-reported flu –like illness including days missed from work as a result (7) vaccination status/plans for the flu season 2012-2013 at the time of the questionnaire. Following this, two sections were added, which allowed participants to provide comments regarding (a) any additional opinions or experiences with influenza, the flu shot, PPE or the transport of patients with influenza; and (b), comments regarding their experience with the questionnaire, (e.g., difficult to answer questions, confusing wording etc.).

**5.3.2 Ethics Review and Approval.** All items included within the study were reviewed and approved by the University Research Ethics Board at Wilfrid Laurier University.

## 5.4 Data Entry and Verification

Upon receipt of the completed questionnaires, each questionnaire was labelled with a unique 7-digit identifier. Data were coded into MS Excel® (Microsoft, 2012) as found in Appendix I (Independent Variables Used in the Analysis of EMS Data). Data were entered through the use of an entry form specifically designed to record the questionnaire responses. Each field on the entry form was restricted to allow only accepted values. For example, a

question with dichotomous response (i.e., no, yes) was coded to only accept values ranging from 0 to 1 as outlined in Appendix I.

In order to further promote the entry of reliable data into the database, at least 50% of the data were randomly selected and verified by the principal investigator. After this, data cleaning procedures were employed to ensure data were reliable and accurate before analysis began.

Electronic data were stored onto an encrypted hard drive in Dr. MacPhee's research office on a password protected computer. A copy of the electronic data was stored onto an encrypted flash drive in Dr. MacPhee's research office. All electronic files will be kept for a period of five years, after which time they will be destroyed. Hard copy data (returned, completed questionnaires) will be stored in a locked filing cabinet in Dr. MacPhee's research office. All paper based files will be kept for a period of two years, at which point they will be shredded using the confidential shredding company employed by Wilfrid Laurier University.

### 5.5 Analyses

**5.5.1 Sample Size.** There are currently 7,200 paramedics employed in Ontario (MOHLTC, 2012). This study is aimed at describing specific characteristics of a subset of this group: paramedics employed with rural services.

Hubble et al. (2011) placed the rate of vaccination among paramedics at 47.9% and reported several factors related to positive vaccination status, including employer-offered vaccinations within the service (odds ratio [OR] = 3.3, $p < 0.01$), employer-recommended vaccinations (OR= 3.6, $p < 0.01$), a belief in vaccine effectiveness (OR = 9.5, $p < 0.01$) and employer-offered influenza training (OR = 1.5, $p < 0.01$). As there exists a large range of ORs with respect to flu vaccine uptake factors as shown above (1.5-9.5), a conservative OR of 3.3 was used. With a proportion of positive cases set at 0.48, and an expected power of 0.8, this places the required sample size at 114 participants (SAS, 2012). As we received 99 responses,

this places the actual power at 0.68 as determined by the SAS power calculation tool (SAS, 2014, version 9.2).

The questionnaire tool generated several types of data: rational, ordinal and categorical. The data were analyzed at the univariate (one variable independently), bivariate (two variables simultaneously) and multivariate (multiple variables) levels.

There were three types of analyses performed in this study.

***5.5.2.1 Univariate Analyses.*** Descriptive information about the sample participants was collected (i.e., age, gender, type of paramedic) along with rates of rural paramedic vaccination, knowledge of influenza and personal protective equipment. The mean, mode, median, range, standard deviation and frequency distribution (for discrete variables), of each dataset was calculated. Along with generating meaningful information about each dataset, these univariate analyses allowed for a preliminary examination of the data for trends or outliers which could have caused potential problems during later tests.

***5.5.2.2 Bivariate Analyses.*** These were used to determine the relationships between positive vaccination status and demographic or employment status. Spearman's rho analyses were performed (when one variable was continuous) and chi-square analyses were performed (where both variables were discrete). Statistical significance was reached if the p-value was less than 0.05. Univariate logistic regression was also employed to determine the relationships between variables. The limited sample size increased the potential for a Type II error. Therefore, significance was assumed only if the Odds Ratio (OR) differed from 1 by more than 20% to highlight any potential clinical significance, and if the p-value was less than 0.05 and the confidence interval value (95%) did not cross 1 to highlight any potential statistical significance.

***5.5.2.3 Evaluating the HBM.*** Given that there were several independent variables to consider (e.g., age, gender, type of paramedic etc.), it was useful to determine if there were differences in vaccination status associated with any specific combination of covariates and

control variables. Due to the small sample size, multivariate logistic regression could not be effectively used to examine possible predictors of paramedic influenza vaccination status. In order to utilize the data effectively, bivariate analyses (i.e., t-tests, chi-square) were performed in order to determine if there were any significant differences in the *Perceived Severity, Barriers, Benefits* and *Susceptibility* between rural paramedics who were vaccinated and those who chose to remain unvaccinated. Responses from Section A (Demographic Characteristics) of the questionnaire were used to determine the relative strength of the *Demographic and Sociopsychological Components* of the HBM. The Breslow-Day Test was performed to determine if any confounding variables existed within any of the Demographic Characteristics included in the model. Any potentially confounding characteristics were evaluated to determine if any significant correlations existed between each characteristic and any highly statistically significant dimensions of the HBM.

Statements pertaining to the five core dimensions of the HBM, *Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers* and *Calls to Action* were generated and evaluated using responses from the questionnaire particularly Sections C (Vaccination History), D (Experience with Influenza), and E (Knowledge of Influenza).

The final section, Section F (Opinions Regarding the Flu Shot) consisted of a set of Likert scale questions to which the participant could respond to statements related to their opinions regarding the flu shot with one of the following: Strongly Agree, Agree, Neither Agree nor Disagree, Disagree or Strongly Disagree. Responses that were under either Agree or Strongly Disagree were coded as 1; responses that were under Strongly Disagree or Disagree were coded as 0. Neutral responses were omitted from the final analyses. The responses in these sections were analysed using chi-square analysis to determine if any variables were eligible for entry into the graphical model.

Due to the small sample size, any variables that were traditionally included in the HBM but did not achieve statistical significance with the current study were subjected to further scrutiny. In this case, variables whose p-value approached 0.05, were included in the model, however, their relationship within the model was re-evaluated.

To achieve a useful measure of internal validity and to assess the validity of the responses throughout the questionnaire, responses to questions included in the model creation were continually analysed. Responses that were mismatched within an individual questionnaire (contradictory to one another) were excluded from the final analysis.

**5.5.3 Independent and Dependent Variables.** The key objective of this study was to determine which independent variables (e.g., age, type of paramedic, gender, previous exposure etc.) were most likely to affect the dependent variable (vaccination status) and in what way (refusal vs. acceptance). Data analysis was computer-assisted and was performed by SAS® (2012, version 9.2).

# 6.0 Results

## 6.1 Demographic & Employment Characteristics

Out of 540 questionnaires sent by email to the EMS services, 102 unique response envelopes were received back at the university. Two envelopes were returned empty and one questionnaire was returned incomplete. The sample size was reduced to 99 and only included the completed questionnaires.

The sample population consisted of mostly males (65.3%), and a majority of married individuals (81.8%) with a mean age of (40.8, SD=10.82) (Table 1). The majority (80.6%) of the respondents Primary Care Paramedics (PCPs) and were graduates of a college or university certification program (73.7%). Almost one-half had been employed as a paramedic for more than 15 years (51.0%), and the vast majority (85.7%) worked in variable rotating shifts. (Table 2).

**Table 1. Demographic Characteristics of Rural Ontario paramedics**

| Characteristics | N=99 |
|---|---|
| Age (n=98, SD=10.82) | |
| Mean | 40.8 |
| Missing | 1 |
| Gender (n=98) | |
| Male | 64 |
| Female | 34 |
| Missing | 1 |
| Living Arrangement (n=99) | |
| Married/Lives with Someone | 81 |
| Lives Alone | 18 |
| Missing | 0 |

**Table 2. Employment Characteristics of Rural Ontario paramedics**

| Characteristics | N=99 |
|---|---|
| Level of Education (n=99) | |
| > Undergrad | 73 |
| Graduate or higher | 26 |
| Missing | 0 |
| Paramedic Certification Level (n=98) | |
| PCP | 79 |
| ACP/CCP | 19 |
| Missing | 1 |
| Employed with more than one service (n=98) | |
| Yes | 19 |
| No | 79 |
| Missing | 1 |
| Time employed (n=96) | |
| Less than 5 years | 21 |
| 5-14 years | 26 |
| 15-20 years | 25 |
| 20+ years | 24 |
| Missing | 3 |
| Work Schedule (n=98) | |
| Regular Shifts (day, evening) | 14 |
| Night Shifts and Rotating Shifts | 84 |
| Missing | 1 |

### 6.2 Rates of Vaccination

Nearly ninety percent (90.9%) of participants reported receiving the flu shot at least once in the four-year period. During the H1N1 season of 2009-2010, many individuals reported receiving both the H1N1 and seasonal flu shots. However, the 2010-2011 flu season showed the highest rate of seasonal flu vaccination (Table 3).

**Table 3. Frequency of Flu Vaccinations by Rural Ontario Paramedics by year**

| Year | Vaccinated N=99* |
|---|---|
| 2009-10 H1N1 | 77 (79.4%) |
| 2009-10 Seasonal | 67 (67.6%) |
| 2010-11 Seasonal | 77 (77.7%) |
| 2011-12 Seasonal | 70 (70.7%) |
| 2012-13 Seasonal | 74 (75.5%) |

* There were 99 respondents, but not all respondents replied to every item in the period. The proportions shown are relative to the number of respondents to each item.

According to the sample, individuals were significantly more likely to be vaccinated if they lived with another person at home (OR=4.80, 95% CI=1.14-20.74). Additional characteristics that were not deemed statistically significant, but showed trends toward positive vaccination status included male gender (OR=2.50, 95% CI=0.10-1.66) and individuals who had been employed with the service for fewer than 5 years (OR=5.00, 95% CI=0.07-10.21). These individuals tended toward higher rates of vaccination over those employed 5-14 years. Additionally, the vaccination rate among the most senior veterans in each service (20+ years of service) trends toward higher vaccination rates than those in the 5-14 year range (OR=5.50, 95% CI=0.02-6.06).

**Table 4. Unadjusted odds ratios relative to positive vaccination status***

| | OR | CI (95%) | p-value | C statistic | SE |
|---|---|---|---|---|---|
| **Age n=98** | | | | | |
| | 0.981 | 0.91-1.06 | 0.6426 | 0.544 | 0.0408 |
| | | | | | |
| **Gender n= 98** | | | | | |
| Male | 2.500 | 0.62-10.05 | 0.1958 | 0.611 | 0.7096 |
| Female | REF | | | | |
| | | | | | |
| **Living Arrangement n=99** | | | | | |
| Lives w someone | 4.800** | 1.13-20.46** | 0.0340** | 0.651 | 0.7623 |
| Lives Alone | REF | | | | |
| | | | | | |
| **Level of Education n=99** | | | | | |
| > Undergrad | 2.400 | 0.59-9.78 | 0.2218 | 0.597 | 0.7164 |
| Graduate and up | REF | | | | |
| | | | | | |
| **Paramedic Certification Level n=98** | | | | | |
| PCP | 2.300 | 0.52-10.25 | 0.2746 | 0.577 | 0.7623 |
| ACP/CCP | REF | | | | |
| | | | | | |
| **Employed with more than one service n=98** | | | | | |
| Yes | 1.126 | 0.21-5.92 | 0.8885 | 0.510 | 0.8465 |
| No | REF | | | | |
| | | | | | |
| **Time employed n=96** | | | | | |
| Less than 5 years | 5.000 | 0.54-46.72 | 0.1581 | 0.686 | 1.4438 |
| 5-14years vs. | 2.875 | 0.50-16.48 | 0.2358 | | 1.4502 |
| 15-19 years | REF | | | | |
| 20+ years | 5.500 | 0.59-51.19 | 0.1342 | | 1.4842 |
| | | | | | |
| **Work Schedule n=98** | | | | | |
| Regular Shifts (day, evening) | 1.896 | 0.35-10.322 | 0.4593 | 0.546 | 0.8646 |
| Night Shifts & Rotating Shifts | REF | | | | |
| | | | | | |

*H1N1 vaccinations were omitted; **Statistically significant;

### 6.1.1. Location of Flu Vaccination.

During the H1N1 flu season, most paramedics reported being vaccinated at their place of employment (43%), however, for the seasonal flu shot, paramedics most often reported their family physician, community clinic, or public health office (Figures 1-5).

**Figure 2: Location of Rural Paramedic H1N1 Vaccination during the 2009-2010 Flu Season, by percent (%)**

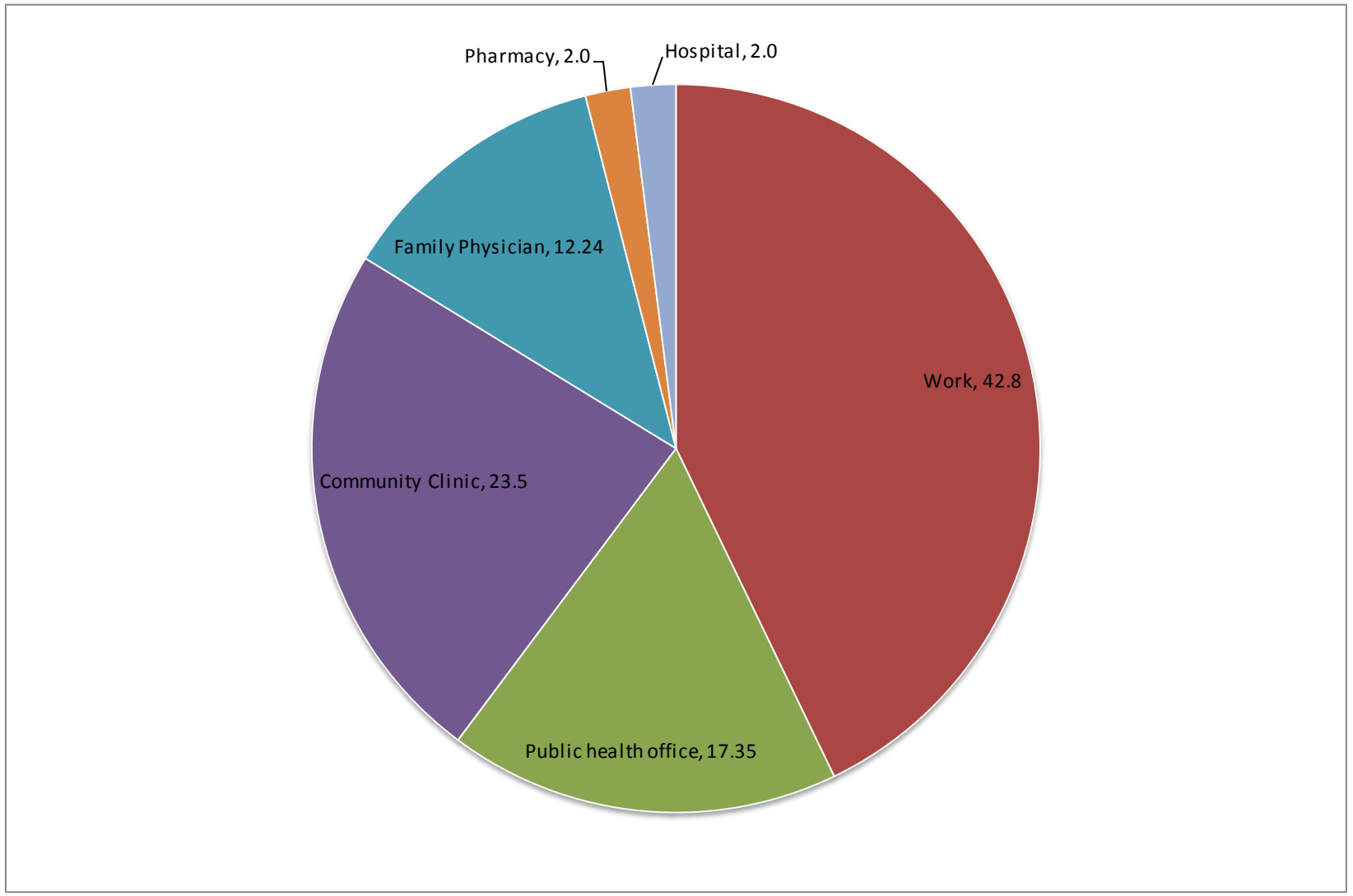


**Figure 3: Location of Rural Paramedic Seasonal Flu Vaccination during 2009-2010 Flu Season, by percent (%)**

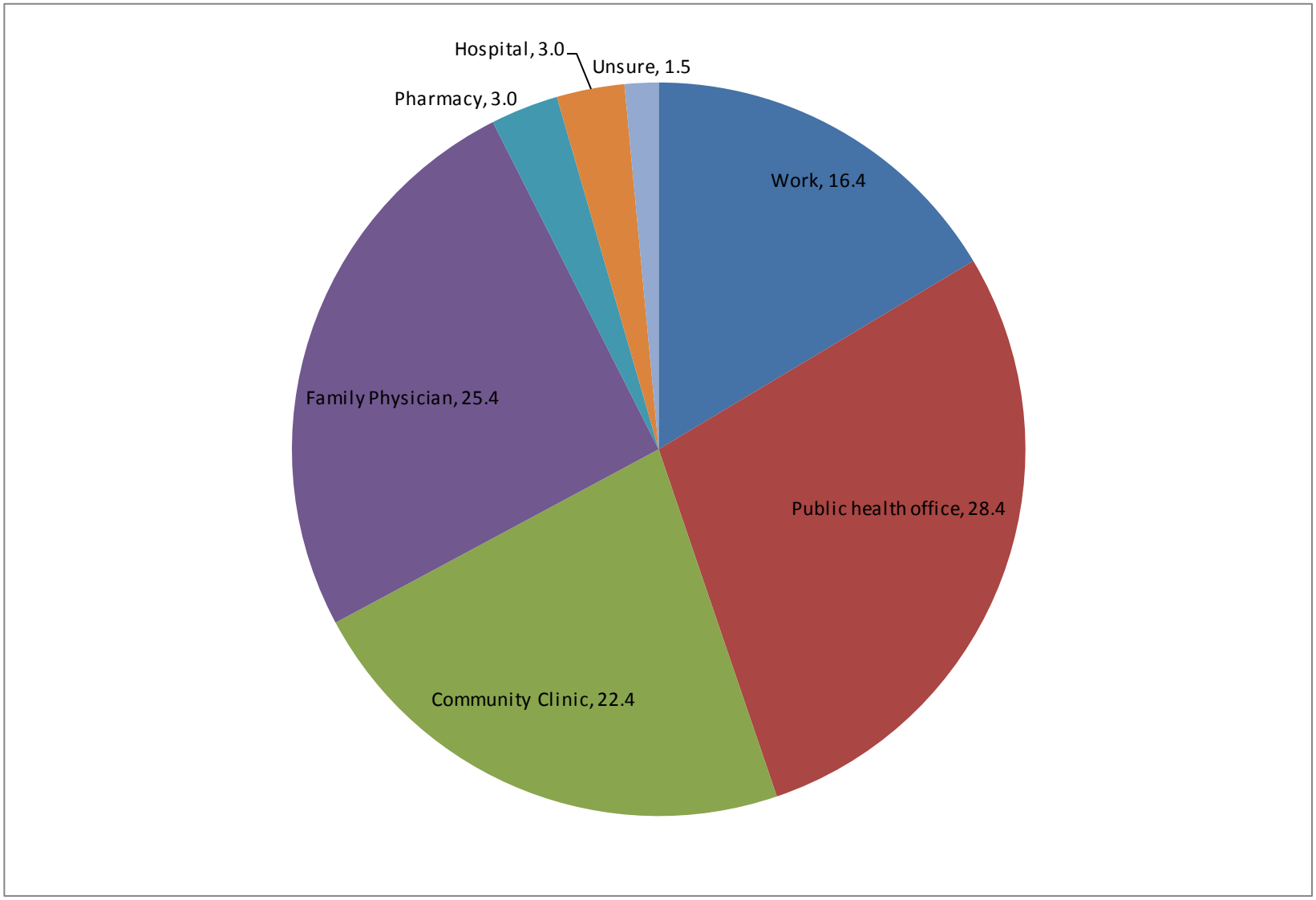


**Figure 4: Location of Rural Paramedic Seasonal Flu Vaccination during the 2010-2011 Flu Season, by percent (%)**

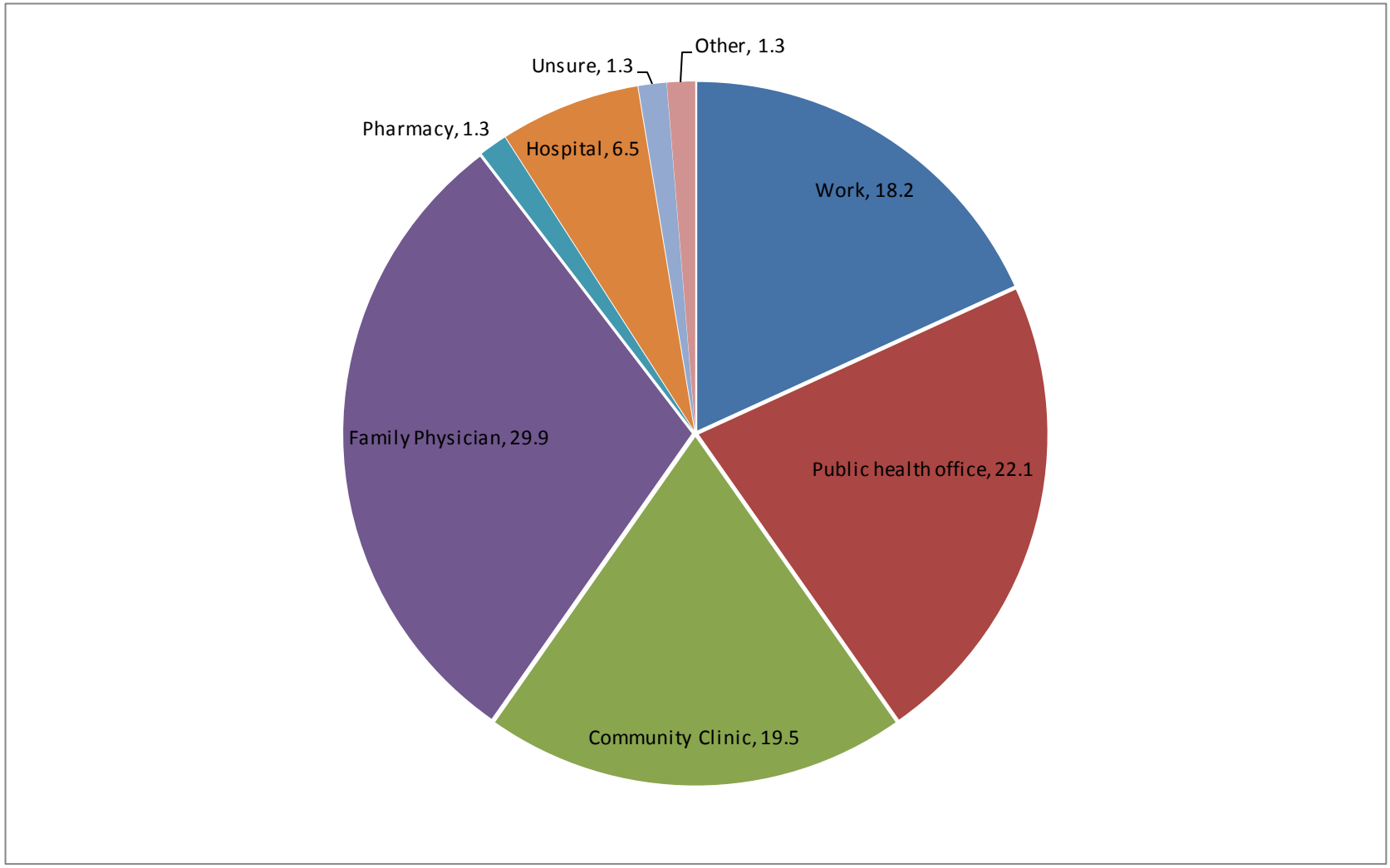


**Figure 5: Location of Rural Paramedic Seasonal Flu Vaccination during the 2011-2012 Flu Season, by percent (%)**

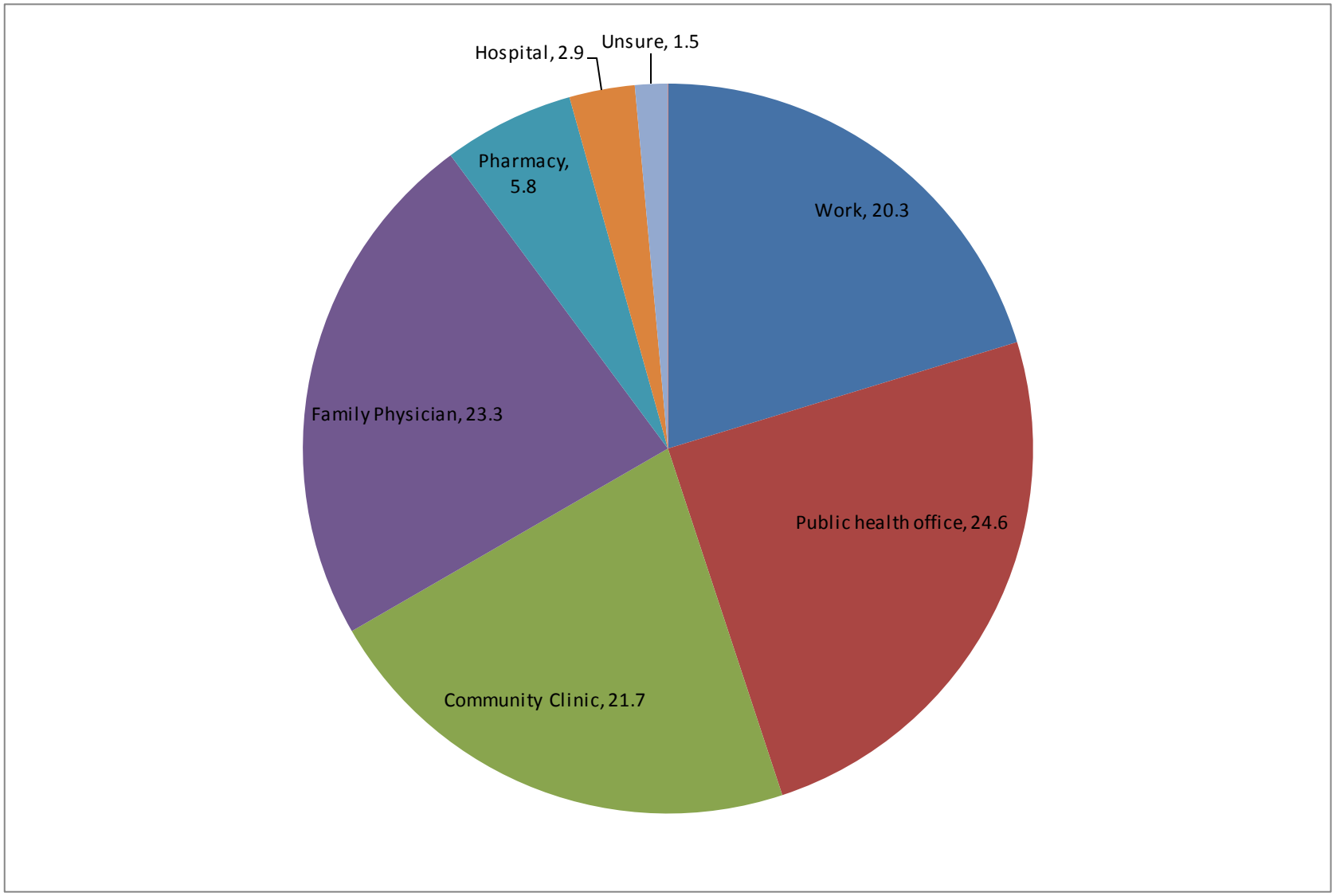
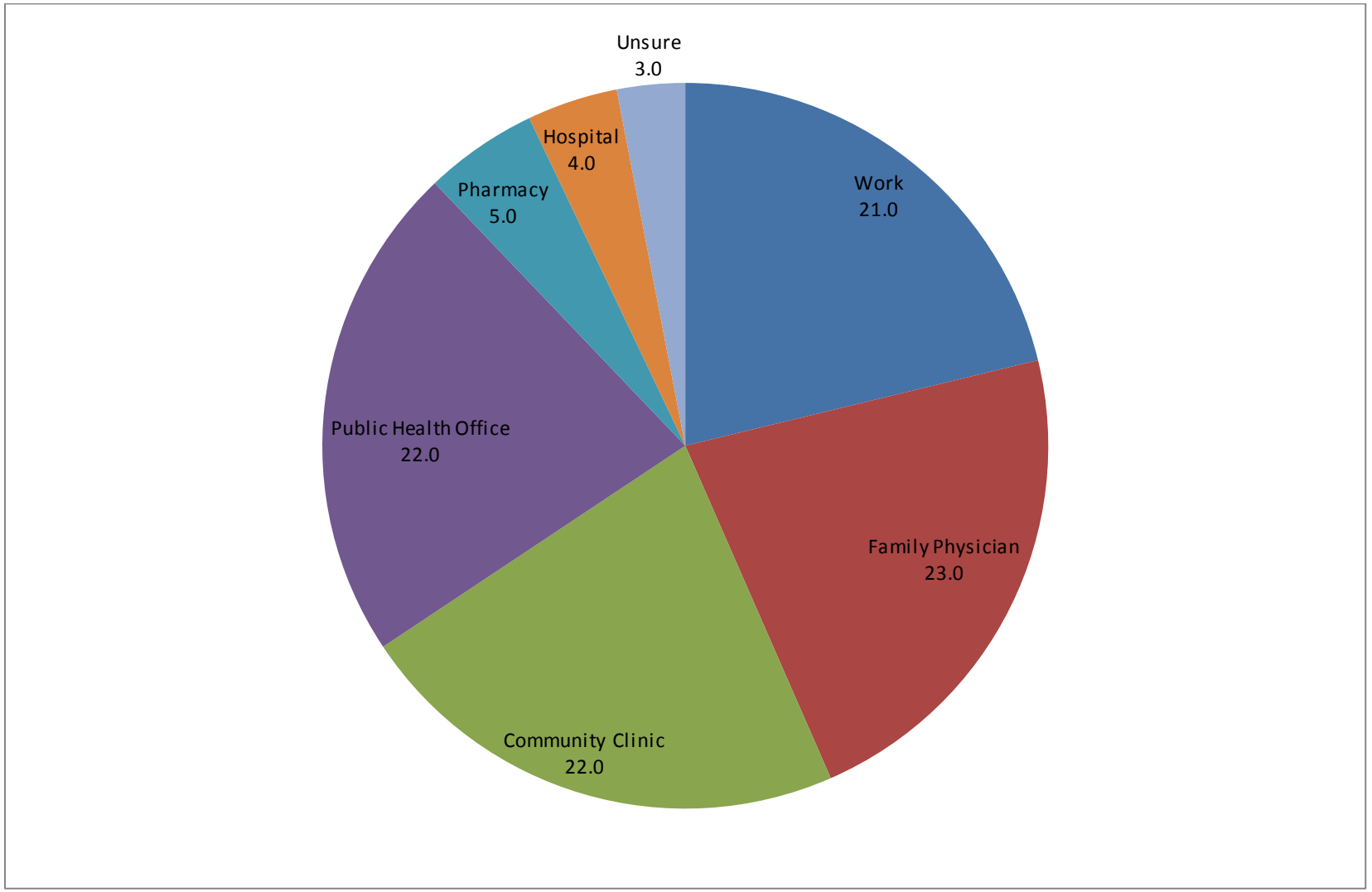


**Figure 6: Location of Rural Paramedic Seasonal Flu Vaccination during the 2012-2013 Flu Season, by percent (%)**



### 6.1.2 Reasons for Accepting the Flu Shot.

Across the four year period, on average, most individuals cited a requirement or request by their employer or school as a reason to receive the flu shot (78.2%). Table 5 also outlines additional motivating factors for accepting the flu shot which included fear of transmission to their family (52.4%), a fear of getting influenza (48.6%), and a fear of transmission to patients (41.3%) respectively.

### 6.1.3 Reasons for Declining the Flu Shot.

The most common reasons for declining the flu shot included skepticism about vaccine effectiveness (63.7%), followed by a concern about side effects (36.8%), skepticism about the danger of the flu (24.8%), and a previous experience of flu sickness or symptoms following the flu shot (20.7%). Additional reasons for refusing the flu shot are listed in Table 6. No one in the current sample reported an egg allergy, previous allergic reaction or fear of needles.

**Table 5. Frequency Table of Reasons Cited for Accepting Flu Vaccination among rural Ontario paramedics, by year**

| Reason, by class | H1N1 Vaccine n=77* | Seasonal Vaccine n=67** | Seasonal Vaccine n=77 | Seasonal Vaccine n=70 | Seasonal Vaccine n=74 | Average Rate of Vaccination Acceptance, by reason % |
|---|---|---|---|---|---|---|
| By year | (2009-10) | (2009-10) | (2010-11) | (2011-12) | (2012-13) | All years |
| Requested by employer/school | 74.0 (57) | 80.6 (54) | 76.6 (59) | 81.2 (56) | 78.4 (58) | 78.2 |
| Fear of transmission to family | 54.6 (42) | 46.3 (31) | 50.6 (39) | 56.5 (39) | 54.1 (40) | 52.4 |
| Fear of getting influenza | 54.6 (42) | 47.8 (32) | 42.9 (33) | 46.4 (32) | 52.7 (39) | 48.6 |
| Fear of transmission to patients | 35.1 (27) | 40.3 (27) | 42.9 (33) | 49.3 (34) | 39.2 (29) | 41.3 |
| Required for all HCWs | 38.9 (30) | 35.8 (24) | 39.0 (30) | 40.6 (28) | 36.5 (27) | 38.2 |
| Previous flu exposure | 18.2 (14) | 17.9 (12) | 18.2 (14) | 18.8 (13) | 17.6 (13) | 18.1 |
| Recommended by physician | 13.0 (10) | 10.5 (7) | 4.3 (11) | 14.5 (10) | 18.9 (14) | 12.2 |
| Other | 1.3 (1) | 0 (0) | 0 (0) | 0 (0) | 2.7 (2) | 0.8 |

*Three paramedics could not remember whether or not they had received the H1N1 flu shot in this flu season.
*Ten paramedics could not remember whether or not they had received the seasonal flu shot in this flu season.

**Table 6. Frequency Table of Reasons Cited for Refusing Flu Vaccination among rural Ontario paramedic, by year**

| Reason, by class | H1N1 Vaccine n=19* | Seasonal Vaccine n=22** | Seasonal Vaccine n=22 | Seasonal Vaccine n=29 | Seasonal Vaccine n=25 | Average Rate of Vaccination Refusal, by reason % |
|---|---|---|---|---|---|---|
| By year | 2009-10 | 2009-10 | 2010-11 | 2011-12 | 2012-2013 | All years |
| Skeptical of effectiveness | 52.6 (10) | 68.2 (15) | 72.7 (16) | 69.0 (20) | 56.0 (14) | 63.7 |
| Concerned about side effects | 42.1 (8) | 36.4 (8) | 31.8 (7) | 37.9 (11) | 36.0 (9) | 36.8 |
| Skeptical of danger of flu | 36.8 (7) | 27.3 (6) | 22.7 (5) | 17.2 (5) | 20.0 (5) | 24.8 |
| Sick with flu following vaccination | 21.1 (4) | 18.2 (4) | 22.7 (5) | 13.3 (4) | 28.0 (7) | 20.7 |
| No previous flu experience despite high-risk | 10.5 (2) | 9.1 (2) | 13.6 (3) | 17.2 (5) | 20.0 (5) | 14.1 |
| Pregnancy/Breastfeeding | 5.6 (1) | 4.6 (1) | 9.1 (2) | 6.9 (2) | 4.0 (1) | 6.0 |
| Didn't want/Forgot | 5.6 (1) | 4.6 (1) | 4.6 (1) | 3.5 (1) | 4.0 (1) | 4.4 |
| Inconvenient | 5.6 (1) | 0 | 0 | 6.9 (2) | 4.0 (1) | 3.3 |
| Believes flu shot causes the flu | 5.6 (1) | 0 | 0 | 0 | 8.0 (2) | 2.7 |
| Only got H1N1 | N/A | 4.6 (1) | 0 | 0 | 0 | 1.1 |
| Other | 5.6 (1) | 0 | 0 | 0 | 0 | 1.1 |

No individuals were found to have an egg allergy, previous allergic reaction or fear of needles.

**6.1.4. Knowledge of the Flu and Flu Symptoms.** Sixty-seven percent of paramedics correctly identified the seasonal flu symptoms and 54.1% could identify the H1N1 flu symptoms. When given a multiple choice question, most paramedics (57.7%) could recognize the known methods of flu transmission. Only 21.8% correctly identified the timeline of transmission and 48.9% could correctly describe for how long the flu vaccine offers protection. Twenty-one percent of paramedics could properly describe the PPE donning protocol as mandated by the CDC (CDC, 2012). (Table 7).

**Table 7: Paramedic Knowledge of the Flu, Flu Symptoms, Flu Timeline and PPE, by percent**

| Paramedic Responses regarding Influenza N=99 | Percent (%) |
|---|---|
| Correctly identified seasonal flu symptoms, n=96 | 67.7 |
| Correctly identified H1N1 flu symptoms, n=96 | 54.1 |
| Correctly identified known methods of flu transmission, n=97 | 57.7 |
| Correctly identified flu transmission timeline, n=96 | 21.8 |
| Correctly outlined flu vaccine protection timeline, n=96 | 48.9 |
| Correctly outlined PPE donning protocol, n=97 | 20.6 |

Table 8 summarizes the data received from Section C (Seasonal Vaccination History), Section D (Experience with Influenza), Section E (Knowledge of Influenza and PPE) and Section F (Opinions Regarding the Flu Shot) to generate a graphical model representing the decision-making process to become vaccinated using the HBM as a guideline. Statements pertaining to the five components of the model were created and analyzed to assess their relative strength. The following variables were perceived to be significant, by dimension: *Perceived Susceptibility* (felt greater exposure than general population), *Perceived Severity* (previous moderate to severe exposure, previous required time off of work), *Perceived Benefit* (belief in vaccine safety, belief in vaccine effectiveness, belief in transmission protection). *Perceived Barriers* (belief that vaccine is associated with adverse effects, belief that vaccine is ineffective), *Cues to Action* (Employer/School encouraged flu shot). Traditionally, *Convenience*, or stated alternatively, *Inconvenience,* is included in the HBM as a subcomponent of the *Perceived Barrier* dimension. Although *Convenience* (belief that flu vaccine is convenient to acquire) did not specifically achieve statistical significance, it was included in the model. The role *Convenience* plays within the HBM, however, was re-evaluated.

**Table 8. Chi-square table of health belief model components as predictors of vaccine uptake**

| **Health Belief Model Component** | Vaccinated (%) n=90 | Unvaccinated (%) n=9 | p-value | Include in Model (y/n) |
|---|---|---|---|---|
| PERCEIVED THREAT | | | | |
| Perceived Susceptibility | | | | |
| Felt greater exposure than general population | 65 (72.2%) | 2 (22.2%) | 0.040 | Y |
| High transport of flu patients | 38 (42.2%) | 3 (33.3%) | 0.324 | N |
| | | | | |
| Perceived Severity | | | | |
| Previous exposure to the flu in past year | 38 (42.2%) | 2 (22.2%) | 0.154 | N |
| Previous moderate to severe | 65 (72.2%) | 2 (22.2%) | 0.040 | Y |
| Previous exposure required time off work | 65 (72.2%) | 2 (22.2%) | 0.040 | Y |
| | | | | |
| PERCEIVED BENEFIT | | | | |
| Belief in vaccine safety | 57 (63.3%) | 0 (0%) | <0.0001 | Y |
| Belief in vaccine effectiveness | 48 (53.3%) | 0 (0%) | <0.0001 | Y |
| Belief in transmission protection | 42 (46.7%) | 0 (0%) | 0.004 | Y |
| HCW requirement | 15 (16.7%) | 2 (22.2%) | 0.638 | N |
| | | | | |
| PERCEIVED BARRIERS | | | | |
| Belief that vaccine associated with adverse effects | 9 (10.0%) | 6 (67%) | <0.0001 | Y |
| Belief that vaccine is ineffective | 17 (18.9%) | 7 (77.8%) | <0.0001 | Y |
| Belief that PPE reduces need for flu shot | 18 (20.0%) | 2 (22.2%) | 0.071 | N |
| Belief that Tamiflu® reduces need for flu shot | 0 (0%) | 0 (0%) | N/A | N |
| | | | | |
| CONVENIENCE | | | | |
| Belief that vaccine convenient to acquire | 42 (46.7%) | 2 (22.2%) | 0.066 | Y |
| | | | | |
| CUES TO ACTION | | | | |
| Professional colleagues encouraged vaccination | 11 (12.2%) | 0 (0%) | 0.365 | N |
| Employer/School encouraged flu shot | 43 (47.7%) | 1 (11.1%) | 0.030 | Y |
| Made decision with strong knowledge about flu/flu shot | 4 (4.4%) | 0 (0%) | 0.710 | N |

**6.1.5. Confounding Variables within Sociodemographic Variables.** Table 9 outlines the Sociodemographic Characteristics included in the final graphical representation and the results of the Breslow-Day Test for Homogeneity of the Odds Ratios. Despite the existence of a strong correlation between age and years of service (0.743), the Breslow-Day Test did not identify any significant confounding effects of either characteristic on vaccination status (Table 9). In fact, no confounding variables were found among the Sociodemographic Characteristics included in the graphical representation. Potential relationships between statistically significant perceived benefit variables and potential confounders were also analyzed. There existed a mild correlation between gender and a belief in vaccine effectiveness (0.274) and a moderate correlation between living arrangement and a belief in vaccine effectiveness (0.525).

**Table 9: Potential Confounding Variables among Sociodemographic Characteristics**

| Potential Confounding Variables | Controlled Variable | Breslow-Day Test | |
|---|---|---|---|
| | | Chi-Square | p-value |
| Age & Vaccination Status | Years of Service | 2.54 | 0.107 |
| Gender & Vaccination Status | Living Arrangement | 1.32 | 0.545 |
| Years of Service & Vaccination Status | Gender | 0.89 | 0.305 |
| Living Arrangement & Vaccination Status | Years of Service | 0.93 | 0.777 |

**Table 10. Relationships between Potential Confounders and Perceived Benefit Variables**

| Perceived Benefit Variable | Potential Confounding Variable | Correlation Coefficient, r |
|---|---|---|
| Belief in Vaccine Safety | Gender | 0.161 |
| | Living Arrangement | 0.114 |
| | YOS* (<5 years) | 0.056 |
| | YOS* (20+ years) | 0.060 |
| | | |
| Belief in Vaccine Effectiveness | Gender | 0.274 |
| | Living Arrangement | 0.525 |
| | YOS* (<5 years) | 0.040 |
| | YOS* (20+ years) | -0.032 |
| | | |
| Belief that Vaccine aids Transmission Prevention | Gender | 0.086 |
| | Living Arrangement | 0.284 |
| | YOS* (<5 years) | 0.071 |
| | YOS* (20+ years) | 0.026 |

*YOS = years of service

# 7.0 Discussion

Previously, very little was known about flu vaccination rates among rural Ontario paramedics. This study was able to ascertain additional information about rural paramedics' flu vaccination habits.

## 7.1 Discussion of Flu Vaccination

**7.1.1 Rate of Flu Vaccination among rural Ontario paramedics**. Overall, the MOHLTC (2012) reported an increase in flu vaccination rates among Canadians during the H1N1 epidemic of 2009-2010. In the current study, although more individual vaccinations were distributed during this time, this increase was due to the fact that many paramedics received *both* the H1N1 and seasonal flu shots (83.7%). Seasonal flu vaccination rates among the study population remained virtually identical when comparing the 2009-2010 flu season to other years (Table 3).

By examining the total rate of flu vaccination within this group, it was found that 90% of paramedics within these services were vaccinated at least once during the flu seasons of 2009-2012. This rate is much higher than the rates of flu vaccination reported by other studies involving paramedics (Hubble et al., 2011; MacPhee et al., in preparation; Rueckmann et al., 2009) which could be a result of some of the protocols within the EMS services.

In the current study, several paramedics reported being encouraged by their employer or paramedic training program as a motivator for their vaccination.

First, it is important to note that nearly 25% of the sample was employed with its service for fewer than five years. According to Niagara College Canada (2015), college-based paramedic training programs often require students to be vaccinated with the flu shot before they can progress through the requirements of the program. In light of this requirement, it is possible that this requirement has served to inflate flu vaccination rates within this group.

Although individuals may be resistant to the idea of vaccination, it appears that this external requirement may result in a shift toward vaccine acceptance.

Seventy-eight percent of paramedics reported a request or requirement to be vaccinated by their employer (Table 5). Several individuals revealed that during a flu epidemic, they would not be scheduled for duty and would not be paid for this time if they remained unvaccinated. Again, this could be a direct contributor to the higher rates of vaccination within this group.

These interventions appear to result in higher flu vaccination rates than what has been previously reported in the literature (Hubble et al., 2011, MacPhee et al., 2011, Rueckmann et al., 2009). Although there are several factors that are traditionally reported as barriers to vaccination (limited resources, time, health care facilities and personnel), these employer or school requirements appear to, at least in part, override these potential barriers.

**7.1.2 Location of Flu Vaccination.** Paramedics reported being vaccinated more often at their place of work than any other location during the H1N1 epidemic, a finding which was not repeated at any other time during the following four flu seasons. According to Simcoe Paramedic Services (2009), and Toronto EMS (2010), EMS stations around Ontario were outfitted with increased PPE and mobile vaccination stations within their services during this time. Despite this increase in convenience, the paramedic flu vaccination rate remained virtually unchanged during this year. The increased convenience appeared only to facilitate vaccination for those who were already willing. Similar to the finding by John & Cheney (2008), increasing the convenience of a vaccine does not necessarily increase vaccination rates among individuals who are resistant to the idea of vaccination, but serves only to assist those who are already considering it.

Singleton, Poel, Lu, Nichol & Iwane (2005) found that within urban communities, most flu vaccinations are distributed by family physicians. In this study, family doctors were chosen to administer the flu shot just as regularly as other community health service providers. Other

notable vaccination locations included public health offices (17-28%) and community clinics (19-25%).

According to the MOHLTC (2010), the rural regions have a difficult time securing and maintaining human health resources. As a result, fewer numbers of rural residents have family physicians when compared to urban communities. In addition, Singleton et al., (2005) highlighted a higher rate of "non-traditional location vaccinations" (i.e., vaccinations at sites other than with the family physician) among individuals living in areas with a lower population density. The results of the current study identified a similar trend.

#### 7.1.3. Knowledge of Flu Transmission Timeline, Methods and Flu Vaccine

Similar to findings with other HCWs, most paramedics could correctly identify the transmission methods and symptoms of influenza (Ofstead et al, 2008), however incorrect answers with respect to transmission timeline, timeline of vaccine protection and PPE donning protocol were common. Although it could be suggested that increased information about the flu could increase vaccine uptake within this group and with other HCWs, Ofstead et al submits that there is a limit to how much vaccination rates could potentially increase with increased flu knowledge. It appears that increased knowledge regarding the flu or the flu vaccine is not necessarily correlated with higher vaccination rates among HCWs.

### 7.2 Using the Health Belief Model (HBM) to reflect to flu vaccination decision-making processes

**7.2.1. Perceived Benefits: Motivating Factors for Receiving Flu Shot.** This study highlighted several motivating factors for vaccination, which included an employer recommendation of vaccination (78.2%), fear of transmission to family (52.4%), fear of getting influenza (48.6%) and fear of transmission to patients (41.3%). This study provides further

evidence to support the results of Christini, Shutt & Byers (2007) and Nichol & Hauge (1997). This concept of Employer-Recommended vaccination will be revisited later in the discussion.

***7.2.1.1 Fear of Transmission to Family, Self or Patients.*** Despite the mandate by the CDC (2009) for all HCWs to receive the flu shot, this is not the main motivator for paramedics to receive the flu shot. Both dePerio, Wiegand & Evans (2011) and John & Cheney (2008) maintained that one of the most effective ways to encourage those resistant to the idea of vaccination is to appeal to their altruism. According to their findings, resistant individuals are better motivated to accept the flu shot when attempting protect loved ones rather than attempting to protect themselves. This altruistic motivation works most effectively within families but is also observed with respect to patients, albeit to a lesser extent.

### 7.2.2 Perceived Barriers: Factors that Deter Flu Vaccination.

***7.2.2.1 Vaccine perceived to be ineffective/carry adverse effects.*** In this sample, the most commonly cited reason not to receive the flu shot was a general skepticism of effectiveness. This theme of ineffectiveness resonates throughout the literature (Carman & Mosca, 2014; dePerio et al., 2011; Hofmann, Ferracin, Marsh, & Dumas, 2006). In addition, the two other most commonly cited reasons for refusing the flu shot were also reflected in this study: a feeling of not being at risk for the flu (6%-58%); and, a fear of adverse effects (10%-45%). It appears that paramedics' reasons for refusing the vaccine mirror those of other HCWs.

***7.2.2.2 Convenience.***, Very few paramedics (5%) cited inconvenience as a reason for declining the flu shot. According to this observation, paramedics feel they have ample time and ability to get the flu shot. In contrast to the finding with hospital nurses by (Moore, 2009), the current study suggests that the apparent 'inconvenience limitation' does not apply to this sample. Additional barriers to vaccine uptake relate to the perceived ineffectiveness of the vaccine and possible side effects. Therefore, it appears that protocols and initiatives that increase the convenience of the vaccine appeal only to those who are already accepting of flu

vaccination. Consequently, in contrast to the findings of Mah et al. (2005) and Rhudy et al., (2010) it is possible that inconvenience may not serve as powerful a potential barrier to flu vaccination among paramedics and HCWs as previously speculated.

### 7.2.3 Demographic & Employment Characteristics/Sociopsychological Factors.

***7.2.3.1 Gender and the Flu Shot.*** Within this sample, male paramedics were more likely to be vaccinated than female paramedics (OR:2.5, 95%CI: 0.62-10.05). This observation is congruent with that of Beguin, Boland & Ninane (1998) and Nichol & Hauge (1997) that outlined higher numbers of vaccinated male HCWs within a hospital setting, despite the fact that the majority of the HCWs in each location were female. While a number of female paramedics reported refusing the vaccine due to pregnancy, this group maintained a small subset of the study population (2%).

Since the early days of vaccination, there has always been a subset of the population who are resistant to the concept of vaccination. A North American study by Poland & Jacobson (2012), suggested the majority of these individuals who are resistant to the concept of vaccinating either themselves, or their families, are female. Over 15% of Canadian mothers have either refused a routine childhood vaccination or requested a change in the vaccination timeline (Kata, 2010). Poland & Jacobson suggest this reflects skepticism in the safety and effectiveness of vaccines in general. It can be inferred that the lower numbers of female flu vaccinations could be related to this finding.

***7.2.3.2 Years of Service.*** The current study determined two periods where flu vaccine uptake was more likely, although not deemed significant.

First, it appears that paramedics employed less than five years reported a positive vaccination status more often than individuals who have been employed 15-19 years (Table 4). This is most likely due to the fact that individuals must have been vaccinated for the flu during their training years in college.

Flu vaccination rates were also higher among those employed the longest (i.e., 20 or more years). While longer years of service does not directly relate to increased age, the two are correlated. Gross, Hermogenes, Sacks, Law & Levandowski (1995) revealed that flu vaccination among individuals aged 50 and older reduces the risk of complications such as pneumonia. As individuals are made aware of the dangers of acquiring the flu after age 50, it would seem that the rate of vaccinations among members of this group appears to increase.

***7.2.3.3 Living Arrangement.*** The current study reported a relationship between individuals who lived with someone and positive vaccination status (Table 4). As discussed earlier, there appears to be an altruistic component to the decision to receive the flu shot. According to John & Cheney (2008), individuals are more likely to receive the flu shot in an attempt to protect their loved ones than to protect themselves.

**7.2.4 Perceived Threat.** According to Rosenstock (1974), *Perceived Threat* is comprised of two parts: *Perceived Severity*, the idea that the condition would result in a large disruption of daily life and activities, and *Perceived Susceptibility*, the likelihood of experiencing the particular condition.

***7.2.4.1 Perceived Severity and Susceptibility.*** In the current study, individuals who had recently experienced moderate to severe flu symptoms (p=0.03) or who have had to take days off of work (p=0 04) were more likely to report getting the flu shot. This mirrors the finding by Hubble et al. (2011) that claims that first-hand experience with the flu tends to serve as a motivator for getting the flu shot. Given that these individuals have already successfully contracted the flu, and it has interfered with their daily life and productivity, it stands to reason that without preventative action they could contract it again. In addition, individuals who felt that they were exposed to the flu more often and required additional protection received the flu shot more often (p=0.04), (i.e., their *Perceived Susceptibility* has been increased). Thus, it is more likely that they will take action in order to prevent a future infection.

### 7.2.5 Cues to Action

***7.2.5.1 Employer-Recommended Vaccination.*** As mentioned earlier, there appears to be a relationship between the high rates of flu vaccination found within these services and the encouragement to receive the shot, either by one's employer or school administration. Eighty-five percent of paramedics employed for five years or less, cited the vaccination requirement for their training program as a main reason for their vaccine acceptance.

For paramedics employed for longer than five years, several respondents specifically outlined a protocol where they were not directly required to get the flu shot as a requirement for employment. In this case, if an outbreak was to occur, they would be removed from active duty until the outbreak was over, or until they received their shot. In the current study, many paramedics cited this as a main reason for their vaccine acceptance ($p=0.03$).

Influenza is a difficult disease to fully understand. It can be quick-moving and brutal; an individual can go from first infection to bedbound with symptoms within a few days. The infection can be critical in certain individuals and high-risk groups; however many of its sufferers never show clinical-level symptoms (Ferguson et al., 2006). The flu has several different methods of transmission (Hall, 2007), yet the vaccine is at full effect for only a limited time (CDC, 2013). This increased knowledge of the flu along with understanding the pitfalls of preventing and treating the flu appear to correspond to having both a higher *Perceived Severity* and *Perceived Susceptibility*.

### 7.3 Understanding predictions generated by the HBM with respect to flu vaccination

Paramedics undergo a specific decision-making process to determine whether or not to receive the flu shot. Utilizing the responses generated from the questionnaire, and using the HBM as a guideline, an understanding of this decision-making process can be modelled (Figure 6).

This graphic representation relates the HBM to a 'weighing scale'. On each side of the scale, components of the HBM are represented along with how each affects the decision outcome, in this case, influenza vaccination. On the right side of the scale are the potential motivators to vaccination, on the left, the potential barriers.

*Perceived Susceptibility* (one's perceived likelihood of catching the flu), along with *Perceived Severity* (how much one believes contracting the flu will affect their daily lives), is combined to form the *Perceived Threat*. The subcomponents of each dimension are listed in descending order underneath each heading. The greater the effect of each of its subcomponents, the greater the *Perceived Threat*. The greater the *Perceived Threat*, the 'heavier' it is (i.e., the more it contributes to the likelihood of taking the perceived health action).

Also on the right side of the scale are the *Perceived Benefits*; the positive aspects of undergoing the health behaviour. As with *Perceived Threat*, the greater the effect of these subcomponents, the more noteworthy the *Perceived Benefits* become, which lead to an increased likelihood of positive vaccination status.

Finally on the right side, is the concept of *Convenience* or stated alternatively, *Inconvenience*. Traditionally with the HBM, *Inconvenience* was included as one of the *Potential Barriers* to vaccination. As is shown with this study and corroborated by John & Cheney (2008), *Convenience* only serves to give support to those already considering vaccination and it does very little to convince those resistant to vaccination to become vaccinated. For this reason, although it is part of the decision to become vaccinated, it does not carry the same affective

influence as *Perceived Threat* or *Perceived Benefit*. This is why it is represented as a small addition of 'weight' to the scale. If either or both of the *Perceived Threat* or *Perceived Benefit* dimensions are already persuasive, *Convenience* will also assist in promoting vaccination. On the other hand, if neither the *Perceived Threat* nor *Perceived Benefit* are particularly influential, or if the *Perceived Barriers* are compelling, *Convenience* will be insufficient to sway the argument.

Represented on the opposite side of the scale are the *Perceived Barriers*. These are the factors that dissuade an individual to be vaccinated. In descending order, these include: skepticism of the effectiveness of the vaccine; a concern over both short and long term side effects; and, previous negative experiences with the vaccine, either personally or vicariously.

*Perceived Barriers* are very effective in discouraging individuals to become vaccinated. This is especially true in recent years where the anti-vaccination movement has become a popular topic in mainstream media.

With respect to our "Weighing Scale Health Belief Model", these *Perceived Barriers* are difficult to outweigh, as many barriers do not come from personal experiences. The internet has become highly influential in this area as it provides a wealth of information that can be used to support either side.

Over 72% of North Americans use the internet and nearly 80% of those use the internet for health related information (Fox, 2008). Among the cacophony of opinions regarding the merits and pitfalls of vaccination, there exists the re-emergence of the anti-vaccination community. Armed with emotive appeals, personal testimonials about harmed children/personal experiences, and an adversarial "us vs. them" mentality, these opinions have become increasingly difficult to ignore. This is especially true when one considers the difference in the mode of communication used by each faction. The traditional research journal or medical paper

is characteristically lacking the visual or emotive appeal of a television celebrity or internet sensation.

In this case, it appears that even the "expert estimation" of a leader in vaccine research becomes just another opinion, and then can be easily discarded (Kata, 2010).

With respect to the "Weighing Scale Health Belief Model", it is here where the majority of the counter-opinion and *Perceived Barriers* are generated. If these *Perceived Barriers* are persuasive, they require a lot of 'counterweight' to be offset.

Beneath the "Weighing Scale Health Belief Model" are the *Cues to Action*. Due to the dynamic effect of the *Cues to Action* on the decision-making process, this is represented as an arrow. If both sides are balanced and a decision has not been reached regarding the health action, the *Cues to Action* appear to expedite the decision-making process. With the current study, the most crucial cues to action appear to come from external sources.

For paramedics in training, the vaccination requirement for most Canadian college programs appears to strongly influence this decision. In the current study, Individuals who reported avoiding the flu vaccine during their current employment reported that they accepted it in order to complete their training in college. This suggests that an external *Cue to Action* can outweigh *Perceived Barriers* to vaccination, at least in the short term.

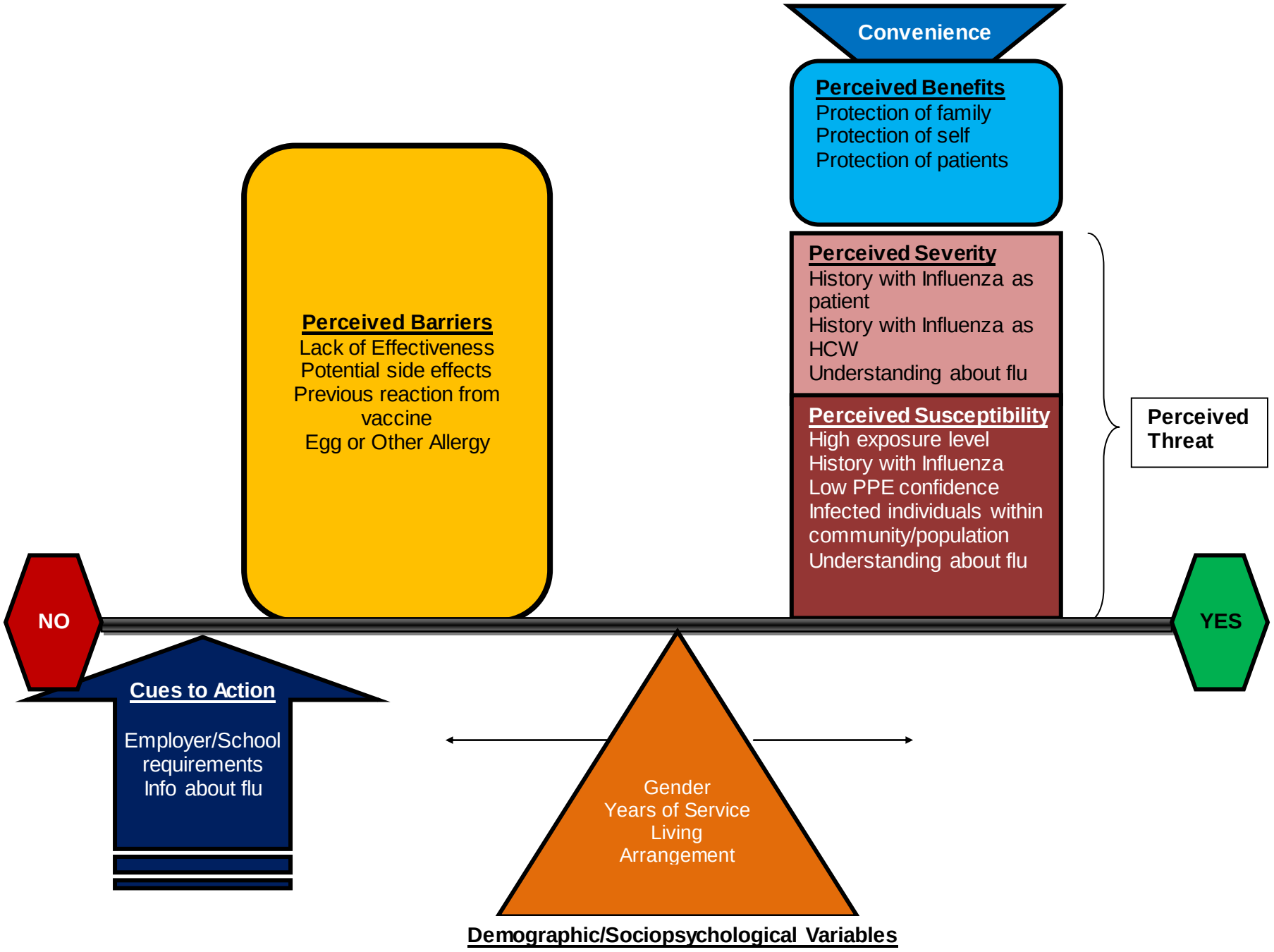
Additionally, several participants in this study reported a request by their employer to become vaccinated. In this case, if a flu epidemic occurred, unvaccinated paramedics would not be scheduled to work and would be required to forfeit the salary that accompanied those work days. For several paramedics, this appeared to 'tip the scale' toward the positive vaccination status, suggesting that this recommendation greatly affects the decision-making process for these individuals.

Finally, the fulcrum of the scale is the *Demographic* and *Sociopsychological Characteristics* of the individual making the decision. All other things being equal, these

variables effectively move the fulcrum of the scale either to the left or the right allowing the factors above to allocate weight in the opposite direction. This can effectively cause a change in the likelihood of the outcome without changing any of the factors above.

Using the current study as an example, it appears that more male paramedics reported becoming vaccinated more often than female paramedics. In this case, for males, the fulcrum would move to the left, resulting in a higher likelihood of vaccination. To illustrate the opposite outcome, paramedics who lived alone reported being vaccinated less often. In this case, the fulcrum essentially moves to the right, making the vaccine refusal more likely. It is therefore important that the *Demographic* and *Sociopsychological Characteristics* of the individual making the decision be incorporated into the model as they are pivotal contributors to the decision-making process.

**Figure 7. Conceptual Model with Respect to Influenza Vaccination Decision-Making among rural Ontario paramedics**



## 8.0 Limitations

A major limitation of this study is the small sample size. By receiving only 99 responses, the estimated power holds at only 68% power. Due to this low power, some variables that approached, but did not explicitly achieve statistical significance were included in the model (e.g. *Convenience*). In cases like these, the possibility of Type II error is increased. This power estimate (68%) could also be inflated as the sample size calculation used an OR of 3.3 as a benchmark of the influence of flu vaccine uptake factors within this community. It is important to note that if the lower bound OR of 1.5 was used as a standard, the estimated power of the study would decrease further. Despite the reduced power, this study also found several statistically significant differences found between groups of vaccinated and unvaccinated individuals. To be able to uncover this variation, even with the reduced power, gives additional weight to the findings and serves as a starting point for further study.

Another limitation of the reduced power is that it was not possible to perform logistic regression analysis in order to generate a potential mathematical model to predict positive vaccination status. Although a mathematical model was not possible, it was possible to create a graphic representation of the decision-making process using the HBM as guideline. This graphic representation is intended to highlight significant points within the data in a clear and concise manner.

There was also some recall bias within the sample. As illustrated in Table 5, there were three individuals who reported that they could not recall whether or not they had received the H1N1 flu shot during the 2009-2010 flu season, and there were ten individuals who reported that they could not remember whether or not they had been vaccinated for the seasonal flu shot in that same season. Despite the use of a paper-based survey, which would have allowed participants to check past calendars and memoranda, a recall bias remained. In spite of this,

the vaccination status for remaining flu seasons 2010-2013 were recalled by all of the paramedics included in the study.

Also, it appears that there is some self-selection bias within the sample. The study population needed to be comprised of currently employed paramedics and this could only be accomplished with the approval of the EMS Chiefs and Directors of the services involved in the study. Knowing this, the Chiefs and Directors of EMS services with strong pro-vaccination attitudes and procedures could have been more eager to submit to the study than Chiefs and Directors who are resistant to flu vaccination. Despite the fact that all five of the EMS services initially contacted via email agreed to participate in the study, a positive, pro-vaccination atmosphere within these services could have been one of the *reasons why* each service agreed to participate. This could explain the high number of vaccinated individuals within these services. In addition, once the EMS Chiefs and Directors were contacted and agreed to participate in the study, it would have been beneficial to allow contact the service's union representative. He or she could have been able to help promote the study among the paramedics within each service, leading, potentially, to an improved response rate. This, also, would shed have more light on the atmosphere with respect to flu vaccination within the services as whole.

Although there are some recruitment limitations, the high flu vaccination rate found within these services demonstrates the effectiveness of some of their programmes. This could point toward future successful initiatives for other paramedic services, HCWs and the community-at-large.

Also, the questionnaire tool lacked the ability to adequately address some relevant questions that arose from the analyses. Each of the subcomponents of the HBM dimensions could easily be further divided into even smaller classifications which would have made it possible to generate a more robust graphical model.

For example, one of the *Perceived Benefits* discovered in the current study is the idea of vaccinating one's self in order to protect family members, however, additional questions arise from this finding. Do any of these families have high risk individuals, such as young children, elderly individuals or the immunocompromised living with them? If so, do these paramedics perceive an even greater benefit through vaccination? Clearly stated, there were a few questions that arose from the data that would have been difficult to address without inference by the researcher.

The final section of the questionnaire allowed participants to make any comments about the questionnaire (e.g., difficult to answer questions, confusing wording etc.). Although the questionnaire tool was originally used by MacPhee et al. (in preparation), additional pretesting would have been beneficial. Pre-testing would have identified any potential pitfalls of the questionnaire, such as: providing a better estimation of the length of time needed to complete the survey, estimating a response rate; identifying redundant questions for removal from the questionnaire; determining if and where survey fatigue occurred and to establish a measure of instrument reliability. Despite the fact that a formal pretest was not conducted, very few of the participants returned surveys with negative or constructive comments regarding the questionnaire or its components (~2%). The response section was useful, however, as participants used this section to outline their reasons for or against vaccination in greater detail. By cross-referencing comments in the final section with responses to questions earlier in the questionnaire, a useful measure of reliability of the responses could be achieved. Less than a 2% response mismatch was found when responses were analyzed throughout individual questionnaires, which suggests that the questionnaire responses were relatively reliable throughout the study.

Finally, although this study appears to have face validity, validation analyses were not conducted with this study as these analyses were beyond the scope of this project. Therefore,

no further validity can be assumed. However, while their increased risk for the flu and their dynamic work environment separate paramedics from other HCWs, paramedics show some similarities to HCWs with respect to their health concerns and behaviours. In these cases, it would be possible to establish a measure of concurrent validity between this questionnaire and one that has successfully been implemented with other HCWs. This way, it would be possible to create an even more reliable questionnaire tool specifically designed for paramedics. This would allow for a greater understanding of paramedics and their decision-making process with respect to the flu shot and other preventative health behaviours.

# 9.0 Recommendations

## 9.1. Community Interventions

Providing convenient vaccination locations throughout paramedic services should continue to be encouraged, since it allows individuals who are already willing to be vaccinated a method of doing so. In addition, continuing to provide vaccination stations and clinics throughout rural communities will provide increased convenience for not only paramedics but also the community members they serve. This increased convenience, however, has a lessened affect on those who have very specific vaccine objections.

In the current study, through examining the HBM, it appears that there are two main points at which pressure can be applied: increasing one's *Perceived Benefits* and employing stronger *Cues to Action*.

## 9.2 Increasing Perceived Benefits

Kata (2010) suggests that the idea is not to work against the anti-vaccination movement, but to work with it.

Currently, it appears that health care in North America has a greater focus on disease management and treatment, than on disease prevention (Yong, Saunders & Olsen, 2010). By presenting vaccination to Canadians as a shift toward a more preventive type of medicine, it represents a shared goal between both the 'vaccinated' and 'vaccinators'. Care should be taken to avoid the promotion of vaccines as the pharmaceutical, medical and to some, the more unnatural option. By marketing the idea as more of a prophylactic alternative, a greater effect could be generated.

In the current study, 'protecting one's patients' and 'protecting one's family' were reported as motivators for getting the flu shot. Additional *Perceived Benefits* could be generated by appealing to one's sense of community living. For example, some hospitals have adopted a program where HCWs who are vaccinated for the flu wear a sticker attached to their name

badge to indicate positive vaccination status. This initiative has been implemented in several Toronto hospitals with some success (McKeown, 2011). By combining the aspects of vaccination with public safety, it is possible to appeal to one's altruism and provide another *Perceived Benefit* of getting the flu shot.

Also, by promoting self-vaccination as a way of protecting not only one's self but the community-at-large, it may be possible to break down the in-group vs. out-group mentality produced by the current vaccination debate. Put another way, if one would choose to protect their families, why not their friends, colleagues and co-workers? Instead of focusing on a vaccination as being a solely personal choice, perhaps by "marketing" the idea as a social choice, the movement would gain further traction. For example, frequent hand washing not only prevents individuals from being infected by other community members; it also prevents disease transmission throughout the community (CDC, 2013). The concept of community service through vaccination could serve as an additional *Perceived Benefit* which could indirectly contest, and arguably be more effective in counterbalancing the *Perceived Barriers* held by those opposed to vaccination. This provides the potential for a shift toward increased rates of vaccinations among HCWs, but could also increase vaccination rates within the communities they serve.

### 9.3 Cues to Action (CTAs)

Many paramedics cited a request or requirement from their school or their employer as a main reason for their vaccination, despite their personal objections. Although it could be suggested that a mandatory vaccination program would be beneficial, recent events have shown that a mandatory vaccination program would not work (Lugo, 2007). In the current study, some paramedics commented that they felt that the idea of being "forced" to get the flu shot was unethical and unfair. In addition, it could be argued that a mandatory program would directly

promote the in-group vs. out-group mentality outlined by the *Social Identity Theory*, and would be met with so much resistance that it would be unlikely to be ratified.

Despite this, it cannot be ignored that within the services included in this study, there existed an unusually high flu vaccination rate. Thus, it appears the *Cues to Action* employed within these services have been considerably successful.

Segen (2012) defines "informed decision" as the ability of an individual to feel that they can make a choice based on the available information that mirrors their personal values and goals. Within several of the paramedic services included in this study, individuals who object to flu vaccination can simply abstain from receiving it. In the case of an outbreak, however, they have another choice. They can choose to remain home from work, which would serve as the safest place to be for an unvaccinated individual, or they can choose to be vaccinated at that time.

This is a very simple and easily reproducible protocol and mimics the decision-making processes that one encounters daily. For example, suppose an individual objects to paying their taxes, a choice that can be made at any time. In this case, if questioned, they face a similar dilemma: accept the financial consequences; or, act against their original opinion. By utilizing *Cues to Action* that allow individuals to make an informed decision about vaccination, individuals can retain a sense of autonomy, albeit in the short term.

## 10.0 Future Research

More research is needed in this area; however, it is possible that the focus should shift toward the social marketing of the flu shot to community members. Currently, the vaccination rates of most HCWs are very low, as it is with the rest of the North American community at large.

Based on the results of the current study, it appears a lack of information about the flu and the flu shot is not the issue; it appears that most of the participants *felt* that they had enough information to make a confident decision in either case.

Nevertheless, it is important for future research to focus on why certain opinions are believed while others are rejected. As Kata (2010) outlined, a large number of community members are willing to believe sources with little to no evidence, but reject information gathered by hundreds of credible sources. Therefore, it begs the question, "If you don't accept that the flu shot will be effective, what evidence brought you to that decision and what made it so credible to you?"

Finally, the current study highlighted the importance of *Cues to Action* (e.g., employer/school recommendations) to serve as temporary solutions to a low vaccination rate among paramedics. Despite its apparent success, this will not serve as a long-term solution. Policies like these can negatively affect one's continuing sense of autonomy with respect to health-based decisions.

Additional research should be conducted to ascertain which factors would persuade individuals resistant to vaccination to *reconsider* their position. This way, a coordinated effort to improve vaccination rates could be generated among both the members of the medical community and the community-at-large.

## 11.0 Conclusion

Flu vaccination rates among HCWs have traditionally been very low. Despite the fact that 221 studies have been conducted relating HCWs and flu vaccination rates, very few studies have been conducted with paramedics. In contrast to the traditionally low flu vaccination rates, in the current study, the majority of paramedics reported at least one flu vaccination in the past five flu seasons. In past studies, it has been suggested that rural paramedics are hindered by limits in physical and/or human resources as a result of their distance from urban centers, which results in lower vaccination rates. It appears, however, the concept of limited resources is not as strong a barrier to vaccination as was previously suspected.

Living arrangement, sex and years of service appear to play a pivotal role in determining vaccination status.

The Health Belief Model can be applied to better understand the decision-making process with respect to vaccination uptake among paramedics. Through the application of specific *Cues to Action* such as employer or school recommendations, vaccination rates can be increased. In addition, although *Perceived Barriers* remain a major impediment to vaccine uptake, it appears that through increasing the *Perceived Benefits* of vaccination, these barriers can be offset.

Although traditionally seen as a major hindrance to vaccination, *Inconvenience* does not seem to affect vaccine acceptance as much as previously suspected. Increased *Convenience* only serves individuals who are already considering the vaccine, but do not serve to persuade resistant individuals to reconsider their position.

Clearly, more research is needed as the reasons for accepting or declining the flu shot are varied and complex, however, through a greater understanding of the way individuals,

including HCWs, make health-related decisions; it is possible to bring about valuable and permanent change.

# Appendix A

**Terms Relating to Paramedics and EMS**

| Term | Description | |
|---|---|---|
| Dispatch operations | | The dispatch operations are responsible for the coordination and communication with the outgoing land ambulance operators. |
| Paramedic operations | | Paramedic operations deal directly with patient care. |
| Paramedic Levels (Ontario Paramedic Association, 2012) | Primary Care | The PCP holds certification following successful completion of a certified community college program and the Advanced Emergency Medical Care Exam. The PCP is duties include: emergency patient care, CPR and basic trauma support. |
| | Advanced Care | Upon completion of 2 years experience as a paramedic, candidates qualify for training as an ACP. In addition to the duties performed by PCPs, the ACP scope of practice includes: advanced airway management equipment, intravenous therapy, pharmaceutical therapy, treatment of cardiac emergency, manual defibrillation and basic intubation techniques. |
| | Critical Care | The highest level of paramedic in Ontario. The duties of the CCP include those of the ACP and in addition include: blood product administration, IV pumps, rapid sequence intubation, intraosseous and intrajugular IV techniques. |
| Ornge | | Ornge offers air ambulance services to many areas around to critically ill patients around Ontario. |

## Appendix B

**Terms Relating to Influenza**

| | |
|---|---|
| Antigen | A substance that invokes an immune response, such as the creation of antibodies. |
| Antibody | A product of the immune system, an antibody is a protein complex that allows for the recognition and neutralization of foreign substances within a body system. |
| Capsule | The protein shell of a virus which houses the genetic material used in viral replication. |
| Glycoprotein | Proteins with oligosaccharide chains. These are found protruding from viral capsules. Their makeup can be recognized by the immune system and used to create specific antibodies. |
| Seroprotection | The development of specific antibodies in the blood serum which allows for defense against specific antigens. |
| Trivalent inactivated vaccine (TIV) | An intramuscularly delivered version of the influenza vaccine. Three types of destroyed influenza viral strains in are contained in each seasonal dose. |
| Live attenuated influenza vaccine (LAIV) | An intranasally delivered version of the influenza vaccine. The vaccine is attenuated, meaning that the vaccine contains live virus, albeit significantly less virulent. |

## Appendix C

**Factors influencing influenza vaccination rates among rural Ontario paramedics.**

Tonya Leduc, BSc, BEd

Department of Kinesiology and Physical Education

& Health Sciences Program

Wilfrid Laurier University

## Participant Information Letter

You are invited to participate in a research study. Previous research that has addressed rates of influenza vaccinations among healthcare professionals has focused primarily on nurses and physicians. Unfortunately, paramedics have been excluded from the vast majority of the research. The purpose of this pilot study is to determine the frequency of Influenza A vaccinations among paramedics employed with rural Ontario EMS services.

### Study Overview

Each year hundreds of individuals contract Influenza A, a viral respiratory illness, which for some high risk populations (e.g., children, immunocompromised, elderly, etc.) can result in an untold number of infections and in many cases, death. According to the Centres for Disease Control (CDC), vaccination against Influenza A is the key to the prevention of this potentially fatal illness. Because of their direct patient contact, especially those in high risk patient populations, the CDC, the Public Health Agency of Canada, and the Ontario Health Pandemic Influenza Plan recommend that all healthcare professionals be vaccinated against influenza annually. Despite these recommendations, the rate of vaccination among healthcare professionals (e.g., physicians, nurses, healthcare aides, etc.) hovers between 36% and 41%, with an average of 40%.

Previous research studies pertaining to Influenza A vaccinations (more commonly referred to as the “flu shot”) among healthcare professionals have focused primarily on nurses and physicians; research on paramedics is very limited, only three studies to date. In an effort to reduce this gap in the research, the primary goal of this pilot study will be to determine the frequency of Influenza A vaccinations for both the H1N1 strain (also referred to as the ‘swine flu’) and the seasonal flu strains for paramedics employed with the County of Renfrew Paramedic Services (CRPS), Haliburton County EMS (HCEMS), Haldimand County EMS (HEMS), Bruce County EMS (BCEMS) and Perth County EMS (PCEMS).

In order to accomplish this, the research study will administer questionnaires to approximately 360 paramedics.

This collaborative study will: 1) collect valuable data regarding influenza vaccinations in several rural Emergency Medical Services (EMS) within the province of Ontario; 2) provide an excellent opportunity to examine rates of use of both the H1N1 and seasonal flu vaccines within this group of healthcare professionals for the first time; 3) generate findings that will be used in the development of a larger research grant proposal through the Worker Safety Insurance Bureau (WSIB).

**Information**

*Self-administered Questionnaires*

A package containing a letter of information, the questionnaire, a ticket for the prize draw, and a return envelope, will be placed in the internal mailbox of each paramedic employed with CRPS, HCEMS, HEMS, BCEMS and PCEMS. The questionnaire will ask paramedics to provide socio-demographic data (e.g., age, gender, length of employment, employment status, etc.) and vaccination status for each year beginning in 2009 through to and including 2013. Additional questions on the survey will include (but not limited to) the following: whether they experienced any side effects from their vaccination; the level of knowledge about the effectiveness of influenza vaccinations, potential adverse effects, and the reasons they chose to receive or not receive annual vaccination. It will take approximately 15 minutes to complete the questionnaire.

Paramedics will be asked to return the completed questionnaires directly to the Principal Investigator (Tonya Leduc) using a pre-addressed stamped envelope. Approximately two weeks after the questionnaire has been distributed, a follow-up email will be sent to each paramedic via the internal email system utilized by the service; the email will thank those who have already completed the questionnaire and request a response from those who have not already done so.

**Risks**

*Questionnaires*

There are no repercussions by participating or not participating in the questionnaire phase of the study. The risks associated with participation in this study are no greater than those faced by the participants on a daily basis.

There are no potential social risks to the participants who choose to complete the surveys. This task should be done in private and on an individual basis. All surveys will be returned directly to the researcher in order to maintain anonymity and confidentiality. For participants answering the questionnaire, boredom, revelation of personal information are possible psychological or emotional risks of this study.

In effort to minimize the potential risks during the questionnaire phase of the study, the questionnaire will use a variety of questions, such as check boxes, Likert-type scales and 'yes/no' answer options to reduce the possibility of boredom with answering the questionnaire. Participants will be instructed to leave blank any questions they do not feel comfortable answering. Additionally, participants will also be instructed to complete the questionnaire at a convenient time.

**Benefits**
Potential benefits that are anticipated from completing this study will include: the collection of valuable data regarding influenza vaccinations in several rural Emergency Medical Services (EMS) within the province of Ontario; providing an excellent opportunity to examine rates for the first time use of the H1N1 and seasonal flu vaccines within this group of healthcare professionals; and, identification of those variables that facilitate or discourage influenza vaccination within this group of healthcare professionals

**Confidentiality**
*Questionnaires*
Data from the completed questionnaires will be coded numerically and entered into MS Excel files for the purpose of data analyses. The MS Excel files, which will be stored on an external USB drive, will be password encrypted. The USB drive will be stored in a locked filing cabinet within Dr. MacPhee's locked research office within the Department of Kinesiology and Physical Education. All completed paper copies of the questionnaires will be stored separately in a locked filing cabinet within Dr. MacPhee's locked research office. All paper based files will be kept for a period of two (2) years at which point they will be shredded using the confidential shredding company employed by WLU. All electronic files will be kept for a period of five (5) years, at which time they will be destroyed. Only the Principal Investigator (Tonya Leduc), the Research Supervisor (Dr. MacPhee) and a research assistant in Dr. MacPhee's lab will have access to the collected data.

**Contact**
If you have any questions at any time about the study procedures or should you experience any adverse effects as a result of participating in this study you may contact the principal investigator (Tonya Leduc) or the research supervisor (Dr. MacPhee) directly. Tonya Leduc may be reached via telephone at (519) 884-1970 x 2002 or by email at ledu2930@mylaurier.ca. Dr. Renée MacPhee may be reached via telephone at (519)884-0710, extension 2754, or email at rmacphee@wlu.ca . This study has been reviewed and approved by the University Research Ethics Board at Wilfrid Laurier University. If you feel that you have not been treated according to the description of this form, or your rights as a participant in research have been violated during the course of this study, you may contact Dr. Robert Basso, Chair, University Research Ethics Board, Wilfrid Laurier University, (519) 884-0710, extension 5225.

**Participation**
Your participation in this study is voluntary; you may decline to participate without penalty. If you decide to participate, you may withdraw from the study at any time without penalty and without loss of benefits to which you are otherwise entitled. If you withdraw from the study before the data collection is completed, your data will be returned to you, or destroyed. You have the right to omit any question(s) or procedure(s) you choose.

**Compensation**
*Phase 1: Questionnaires*
Individuals who return their completed questionnaire by March 1, 2014 will be eligible to enter their name into a draw for one of three $25.00 gift certificates.

**Feedback and Publication**
A one-page executive summary of the results will be made available to you upon completion of the study. The results from the study may also be published in a research journal. If you wish, we will contact you with the dates of the conferences in which data from this study will be presented. If you would like to request feedback concerning this study, please provide either your mailing address or email address directly to the principal researcher, Tonya Leduc or the research supervisor, Dr. MacPhee.

I would like to thank you for reviewing the enclosed information. Should you have any questions, require additional information; please contact me directly at (519) 884-0710 x2002 or by email at ledu2930@mylaurier.ca or my research supervisor, Dr. MacPhee at rmacphee@wlu.ca.
Thank you for your time.

Sincerely,

Tonya Leduc, BSc, BEd

Principal Investigator

## Appendix D

**"Factors influencing influenza rates among rural Ontario paramedics"**

**Tonya Leduc, BSc, BEd**
**Department of Kinesiology and Physical Education**
**Health Sciences Program**
**Wilfrid Laurier University**

## Questionnaire

The following questionnaire is an investigation into the rates of influenza vaccination among rural Ontario EMS personnel. Influenza A represents a major health issue, and one that has been significantly under-researched within the field of Emergency Medical Services. This study will investigate attitudes and opinions regarding influenza vaccination among Ontario EMS personnel in an effort to provide information in this area. Through the use of detailed inquiry and analysis, a greater understanding in this field of study will be generated.

This questionnaire consists of four sections and will take approximately 15 minutes to complete. Please complete each question within each section independently and to the best of your ability. You may complete the questionnaire at a convenient time and over several sessions if need be. In order to ensure your anonymity and the confidentiality of your responses, please do not write your name anywhere on the questionnaire form. When you have completed the questionnaire, please place it in the researcher-addressed stamped envelope and return it by mail by March 1, 2014. Thank you for participating in this study.

### Section A: Sociodemographics

***Please check the most appropriate answer to each of the following questions:***

1. What is your gender?
   - Male
   - Female
   - Transgender
   - Prefer not to answer

2. What is your birth date? (Please list the date: year-mm-dd)

   _____

3. What is your marital status?
   - Single
   - Married and/or living with a partner or common law partner
   - Divorced
   - Separated
   - Widowed
   - Prefer not to answer

4. What is the highest level of formal education you have completed?

High school
Trade, technical or vocational school, apprenticeship or technical trade
Diploma from a community college or non-university certificate
University degree below a bachelor's level (e.g., Associate degree etc.)
Bachelor's degree
Professional degree (e.g., B.Ed., LLB etc.)
Graduate degree (e.g., MSc, MA, MBA etc.)
Post-graduate degree (e.g., PhD)
Prefer not to answer

***This is the end of Section A – please proceed to Section B.***

**Section B: Employment Status**

5. At what skill level are you currently certified as a paramedic? *(Check one)*

Primary Care Paramedic
Advanced Care Paramedic
Critical Care Paramedic
Prefer not to answer

6. Are you currently employed at the paramedic skill level for which you have been certified?

No
Yes
Prefer not to answer

7. Are you currently employed by more than one Emergency Medical Service in Ontario?

No
Yes
Prefer not to answer

8. Please circle your current employment status and fill in the length of time you have been employed at this employment status.

| **Current Employment Status** | **Length of Time at Current Employment Status** |
|---|---|
| Full-Time Employment | |
| Part-Time Employment | |
| Casual Employment | |
| Other<br>_____ | |

9. Which of the following choices best describes your working schedule?
   Regular – daytime schedule or shift
   Regular – evening shift
   Regular – night shift
   Rotating shift, changing periodically from days to evenings or to nights
   Split shift, consisting of two or more distinct periods each day
   Other (please specify): _____
   Prefer not to answer

***This is the end of Section B – please proceed to Section C.***

**Section C: Seasonal Vaccination History**

The "seasonal flu shot" refers to the vaccine that is produced annually and begins administration in the fall prior to each flu season. The seasonal vaccine typically contains three (3) vaccine strains. The "swine flu shot/epidemic flu shot" refers to the H1N1 strain of the Influenza A vaccination; it was only administered in 2009-2010.

***Please check the most appropriate answer to each of the following questions.***

10a. in the flu season of **2009-2010,** did you receive the H1N1 (swine flu) shot?

Yes, I did receive the H1N1 (swine flu) shot (*please proceed to question 10a).*
No, I did not receive the H1N1 (swine flu) shot (*please proceed to question 10e).*
I cannot remember if I received the H1N1 (swine flu) shot *(please proceed to question 11a).*
Prefer not to answer *(please proceed to question 11a).*

**If YES,**

10b. In **2009-2010**, where did you receive the H1N1 (swine flu) shot?

Workplace
Public Health Office
Community Clinic
Family physician
Other (please specify): _____
Prefer not to answer

10c. In **2009-2010**, did you notify your employer that you received your H1N1 (swine flu) shot

No, I did not notify my employer that I received my H1N1 (swine flu) shot.
Yes, I notified my employer that I received my H1N1 (swine flu) shot.
Prefer not to answer

10d. In **2009-2010**, please check all the reasons that motivated you to get the H1N1 (swine flu) shot? *(Please check all that apply)*

It was requested by my employer.
My physician recommended that I get the flu shot.
It is requested for all health care personnel.
I wanted to reduce the risk of transmission to my patients.
I wanted to reduce the risk of getting the flu.
I wanted to reduce the risk of transmission of the flu to my family.
I have been sick with the flu before and wanted to protect myself.
Other (please indicate):_____
Prefer not to answer

*Please proceed to question 11a.*

**If NO,**

10e. In **2009-2010**, please check all the reasons why you did not receive the H1N1 (swine flu) shot? *(Please check all that apply)*

I have an allergy to eggs
The vaccination will result in flu-like illness.
I have had previous experience with pain at the injection site.
I never get sick even though I am often exposed to the flu virus.
I have had a previous allergic reaction.
I am afraid of needles.
I am not convinced of the danger of the H1N1 flu virus.
I am concerned about the potential side effects to the flu vaccine.
I am skeptical of the vaccine's ability to counteract the flu virus.
I have been vaccinated in the past and became sick with the flu.
Other (please indicate): _____
Prefer not to answer

*Please proceed to question 11a.*

11a. in the flu season of **2009-2010**, did you receive the seasonal flu shot (the regular, non-H1N1 shot)?

Yes, I received the seasonal flu shot *(please proceed to question 11b).*
No, I did not receive the seasonal flu shot *(please proceed to question 11e).*
I cannot remember if I received the seasonal flu shot *(please proceed to question 12a).*
Prefer not to answer *(please proceed to question 12a).*

**If YES,**

11b. In **2009-2010**, where did you receive the seasonal flu shot?

Workplace
Public Health Office
Community Clinic
Family physician
Other (please specify): _____
Prefer not to answer

11c. In **2009-2010**, did you notify your employer that you received your seasonal flu shot
No, I did not notify my employer that I received my seasonal flu shot.
Yes, I notified my employer that I received my seasonal flu shot.
Prefer not to answer

11d. In **2009-2010**, please check all the reasons that motivated you to get the seasonal shot? *(Please check all that apply)*
It was requested by my employer.
My physician recommended that I get the flu shot.
It is requested for all health care personnel.
I wanted to reduce the risk of transmission to my patients.
I wanted to reduce the risk of getting the flu.
I wanted to reduce the risk of transmission of the flu to my family.
I have been sick with the flu before and wanted to protect myself.
Other (please indicate):_____
Prefer not to answer

*Please proceed to question 12a.*

**If NO,**

11e. In **2009-2010**, please check all the reasons why you did not receive the seasonal flu shot? *(Please check all that apply)*
I have an allergy to eggs
The vaccination will result in flu-like illness.
I have had previous experience with pain at the injection site.
I never get sick even though I am often exposed to the flu virus.
I have had a previous allergic reaction.
I am afraid of needles.
I am not convinced of the danger of the flu virus.
I am concerned about the potential side effects to the flu vaccine.
I am skeptical of the vaccine's ability to counteract the flu virus.
I have been vaccinated in the past and became sick with the flu.
Other (please indicate): _____
Prefer not to answer

*Please proceed to question 12a.*

12a. in the flu season of **2010-2011**, did you receive the seasonal flu shot?

Yes, I received the seasonal flu shot *(please proceed to question 12b).*
No, I did not receive the seasonal flu shot *(please proceed to question 12e).*
I cannot remember if I received the seasonal flu shot *(please proceed to question 13a).*
Prefer not to answer *(please proceed to question 13a).*

**If YES,**

12b. In **2010-2011**, where did you receive the seasonal flu shot?

Workplace
Public Health Office
Community Clinic
Family physician
Other (please specify): _____
Prefer not to answer

12c. In **2010-2011**, did you notify your employer that you received your seasonal flu shot

No, I did not notify my employer that I received my seasonal flu shot.
Yes, I notified my employer that I received my seasonal flu shot.
Prefer not to answer

12d. In **2010-2011**, please check all the reasons that motivated you to get the seasonal shot? *(Please check all that apply)*

It was requested by my employer.
My physician recommended that I get the flu shot.
It is requested for all health care personnel.
I wanted to reduce the risk of transmission to my patients.
I wanted to reduce the risk of getting the flu.
I wanted to reduce the risk of transmission of the flu to my family.
I have been sick with the flu before and wanted to protect myself.
Other (please indicate):_____
Prefer not to answer

*Please proceed to question 13a.*

**If NO,**

12e. In **2010-2011**, please check all the reasons why you did not receive the seasonal flu shot? *(Please check all that apply)*

I have an allergy to eggs
The vaccination will result in flu-like illness.
I have had previous experience with pain at the injection site.
I never get sick even though I am often exposed to the flu virus.
I have had a previous allergic reaction.
I am afraid of needles.
I am not convinced of the danger of the flu virus.
I am concerned about the potential side effects to the flu vaccine.
I am skeptical of the vaccine's ability to counteract the flu virus.
I have been vaccinated in the past and became sick with the flu.
Other (please indicate): _____
Prefer not to answer

*Please proceed to question 13a.*

13a. in the flu season of **2011-2012**, did you receive the seasonal flu shot?

Yes, I received the seasonal flu shot *(please proceed to question 13b).*
No, I did not receive the seasonal flu shot *(please proceed to question 13e).*
I cannot remember if I received the seasonal flu shot *(please proceed to question 14a).*
Prefer not to answer *(please proceed to question 14a).*

**If YES,**

13b. In **2011-2012**, where did you receive the seasonal flu shot?

Workplace
Public Health Office
Community Clinic
Family physician
Other (please specify): _____
Prefer not to answer

13c. In **2011-2012**, did you notify your employer that you received your seasonal flu shot

No, I did not notify my employer that I received my seasonal flu shot.
Yes, I notified my employer that I received my seasonal flu shot.
Prefer not to answer

13d. In **2011-2012**, please check all the reasons that motivated you to get the seasonal shot? *(Please check all that apply)*

It was requested by my employer.
My physician recommended that I get the flu shot.
It is requested for all health care personnel.
I wanted to reduce the risk of transmission to my patients.
I wanted to reduce the risk of getting the flu.
I wanted to reduce the risk of transmission of the flu to my family.
I have been sick with the flu before and wanted to protect myself.
Other (please indicate):_____
Prefer not to answer

*Please proceed to question 14a.*

**If NO,**

13e. In **2011-2012**, please check all the reasons why you did not receive the seasonal flu shot? *(Please check all that apply)*

I have an allergy to eggs
The vaccination will result in flu-like illness.
I have had previous experience with pain at the injection site.
I never get sick even though I am often exposed to the flu virus.
I have had a previous allergic reaction.
I am afraid of needles.
I am not convinced of the danger of the flu virus.
I am concerned about the potential side effects to the flu vaccine.
I am skeptical of the vaccine's ability to counteract the flu virus.
I have been vaccinated in the past and became sick with the flu.
Other (please indicate): _____
Prefer not to answer

*Please proceed to question 14a.*

14a. Did you receive the flu shot in this past flu season of **2012-2013**?

Yes, I received the flu shot *(please proceed to question 14b).*
No, I did not receive the flu shot *(please proceed to question 14e).*
I cannot remember if I received the seasonal flu shot *(please proceed to question 15).*
Prefer not to answer *(please proceed to question 15).*

**If YES,**

14b. In **2012-2013**, where did you receive the seasonal flu shot?

Workplace
Public Health Office
Community Clinic
Family physician
Other (please specify): _____
Prefer not to answer

14c. In **2012-2013**, will/did you notify your employer that you received your seasonal flu shot

No, I will/did not notify my employer that I received my seasonal flu shot.
Yes, I will/did notify my employer that I received my seasonal flu shot.
Prefer not to answer

14d. In **2012-2013**, please check all the reasons that motivate you to get the seasonal shot? *(Please check all that apply)*

It was requested by my employer.
My physician recommends that I get the flu shot.
It is requested for all health care personnel.
I wanted to reduce the risk of transmission to my patients.
I wanted to reduce the risk of getting the flu.
I wanted to reduce the risk of transmission of the flu to my family.
I have been sick with the flu before and want to protect myself.
Other (please indicate):_____
Prefer not to answer

*Please proceed to question 15.*

**If NO,**

14e. In **2012-2013**, please check all the reasons why you did not receive the seasonal flu shot? *(Please check all that apply)*

I have an allergy to eggs
The vaccination will result in flu-like illness.
I have had previous experience with pain at the injection site.
I am routinely exposure to influenza-like illness on shift.
I never get sick even though I am often exposed to the flu virus.
I have had a previous allergic reaction.
I am afraid of needles.
I am not convinced of the danger of the flu virus.
I am concerned about the potential side effects to the flu vaccine.
I am skeptical of the vaccine's ability to counteract the flu virus
I have been vaccinated in the past and became sick with the flu.
Other (please indicate): _____
Prefer not to answer

*Please proceed to question 15.*

***This is the end of Section C – please proceed to Section D.***

**Section D: The following questions pertain to your experiences with influenza.**

***Please check the most appropriate answer to each of the following questions:***

15. Did you experience flu-like symptoms in the past year?
    Yes *(please proceed through questions 16-17)*
    No *(please proceed to question 18)*
    Prefer not to answer (*please proceed to question 18)*

16a. Please list the signs and symptoms that you experienced (*please check all that apply*):

| | | |
|---|---|---|
| ☐ Fever | ☐ Dry cough | ☐ Muscle pain |
| ☐ Vomiting | ☐ Diarrhea | ☐ Productive cough |
| ☐ Headache | ☐ Abdominal pain | ☐ Respiratory distress |
| ☐ Raised rash | ☐ Increased thirst | ☐ Seizures |
| ☐ Runny Nose | ☐ Sneezing | ☐ Fatigue |
| ☐ Earache | ☐ Dizziness | ☐ Fainting |

16b. In terms of their severity, overall, how would you rank the severity of your symptoms?
    Mild
    Moderate
    Severe

16c. Did you receive an anti-viral medication (i.e. Tamiflu®) when you developed flu-like symptoms?
    No
    Yes

17a. Did you require time off work while you were experiencing the symptoms?
    No *(please proceed to question 20)*
    Yes *(please proceed to question 19b [below])*

17b. Approximately how many days were you sick from work?
_____ (time in days)

*Please proceed to question 18.*

**Section E: The following questions relate to your knowledge of influenza and protective measures employed in the line of duty.**

18. Signs and symptoms in individuals with Influenza A – H3N2 strain (seasonal flu) can include *(please check all that apply)*:

| | | |
|---|---|---|
| ☐ Fever | ☐ Dry cough | ☐ Muscle pain |
| ☐ Vomiting | ☐ Diarrhea | ☐ Productive cough |
| ☐ Headache | ☐ Abdominal pain | ☐ Respiratory distress |
| ☐ Raised rash | ☐ Increased thirst | ☐ Seizures |

19. Signs and symptoms in individuals with the Influenza – H1N1 strain (swine flu) can include *(please circle all that apply):*

| | | |
|---|---|---|
| ☐ Fever | ☐ Dry cough | ☐ Muscle pain |
| ☐ Vomiting | ☐ Diarrhea | ☐ Productive cough |
| ☐ Headache | ☐ Abdominal pain | ☐ Respiratory distress |
| ☐ Raised rash | ☐ Increased thirst | ☐ Seizures |

20. Routine hand hygiene can help prevent infections from spreading. How often do you practice hand hygiene (*Check all that apply).*

| | |
|---|---|
| ☐ beginning of shift<br>☐ during and after PPE removal<br>☐ before invasive procedures<br>☐ after vehicle cleaning<br>☐ before and after smoking<br>☐ after patient contact<br>☐ before leaving a long term care facility (e.g., nursing home, retirement home) | ☐ before patient contact<br>☐ after cleaning or disinfecting equipment<br>☐ before leaving Emergency Department<br>☐ end of shift<br>☐ before and after handling food<br>☐ other (*please specify):*<br>_____ |

21. What is the correct sequence for putting on personal protective equipment (PPE)? Please begin by writing "1" as the first step, followed by "2" for the second, until you have reached "6" as the last step:

— gloves
— gowns/coveralls
— perform hand hygiene
— eye protection
— mask
— perform hand hygiene

**For questions 22-25, please check the most appropriate answer:**

22. Approximately how many patients do you transfer to the hospital with flu-like symptoms in a year?

- 0
- 1-10
- 11-20
- 21-30
- 31-40
- >41
- Don't know/Can't remember
- Prefer not to answer

23. The flu virus is transmitted through (*check only one answer):*

- Droplets only
- Contact only
- Airborne only
- Droplets and airborne
- Droplets and contact
- Contact and airborne
- Contact, airborne and droplets
- Don't know
- Prefer not to answer

24. How soon can individuals (adults) who are symptomatic transmit the virus?

- Immediately
- 1-2 days
- 3-5 days
- 6+ days
- Don't know
- Prefer not to answer

25. How long does the flu shot provide protection for?

- Less than 6 months
- 6-11 months
- 12-23 months
- Greater than 24 months
- It does not provide protection
- Don't know
- Prefer not to answer

***This is the end of Section E - Please proceed to Section F.***

**Section F: Opinions Regarding the Flu Shot**

***Please circle the most appropriate answer.***

26. My employer provides access to seasonal flu shots through clinics held at my place of work.

| Strongly Agree | Agree | Neither agree nor disagree | Disagree | Strongly Disagree | Prefer not to answer |
|---|---|---|---|---|---|

27. I believe that the seasonal flu shot is safe.

| Strongly Agree | Agree | Neither agree nor disagree | Disagree | Strongly Disagree | Prefer not to answer |
|---|---|---|---|---|---|

28. I believe that the H1N1 flu shot is safe.

| Strongly Agree | Agree | Neither agree nor disagree | Disagree | Strongly Disagree | Prefer not to answer |
|---|---|---|---|---|---|

29. I believe that the seasonal flu shot is effective.

| Strongly Agree | Agree | Neither agree nor disagree | Disagree | Strongly Disagree | Prefer not to answer |
|---|---|---|---|---|---|

30. I believe that the H1N1 flu shot is effective.

| Strongly Agree | Agree | Neither agree nor disagree | Disagree | Strongly Disagree | Prefer not to answer |
|---|---|---|---|---|---|

31. I believe the seasonal flu shot prevents the transmission of the seasonal flu.

| Strongly Agree | Agree | Neither agree nor disagree | Disagree | Strongly Disagree | Prefer not to answer |
|---|---|---|---|---|---|

32. I believe the H1N1 flu shot prevents the transmission of the swine flu.

| Strongly Agree | Agree | Neither agree nor disagree | Disagree | Strongly Disagree | Prefer not to answer |
|---|---|---|---|---|---|

33. My employer encourages me to receive the flu shot.

| Strongly Agree | Agree | Neither agree nor disagree | Disagree | Strongly Disagree | Prefer not to answer |
|---|---|---|---|---|---|

34. I feel pressured by my co-workers to receive the flu shot.

| Strongly Agree | Agree | Neither agree nor disagree | Disagree | Strongly Disagree | Prefer not to answer |
|---|---|---|---|---|---|

35. I believe that receiving the flu shot is important.

| Strongly Agree | Agree | Neither agree nor disagree | Disagree | Strongly Disagree | Prefer not to answer |
|---|---|---|---|---|---|

36. I encourage my co-workers to receive the flu shot.

| Strongly Agree | Agree | Neither agree nor disagree | Disagree | Strongly Disagree | Prefer not to answer |
|---|---|---|---|---|---|

37. I am exposed to the flu virus all the time, so I don't need to get the vaccination.

| Strongly Agree | Agree | Neither agree nor disagree | Disagree | Strongly Disagree | Prefer not to answer |
|---|---|---|---|---|---|

38. Only the people who are symptomatic can transmit the virus.

| Strongly Agree | Agree | Neither agree nor disagree | Disagree | Strongly Disagree | Prefer not to answer |
|---|---|---|---|---|---|

39. Tamiflu and other anti-viral medications have reduced the need to have the flu shot.

| Strongly Agree | Agree | Neither agree nor disagree | Disagree | Strongly Disagree | Prefer not to answer |
|---|---|---|---|---|---|

40. The use of Personal Protective Equipment (PPE) has reduced the need to have the flu shot.

| Strongly Agree | Agree | Neither agree nor disagree | Disagree | Strongly Disagree | Prefer not to answer |
|---|---|---|---|---|---|

***This is the end of Section F – please proceed onto Section G.***

**Section G: Participant Comments**

In the space below, please feel free to provide any comments about your experiences as a paramedic relating to influenza vaccinations, the transport of patients symptomatic for influenza, or your experiences or opinions regarding using Personal Protective Equipment (PPE). Any information or insight that you wish to provide would be greatly appreciated by our research team.

***This is the end of Section G – please proceed onto Section H.***

**Section H: Questionnaire Comments**

In the space below, please feel free to provide any comments about your experience with this questionnaire, (e.g., difficult to answer questions, confusing wording etc.) Any information or insight that you wish to provide would be greatly appreciated by our research team.

***This is the end of the questionnaire.***

**Thank you for completing the questionnaire.**

**Please return the questionnaire using the self-addressed stamped envelope provided.**

## Appendix E

Tonya Leduc, BSc, BEd
Department of Kinesiology and Physical Education
& Health Sciences Program
Wilfrid Laurier University

# Volunteers Needed for Research in Emergency Medical Services (EMS)

Primary Care Paramedics, Advanced Care Paramedics and Critical Care Paramedics are needed as volunteer participants in a study entitled:

**"Factors influencing influenza vaccination rates among rural Ontario paramedics"**

Previous research regarding influenza vaccination rates among health care professionals has mainly focused on physicians and nurses. Unfortunately, paramedics have been excluded from the majority of the research. The main purpose of the study is to observe rates of influenza vaccinations among paramedics employed with rurally based EMS services in Ontario. As a participant, you will be asked to complete a short fifteen (15) minute questionnaire. You will be receiving an information package and questionnaire in your internal mailbox. Completed questionnaires may be returned via the researcher-addressed envelope (provided in the package). Individuals who return their completed questionnaire on or before March 1, 2014 will be eligible to have their names entered for a draw to win one of three $25 Tim Horton's gift certificates.

For more information about this study, please contact:
Tonya Leduc BSc, BEd
ledu2930@mylaurier.ca
(519) 884-1970 ext. 2002

## Appendix F

**Ballot card**

Thank you for your participation in this study. By participating, you are eligible to win one of three $25 Tim Horton's Gift Cards.

Name: _____

Contact email or phone: _____

After you have filled out your draw ticket, seal it in this envelope and return it along with your completed questionnaire in the postage paid self-addressed envelope provided in your study package.

Thank you very much for your time!!

## Appendix G

## Email Script: Invitation to participate in Questionnaire

NOTE: This email was distributed to all paramedics in each service by their respective EMS Director and/or Chief.

Dear County of Renfrew Paramedic,
I would like to invite you to participate in a research study that I am conduction entitled **"Factors influencing influenza vaccination rates among rural Ontario paramedics"**. Previous research that has addressed rates of influenza vaccination among healthcare professionals has focused primarily on nurses and physicians. Unfortunately, paramedics have been excluded from the vast majority of the research. The purpose of this study is to examine the frequency of Influenza A vaccinations among paramedics. As a participant, you will be asked to fill out a questionnaire, which will take approximately 15 minutes to complete. You will be receiving an information package and a questionnaire in your internal mailbox within the next few days. Completed surveys can be returned directly to me in a self-addressed stamped envelope (provided in the package). Individuals who return their completed questionnaire to me by March 1, 2014 will be eligible to have their names entered into a draw for one of three $25 gift certificates.

This study has been reviewed and approved by the University Research Ethics Board at Wilfrid Laurier University.

For more information about this study, please contact me via email at ledu2930@mylaurier.ca or via telephone at (519) 884-1970 X 2002

Thank you for your time,

Tonya Leduc BSc, BEd
Wilfrid Laurier University

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Dear Haldimand County Paramedic,
I would like to invite you to participate in a research study that I am conduction entitled **"Factors influencing influenza vaccination rates among rural Ontario paramedics".** Previous research that has addressed rates of influenza vaccination among healthcare professionals has focused primarily on nurses and physicians. Unfortunately, paramedics have been excluded from the vast majority of the research. The purpose of this study is to examine the frequency of Influenza A vaccinations among paramedics. As a participant, you will be asked to fill out a questionnaire, which will take approximately 15 minutes to complete. You will be receiving an information package and a questionnaire in your internal mailbox within the next few days. Completed surveys can be returned directly to me in a self-addressed stamped envelope (provided in the package). Individuals who return their completed questionnaire to me by March 1, 2014 will be eligible to have their names entered into a draw for one of three $25 gift certificates.

This study has been reviewed and approved by the University Research Ethics Board at Wilfrid Laurier University.

For more information about this study, please contact me via email at ledu2930@mylaurier.ca or via telephone at (519) 884-1970 X 2002

Thank you for your time,

Tonya Leduc BSc, BEd
Wilfrid Laurier University

Dear Bruce County Paramedic,
I would like to invite you to participate in a research study that I am conduction entitled **"Factors influencing influenza vaccination rates among rural Ontario paramedics".** Previous research that has addressed rates of influenza vaccination among healthcare professionals has focused primarily on nurses and physicians. Unfortunately, paramedics have been excluded from the vast majority of the research. The purpose of this study is to examine the frequency of Influenza A vaccinations among paramedics. As a participant, you will be asked to fill out a questionnaire, which will take approximately 15 minutes to complete. You will be receiving an information package and a questionnaire in your internal mailbox within the next few days. Completed surveys can be returned directly to me in a self-addressed stamped envelope (provided in the package). Individuals who return their completed questionnaire to me by March 1, 2014 will be eligible to have their names entered into a draw for one of three $25 gift certificates.

This study has been reviewed and approved by the University Research Ethics Board at Wilfrid Laurier University.

For more information about this study, please contact me via email at ledu2930@mylaurier.ca or via telephone at (519) 884-1970 X 2002

Thank you for your time,

Tonya Leduc BSc, BEd
Wilfrid Laurier University

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Dear Perth County Paramedic,
I would like to invite you to participate in a research study that I am conduction entitled **"Factors influencing influenza vaccination rates among rural Ontario paramedics".** Previous research that has addressed rates of influenza vaccination among healthcare professionals has focused primarily on nurses and physicians. Unfortunately, paramedics have been excluded from the vast majority of the research. The purpose of this study is to examine the frequency of Influenza A vaccinations among paramedics. As a participant, you will be asked to fill out a questionnaire, which will take approximately 15 minutes to complete. You will be receiving an information package and a questionnaire in your internal mailbox within the next few days. Completed surveys can be returned directly to me in a self-addressed stamped envelope (provided in the package). Individuals who return their completed questionnaire to me by March 1, 2014 will be eligible to have their names entered into a draw for one of three $25 gift certificates.

This study has been reviewed and approved by the University Research Ethics Board at Wilfrid Laurier University.

For more information about this study, please contact me via email at ledu2930@mylaurier.ca or via telephone at (519) 884-1970 X 2002

Thank you for your time,

Tonya Leduc BSc, BEd
Wilfrid Laurier University

Dear Haliburton County Paramedic,
I would like to invite you to participate in a research study that I am conduction entitled **"Factors influencing influenza vaccination rates among rural Ontario paramedics".** Previous research that has addressed rates of influenza vaccination among healthcare professionals has focused primarily on nurses and physicians. Unfortunately, paramedics have been excluded from the vast majority of the research. The purpose of this study is to examine the frequency of Influenza A vaccinations among paramedics. As a participant, you will be asked to fill out a questionnaire, which will take approximately 15 minutes to complete. You will be receiving an information package and a questionnaire in your internal mailbox within the next few days. Completed surveys can be returned directly to me in a self-addressed stamped envelope (provided in the package). Individuals who return their completed questionnaire to me by March 1, 2014 will be eligible to have their names entered into a draw for one of three $25 gift certificates.

This study has been reviewed and approved by the University Research Ethics Board at Wilfrid Laurier University.

For more information about this study, please contact me via email at ledu2930@mylaurier.ca or via telephone at (519) 884-1970 X 2002

Thank you for your time,

Tonya Leduc BSc, BEd
Wilfrid Laurier University

**Appendix H**

## Email Script: Reminder to complete the Questionnaire

NOTE: This email was distributed to all paramedics in each service by their respective EMS Director and/or Chief.

Dear County of Renfrew Paramedic
You recently received an information package from me in your internal mailbox at the service. The package contained a survey that I am conducting as part of a study entitled "**Factors influencing influenza vaccination rates among rural Ontario paramedics".** The purpose of this study is to determine the frequency of Influenza A vaccinations among paramedics employed with rural Ontario EMS services. I would like to take this opportunity to thank those individuals who have completed and returned their survey. If you have not had an opportunity to complete your survey, your cooperation in doing so would be greatly appreciated. The survey takes approximately 15 minutes to complete and can be returned directly to me in a self-addressed stamped envelope (provided in the package). It would be greatly appreciated if all completed surveys were returned as soon as possible. Thank you again for your time and cooperation.

This study has been reviewed and approved by the University Research Ethics Review Board and Wilfrid Laurier University.

For more information about this study, please contact me via email at ledu2930@mylaurier.ca or via telephone at (519) 884-1970 x2002.

Thank you for your time,

Tonya Leduc, BSc, BEd
Wilfrid Laurier University

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Dear Haldimand County Paramedic,
You recently received an information package from me in your internal mailbox at the service. The package contained a survey that I am conducting as part of a study entitled "**Factors influencing influenza vaccination rates among rural Ontario paramedics".** The purpose of this study is to determine the frequency of Influenza A vaccinations among paramedics employed with rural Ontario EMS services. I would like to take this opportunity to thank those individuals who have completed and returned their survey. If you have not had an opportunity to complete your survey, your cooperation in doing so would be greatly appreciated. The survey takes approximately 15 minutes to complete and can be returned directly to me in a self-addressed stamped envelope (provided in the package). It would be greatly appreciated if all completed surveys were returned as soon as possible. Thank you again for your time and cooperation.

This study has been reviewed and approved by the University Research Ethics Review Board and Wilfrid Laurier University.

For more information about this study, please contact me via email at ledu2930@mylaurier.ca or via telephone at (519) 884-1970 x2002.

Thank you for your time,

Tonya Leduc, BSc, BEd
Wilfrid Laurier University

Dear Bruce County Paramedic,
You recently received an information package from me in your internal mailbox at the service. The package contained a survey that I am conducting as part of a study entitled "**Factors influencing influenza vaccination rates among rural Ontario paramedics".** The purpose of this study is to determine the frequency of Influenza A vaccinations among paramedics employed with rural Ontario EMS services. I would like to take this opportunity to thank those individuals who have completed and returned their survey. If you have not had an opportunity to complete your survey, your cooperation in doing so would be greatly appreciated. The survey takes approximately 15 minutes to complete and can be returned directly to me in a self-addressed stamped envelope (provided in the package). It would be greatly appreciated if all completed surveys were returned as soon as possible. Thank you again for your time and cooperation.

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For more information about this study, please contact me via email at ledu2930@mylaurier.ca or via telephone at (519) 884-1970 x2002.

Thank you for your time,

Tonya Leduc, BSc, BEd
Wilfrid Laurier University

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Dear Perth County Paramedic,
You recently received an information package from me in your internal mailbox at the service. The package contained a survey that I am conducting as part of a study entitled "**Factors influencing influenza vaccination rates among rural Ontario paramedics".** The purpose of this study is to determine the frequency of Influenza A vaccinations among paramedics employed with rural Ontario EMS services. I would like to take this opportunity to thank those individuals who have completed and returned their survey. If you have not had an opportunity to complete your survey, your cooperation in doing so would be greatly appreciated. The survey takes approximately 15 minutes to complete and can be returned directly to me in a self-addressed stamped envelope (provided in the package). It would be greatly appreciated if all completed surveys were returned as soon as possible. Thank you again for your time and cooperation.

This study has been reviewed and approved by the University Research Ethics Review Board and Wilfrid Laurier University.

For more information about this study, please contact me via email at ledu2930@mylaurier.ca or via telephone at (519) 884-1970 x2002.

Thank you for your time,

Tonya Leduc, BSc, BEd
Wilfrid Laurier University

Dear Haliburton County Paramedic,
You recently received an information package from me in your internal mailbox at the service. The package contained a survey that I am conducting as part of a study entitled "**Factors influencing influenza vaccination rates among rural Ontario paramedics".** The purpose of this study is to determine the frequency of Influenza A vaccinations among paramedics employed with rural Ontario EMS services. I would like to take this opportunity to thank those individuals who have completed and returned their survey. If you have not had an opportunity to complete your survey, your cooperation in doing so would be greatly appreciated. The survey takes approximately 15 minutes to complete and can be returned directly to me in a self-addressed stamped envelope (provided in the package). It would be greatly appreciated if all completed surveys were returned as soon as possible. Thank you again for your time and cooperation.

This study has been reviewed and approved by the University Research Ethics Review Board and Wilfrid Laurier University.

For more information about this study, please contact me via email at ledu2930@mylaurier.ca or via telephone at (519) 884-1970 x2002.

Thank you for your time,

Tonya Leduc, BSc, BEd
Wilfrid Laurier University

# Appendix I

**Table 11: Independent Variables Used in the Analyses of EMS Data**

| Section | Variable Name | Variable Label | Description | Values: Labels and Codes |
|---|---|---|---|---|
| | QUESID | Questionnaire Identifier | | 7-digit ID |
| Socio-Demographic Information | A1 | Gender | Male, female or transgender | 0=male; 1= female; 2=transgender; leave blank if no data |
| | A2 | Birth date | Participant birth date | 8-digit numeric birth date |
| | A3 | Marital Status | Participant marital status at the time of questionnaire | 0=single; 1=married/partner/common-law; 2=divorced; 3=separated; 4=widowed; leave blank if no data |
| | A4 | Education | Highest level of education achieved by participant | 0=high school; 1= trade/technical school; 2= community college/non-university certificate; 3=associate degree; 4=bachelor's degree; 5=professional degree; 6= graduate degree; 7=post-graduate degree; leave blank if no data |
| Employment Status | B5 | Paramedic Skill Level | The paramedic level obtained by participant. | 0=Primary Care; 1=Advanced Care; 2=Critical Care; leave blank if no data |
| | B6 | Employment Level | Is the participant employed at their skill (e.g., PCP, ACP, CCP)? | 0=no; 1=yes; leave blank if no data |
| | B7 | Employment Multi-location | Is participant employed at more than one EMS location? | 0=no; 1=yes; leave blank if no data |

**Independent Variables Used in the Analyses of EMS Data cont'd**

| Section | Variable Name | Variable Label | Description | Values: Labels and Codes |
|---|---|---|---|---|
| Employment Status (cont'd) | B8 | Current Employment Status | The level of current employment. | 0=part-time; 1=full-time; 2=casual employment; 4=other; leave blank if no data |
| | B8a | Years of Full-Time Employment | The number of years at which the paramedic has held full-time employment | Continuous variable<br><br>Also coded as a categorical variable; 0=less than 1 year; 1-5 years; 2=6-10 years; 3=1-15 years; 4=16-20 years, 5=20-25 years; 6=26-30 years; 7=30+ years; leave blank if no data |
| | B9 | Current Work Schedule | The currently held work schedule of the participant. | 0= regular-day; 1=regular-evening; 2=regular-night; 3=rotating; 4=split; 5=other; leave blank if no data |
| Seasonal Vaccination History | C10a | 09/10 H1N1 Vaccination Status | 09/10 H1N1 vaccination status of the participant. | 0=no; 1=yes; 2=can't remember; leave blank if no data |

**Independent Variables Used in the Analyses of EMS Data cont'd**

| Section | Variable Name | Variable Label | Description | Values: Labels and Codes |
|---|---|---|---|---|
| Seasonal Vaccination History (cont'd) | C10b | Location of the 09/10 H1N1 Shot | The location where the participant received their H1N1 in 09/10. | 0=workplace; 1=public health office; 2=community clinic; 3=family physician; 4=other; leave blank if no data |
| | C10c | Employer Notification of H1N1 Shot | Was their employer notified that they received their H1N1 shot? | 0=no; 1=yes; leave blank if no data |
| | C10da | Reasons for H1N1 Shot | Employer requested? | 0=no; 1=yes |
| | C10db | | Physician recommended? | 0=no; 1=yes |
| | C10dc | | Increased risk of H1N1? | 0=no; 1=yes |
| | C10dd | | Required for all HCWs? | 0=no; 1=yes |
| | C10de | | Reduce risk of transmission to patients? | 0=no; 1=yes |
| | C10df | | Reduce risk of getting flu? | 0=no; 1=yes |
| | C10dg | | Reduce risk of transmission to family? | 0=no; 1=yes |
| | C10dh | | Previous flu/self-protection? | 0=no; 1=yes |
| | C10di | | Other? | 0=no; 1=yes |
| | C10ea | Reasons for Declining the H1N1 Shot | Egg allergy? | 0=no; 1=yes |
| | C10eb | | Results in flu-like illness? | 0=no; 1=yes |
| | C10ec | | Previous pain? | 0=no; 1=yes |
| | C10ed | | Exposed/never sick? | 0=no; 1=yes |
| | C10ee | | Allergic reaction? | 0=no; 1=yes |
| | C10ef | | Fear of needles? | 0=no; 1=yes |
| | C10eg | | Not convinced of H1N1 severity? | 0=no; 1=yes |
| | C10eh | | Potential side effects? | 0=no; 1=yes |
| | C10ei | | Skeptical of effectiveness? | 0=no; 1=yes |
| | C10ej | | Past vaccinated/flu? | 0=no; 1=yes |
| | C10ek | | Other? | 0=no; 1=yes |

**Independent Variables Used in the Analyses of EMS Data cont'd**

| Section | Variable Name | Variable Label | Description | Values: Labels and Codes |
|---|---|---|---|---|
| Seasonal Vaccination History (cont'd) | C11a *(repeats for all years, C12a C13a C14a* | 09/10 Seasonal Flu Vaccination Status | The 09/10 seasonal flu vaccination status of the participant. | 0=no; 1=yes; leave blank if no data |
| | C11b *(repeats for all years, C12b C13b C14b* | Location of the 09/10 Seasonal Flu Shot | The location where the participant received their seasonal flu shot in 09/10. | 0=workplace; 1=public health office; 2=community clinic; 3=family physician; 4=other; leave blank if no data |
| | C11c *(repeats for all years, C12c C13c C14c* | 09/10 Employer Notification of Seasonal Flu Shot | Was their employer notified that they received their seasonal flu shot? | 0=no; 1=yes; leave blank if no data |
| | C11d *(repeats for all years, C12d C13d C14d* | Reasons for Getting the Seasonal Flu Shot | The reasons why the participant chose to receive their seasonal flu shot. | |
| | C11da, C12da, C13da, C14da | | Employer requested? | 0=no; 1=yes |
| | C11db, C12db, C13db, C14db | | Physician recommended? | 0=no; 1=yes |
| | C11dc, C12dc C13dc,C14dc | | Increased risk of H1N1? | 0=no; 1=yes |
| | C11dd, C12dd C13dd, C14dd | | Required for all HCWs? | 0=no; 1=yes |
| | C11de, C12de C13de, C14de | | Reduce risk of transmission to patients? | 0=no; 1=yes |
| | C11df, C12df C12df, C14df | | Reduce risk of getting flu? | 0=no; 1=yes |
| | C11dg, C12dg C13dg, C14dg | | Reduce risk of transmission to family? | 0=no; 1=yes |
| | C11dh, C12dh, C13dh, C14dh | | Previous flu/self-protection? | 0=no; 1=yes |
| | C11di, C12di C13di, C14di | | Other? | 0=no; 1=yes |

**Independent Variables Used in the Analyses of EMS Data cont'd**

| Section | Variable Name | Variable Label | Description | Values: Labels and Codes |
|---|---|---|---|---|
| Seasonal Vaccination History (cont'd) | C11e, *(repeats for all years, C12e, C13e, C14e* | Reasons for Not Getting the Seasonal Flu Shot | The reasons why the participant chose to not to receive their seasonal flu shot in 09/10. | |
| | C11ea, C12ea, C13 ea, C14ea | | Egg allergy? | 0=no; 1=yes |
| | C11eb, C12eb, C13eb, C14eb | | Results in flu-like illness? | 0=no; 1=yes |
| | C11ec, C12ec, C13ec, C14ec | | Previous pain? | 0=no; 1=yes |
| | C11ed, C12ed, C13ed, C14ed, | | Exposed/never sick? | 0=no; 1=yes |
| | C11ee, C12ee, C13ee, C14ee | | Allergic reaction? | 0=no; 1=yes |
| | C11ef, C12ef, C13ef, C14ef | | Fear of needles? | 0=no; 1=yes |
| | C11eg, C12eg, C13eg, C14eg | | Not convinced of flu severity? | 0=no; 1=yes |
| | C11eh, C12eh, C13eh, C14eh | | Potential side effects? | 0=no; 1=yes |
| | C11ei, C12ei, C13ei, C14ei | | Skeptical of effectiveness? | 0=no; 1=yes |
| | C11ej, C12ej, C13ej, C14ej | | Past vaccinated/flu? | 0=no; 1=yes |
| | C11ek, C12ek, C13ek, C14ek | | Other? | 0=no; 1=yes |
| Previous Experience with Influenza | D15 | Flu-like Symptoms in Past Year | Were flu-like symptoms experienced by the paramedic in the past year? | 0=no; 1=yes; leave blank if no data |
| | | Signs of Flu | The signs and symptoms experienced by the paramedic during the time of flu-like illness | |
| | D16a | | Fever? | 0=no; 1=yes |
| | D16b | | Dry cough? | 0=no; 1=yes |
| | D16c | | Muscle pain? | 0=no; 1=yes |
| | D16d | | Vomiting? | 0=no; 1=yes |
| | D16e | | Headache? | 0=no; 1=yes |
| | D16f | | Diarrhea? | 0=no; 1=yes |
| | D16g | | Productive cough? | 0=no; 1=yes |
| | D16h | | Abdominal pain? | 0=no; 1=yes |

**Independent Variables Used in the Analyses of EMS Data cont'd**

| Section | Variable Name | Variable Label | Description | Values: Labels and Codes |
|---|---|---|---|---|
| Previous Experience with Influenza (cont'd) | D16i | Signs of Flu (cont'd) | Respiratory distress/wheezing? | 0=no; 1=yes |
| | D16j | | Raised rash? | 0=no; 1=yes |
| | D16k | | Increased thirst? | 0=no; 1=yes |
| | D16l | | Seizures? | 0=no; 1=yes |
| | D16m | | Other? | 0=no; 1=yes |
| | D16b | Severity of Flu Symptoms | The severity of the flu-like symptoms experienced by the participant. | 0=mild; 1=moderate; 2=severe; leave blank if no data |
| | D16c | Anti-viral medication | Was anti-viral medication administered during illness? | 0=no; 1=yes; leave blank if no data |
| | D17a | Missed days at work | Were days missed from work during illness? | 0=no; 1=yes; leave blank if no data |
| | D17b | Number of days at work missed? | The number of days missed from work as a result of illness | Categorical variable<br><br>0=less than 1 full work day; 1=1-2 work days; 2=3-7 work days; 3=11-15 work days; 4=more than 15 work days; leave blank if no data |
| | D18 | Participant knowledge of signs/ symptoms of H1N1 | | |
| | D18a | | Fever? | 0=no; 1=yes |
| | D18b | | Dry cough? | 0=no; 1=yes |
| | D18c | | Muscle pain? | 0=no; 1=yes |
| | D18d | | Vomiting? | 0=no; 1=yes |
| | D18e | | Headache? | 0=no; 1=yes |
| | D18f | | Diarrhea? | 0=no; 1=yes |
| | D18g | | Productive cough/congestion? | 0=no; 1=yes |
| | D18h | | Abdominal pain? | 0=no; 1=yes |
| | D18i | | Respiratory distress? | 0=no; 1=yes |
| | D18j | | Raised rash? | 0=no; 1=yes |
| | D18k | | Increased thirst? | 0=no; 1=yes |
| | D18l | | Seizures? | 0=no; 1=yes |

**Independent Variables Used in the Analyses of EMS Data cont'd**

| Section | Variable Name | Variable Label | Description | Values: Labels and Codes |
|---|---|---|---|---|
| Previous Experience with Influenza (cont'd) | | Participant knowledge of signs/symptoms of seasonal influenza A | | |
| | D20a | | Fever? | 0=no; 1=yes |
| | D20b | | Dry cough? | 0=no; 1=yes |
| | D20c | | Muscle pain? | 0=no; 1=yes |
| | D20d | | Vomiting? | 0=no; 1=yes |
| | D20e | | Headache? | 0=no; 1=yes |
| | D20f | | Diarrhea? | 0=no; 1=yes |
| | D20g | | Productive cough/congestion? | 0=no; 1=yes |
| | D20h | | Abdominal pain? | 0=no; 1=yes |
| | D20i | | Respiratory distress? | 0=no; 1=yes |
| | D20j | | Raised rash? | 0=no; 1=yes |
| | D20k | | Increased thirst? | 0=no; 1=yes |
| | D20l | | Seizures? | 0=no; 1=yes |
| | | Paramedic hand hygiene | Participant hand hygiene practices | |
| | D21a | | Beginning of shift? | 0=no; 1=yes |
| | D21b | | During and after PPE removal? | 0=no; 1=yes |
| | D21c | | Before invasive procedures? | 0=no; 1=yes |
| | D21d | | After vehicle cleaning? | 0=no; 1=yes |
| | D21e | | After patient contact? | 0=no; 1=yes |
| | D21f | | Before leaving LTC facility? | 0=no; 1=yes |
| | D21g | | Before patient contact? | 0=no; 1=yes |
| | D21h | | After cleaning equipment? | 0=no; 1=yes |
| | D21i | | Before leaving ED? | 0=no; 1=yes |
| | D21j | | End of shift? | 0=no; 1=yes |
| | D21k | | Before and after handling food? | 0=no; 1=yes |
| | D21l | | Other? | 0=no; 1=yes |
| | D22 | Correct sequence of PPE? | Participant knowledge of correct sequence of PPE donning protocol | 0= none correct; 1= one correct; 2= two correct; 3= three correct, 4=four correct, 5=five correct, 6= all correct; leave blank if no data |

**Independent Variables Used in the Analyses of EMS Data cont'd**

| Section | Variable Name | Variable Label | Description | Values: Labels and Codes |
|---|---|---|---|---|
| Previous Experience with Influenza (cont'd) | D22 | Patients referred to hospital for flu | Number of patients referred to the hospital for flu-like symptoms | Coded as categorical variable<br><br>0=0; 1=1-10; 2=11-20; 3=21-30; 4=31-40; 5=41+; 6=don't know; leave blank if no data |
| | D23 | Paramedic knowledge of flu transmission mode | Paramedic knowledge of flu transmission | 0=droplet only; 1=contact only; 2=airborne only; 3=droplet/contact; 4=contact/airborne; 5=droplet/airborne; 6=droplet/airborne/contact; 7=don't know; leave blank for no data |
| | D24 | Participant knowledge of flu transmission timeline | Participant knowledge of flu transmission timeline | 0=immediately; 1=1-2 days; 2=3-5 days; 3=6+ days; 4=don't know; leave blank if no data |
| | D25 | Participant knowledge of flu vaccine protection timeline | Participant knowledge of flu vaccine protection timeline | 0=less than 6 months;1=1-6 months; 2=6-11 months; 3=12-23 months; 4=no protection; 5=don't know; leave blank if no data |
| Opinions Regarding the Flu Shot | E26 | Opinions Regarding the Flu Shot<br><br>Strongly agree and agree recoded as 1, Disagree and strongly disagree were recoded as 0. Neutral was omitted from analysis. | Employer Provides Shot Access | 0=strongly agree, 1=agree; 2=neutral; 3=disagree; 4=strongly disagree; leave blank if no data |
| | E27 | | Seasonal Flu Shot Safe | 0=strongly agree, 1=agree; 2=neutral; 3=disagree; 4=strongly disagree; leave blank if no data |
| | E28 | | H1N1 Flu Shot Safe | 0=strongly agree, 1=agree; 2=neutral; 3=disagree; 4=strongly disagree; leave blank if no data |
| | E29 | | Seasonal Flu Shot is Effective | 0=strongly agree, 1=agree; 2=neutral; 3=disagree; 4=strongly disagree; leave blank if no data |
| | E30 | | H1N1 Flu Shot is Effective | 0=strongly agree, 1=agree; 2=neutral; 3=disagree; 4=strongly disagree; leave blank if no data |

**Independent Variables Used in the Analyses of EMS Data cont'd**

| Section | Variable Name | Variable Label | Description | Values: Labels and Codes |
|---|---|---|---|---|
| Opinions Regarding the Flu Shot (cont'd) | E31 | Opinions Regarding the Flu Shot (cont'd) | Seasonal Flu Shot Prevents the Flu | 0=strongly agree, 1=agree; 2=neutral; 3=disagree; 4=strongly disagree; leave blank if no data |
| | E32 | | H1N1 Flu Shot Prevents the Flu | 0=strongly agree, 1=agree; 2=neutral; 3=disagree; 4=strongly disagree; leave blank if no data |
| | E33 | | Employer Encourages Shot | 0=strongly agree, 1=agree; 2=neutral; 3=disagree; 4=strongly disagree; leave blank if no data |
| | E34 | | Pressure at Work to Receive Shot | 0=strongly agree, 1=agree; 2=neutral; 3=disagree; 4=strongly disagree; leave blank if no data |
| | E35 | | Flu Shot is Important | 0=strongly agree, 1=agree; 2=neutral; 3=disagree; 4=strongly disagree; leave blank if no data |
| | E36 | | Encourages Others to Receive Shot | 0=strongly agree, 1=agree; 2=neutral; 3=disagree; 4=strongly disagree; leave blank if no data |
| | E37 | | Exposed to Flu often/Don't Need Shot | 0=strongly agree, 1=agree; 2=neutral; 3=disagree; 4=strongly disagree; leave blank if no data |
| | E38 | | Only Symptomatic Individuals Transmit Flu | 0=strongly agree, 1=agree; 2=neutral; 3=disagree; 4=strongly disagree; leave blank if no data |
| | E39 | | TamiFlu® and other Anti-Virals Reduce Need for Flu Shot | 0=strongly agree, 1=agree; 2=neutral; 3=disagree; 4=strongly disagree; leave blank if no data |
| | E40 | | Proper PPE Reduces Need for Flu Shot | 0=strongly agree, 1=agree; 2=neutral; 3=disagree; 4=strongly disagree; leave blank if no data |

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