Improving the Safety of EMS Personnel in the Patient Compartments of Violet Township Fire Department EMS Transport Vehicles

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CERTIFICATION STATEMENT

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ABSTRACT

The problem this study will investigate is how to safely secure Violet Township Fire Department (VTFD) personnel during EMS transports, while maintaining sufficient operational mobility. The purpose of this project is to identify and to describe restraint options that will guide the VTFD in decision making that can improve the safety of crew members while performing patient care during EMS transport. The research design consisted of three segments: an internal survey of the VTFD membership, the review of the current styles and trends in ambulance manufacturing, and an examination of the ambulances of neighboring jurisdictions.

Research Questions

The following questions will be answered by this evaluative research:

1. What options are available to restrain EMS/firefighter personnel, while still allowing the needed mobility for patient care?
2. What are other fire departments doing to address this same problem?
3. What can the VTFD do to improve the safety of its current EMS transport vehicles?
4. What engineering options are available and could be utilized to provide increased occupant safety in future VTFD EMS transport vehicles?

The internal survey identified the occupational habits and tendencies of the VTFD EMS crews. The survey identified that the EMS crews in the VTFD ambulances were riding in the side-facing bench seats 93% of the time. The survey further found mobility as the factor most likely to dictate seatbelt use by the patient attendant during transport. There was a 35% reduction in seatbelt usage when transporting critical or unstable patients. The answers to the survey remained largely unaffected by time on the department or years of EMS experience. A review of several ambulance manufacturers found growing trends towards the development of

safer vehicles. A look at nearby fire departments revealed few safety enhancements to their ambulances.

Recommendations for improving crewmember safety during EMS transport:

1) Upgrade the existing lap belt restraints in the current medics.
2) Continue researching ways to improve existing and future EMS vehicles.
3) Establish a committee to redesign the VTFD ambulance of the future.
4) Increase education/awareness of the VTFD.
5) Incorporate emergency vehicle driver's training into the department's routine.
6) Adjust the placement of supplies and equipment in the current ambulances to reflect the needs and or limitations of a single attendant

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INTRODUCTION

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To teach and to promote safety, firefighters and emergency medical services (EMS) personnel should practice safety as well! The Violet Township Fire Department (VTFD) has worked diligently to provide effective and efficient emergency services, while maintaining a positive example in the community. These efforts have included sophisticated tools, equipment and training. It has also included rules and policies designed to promote and to protect the safety and welfare of the firefighters and EMS personnel, enabling them to better serve the community. An example of these efforts in the VTFD has been the implementation of a seatbelt policy.

The VTFD seatbelt policy exists to protect the members of the department. The policy strictly and simply states that when a department vehicle is in motion, its occupants must be seated and must utilize properly the provided safety restraints. Augmentations were made to seats and seatbelt appliances in the fire engines and rescue vehicles to make them both easier to use and current with the latest standards (lap belts replaced with shoulder harness and lap belt configurations). Wearing seatbelts has become second nature when members of the VTFD are riding on fire apparatus and in the cabs of the EMS transport vehicles (medics). However, fire and EMS personnel are not typically wearing their seatbelts when attending to patients in the rear of the medics during transports.

The problem this study investigates is how to safely secure VTFD personnel during EMS transports, while maintaining sufficient operational mobility. The members of the VTFD have not been defiantly violating the seatbelt policy. The interior layouts of the existing medics and the seatbelt configurations in the patient compartments prohibit the movements and limit the reach required by the EMS personnel. In order to access needed equipment and to perform

necessary procedures, the VTFD personnel have had to remove their seatbelts. This takes place on a regular basis while the transport vehicles travel down the road. The problem is compounded when conditions call for additional personnel for transport. In cases where the patient has required advanced cardiac or trauma care, the unrestrained crew in the rear of a transporting medic may reach as high as four. Although accepted as necessary, the practice of not wearing safety restraints in the rear of the medics is a poor safety practice.

The significance of this study is to identify and to correct the factors and behaviors which prevent VTFD crew members from fastening their safety belts in the back of the medics. We can apply the gathered member input and enrich it with the technology and designs of the ambulance manufacturers. The study then potentially impacts how current and future medics are set up and designed. The goal is to ultimately create a configuration that provides maximum crew safety and versatility while allowing for the required patient care and comfort. These new layouts and designs are incomplete without the acceptance of a cultural change. Safety is an attitude, which must be supported by education and repetition. New safety hardware has little impact if we do not create the habits which incorporate its use.

Purpose of the Study

The purpose of this project is to identify and to describe restraint options that will guide the VTFD in decision making that can improve the safety of crew members while performing patient care during EMS transport.

Research Questions

The following questions will be answered by this evaluative research:

1 What options are available to restrain EMS/firefighter personnel, while still allowing the needed mobility for patient care?
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4. What engineering options are available and could be utilized to provide increased occupant safety in future VTFD EMS transport vehicles?

BACKGROUND AND SIGNIFICANCE

The Violet Township Fire Department, established in 1954, covers an area of approximately 40 square miles. Located in the northwest corner of Ohio's Fairfield County, Violet Township includes the entire city of Pickerington and portions of the city of Reynoldsburg and the village of Canal Winchester. Crossing within the township boundaries are two interstate highways, two state routes, and two railways. Throughout its history, most of Violet Township remained primarily a rural farming community. In the late 1970s, Violet Township's proximity to Columbus caused a population boom that continues through the new millennium. Predictions from the 2004 census, estimate the current township population has exceeded 35,000 residents (Office of Strategic Research 2004). Currently, the community is mainly residential with increasing development of light industrial and commercial properties.

The VTFD was an all-volunteer organization until 1986 when a full-time fire chief and four full-time paid firefighters were hired. These initial salaried members augmented the

volunteer staff by working from 08:00 until 16:30, Monday through Friday. In 1989, nine additional firefighters were hired. This created a three platoon/shift system, where the firefighters worked 24 hours on duty, and then they had forty-eight hours off. The VTFD continues to grow, and currently operates three stations, with 42 full-time employees, 20 part-time firefighters, and 10 volunteer members. In 2007, the VTFD responded to 4,383 emergency and fire runs (VTFD run data 2008). The majority of these emergency calls (3,464) were EMS related.

In recent years, the VTFD has placed an emphasis on reducing accidents and injuries. The department has employed a physical therapist to evaluate and to improve the firefighters' body mechanics and ergonomics while performing their duties. An accident review committee has been established, and a health and wellness initiative is underway. Enhancements have been made to seats, seatbelts, self-contained breathing apparatus (SCBA) brackets, and tool mounts in the cabs of all of the vehicles. Injuries have decreased, and risk awareness is growing.

In the spring of 2006, while transporting a non-breathing patient to the hospital, Medic 592 of the VTFD was struck broadside in an intersection. Fortunately, nobody was hurt. However, this incident highlighted the vulnerability of the EMS crew working in the back of a moving medic. With all of the emphasis on safety, the department is unable to discover a solution for safely restraining EMS personnel, while allowing them to provide effective treatment in the rear of the medics. The department has not sustained any major injuries due to this unmitigated risk, but over the past 20 years, there have been numerous minor injuries and close calls. This research could provide information, solutions and enhancements that will reduce the stated risks and potentially prevent significant incidents and injuries.

LITERATURE REVIEW

"Predictable and preventable" has become the battle cry of risk analysis. The identification, removal, or avoidance of hazards has become a systematic and daily routine in most corporate and industrial settings. Reducing injuries, litigations and lost revenue are some of the major themes that drive this concept. The fire service responds to the principles of risk analysis through the National Fallen Firefighters (NFFF) 16 Life Safety Initiatives. In short, the Life Safety Initiatives challenged the fire service to embrace an attitude based on safety not just tradition (NFF LS I 2004). Change to an organization or service so rich in tradition and history does not come easily. As progress and corrections have been made in some areas, new issues and concerns emerge in others.

Improving the safety of fire department based EMS is a high priority. While reviewing occupational fatalities in EMS, Maguire, Hunting, Smith and Levick (2002) discovered that between 1992 and 1997, the fatality rate of EMS personnel in the United States was 12.7 out of 100,000 workers. This rate was more than twice the national average. These fatality numbers were very similar to that of law enforcement and firefighting. The leading cause of occupational EMS fatalities during this period was transportation incidents. Although the data was incomplete, it did suggest that the patient compartments of ambulances were high-risk environments. Reinforcing this finding, Becker, Zaloshnja, Levick and Miller (2003) stated that the most dangerous part of the ambulance vehicle is the rear patient compartment. They attributed this to "hostile interior surfaces, hazardous head strike zones, poor design of the interior layout, and a non-crashworthy compartment."

In comparison to its emergency service siblings, law enforcement and the fire service, EMS is an infant. Emergency care and transport became a standardized part of the public and private sector in the last 30 to 35 years. Its origins can be traced to morticians using their hearse to transport injured or ill patients to a higher level of medical care. The designs of early ambulances were a direct reflection of their hearse ancestry. Ambulance designs have progressed over the years from modified station wagons to commercially built vans and cab chassis with modular bodies. Over the past 20 years, however, the patient compartments of ambulances have not significantly changed. Linoleum and formica have been exchanged for composites and stainless steel, but the overall layout and designs have remained relatively the same. Levick (2006) states that although the tools, skills, and procedures of paramedics have improved and expanded, the environment in which they are commonly applied has not. Despite the enormous and luxurious advancements the automotive industry has made to recreational, commercial, and personal vehicles over the last 30 years, most of this knowledge and capability has not been significantly implemented to the safety of ambulance vehicles. Questions and evaluations concerning the safety of EMS transport vehicles (and products in that environment) have been limited to opinion and to peer review.

Regardless of the research source, one finding has been clearly repeated; EMS personnel are not wearing their seatbelts while riding in the patient compartment of ambulances. A study by Johnson, Lindholm and Dowd (2006) surveyed the EMS providers in two large ambulance service organizations and a hospital based pediatric transport ambulance service. The study received responses from 67.7% of EMS providers surveyed. Nearly one-half of those answering the survey stated that they had been involved in an ambulance crash. Two- thirds of those EMS providers stated in the survey that they did not wear their seatbelts when sitting on the squad

bench in the patient compartment. Fifty percent of the survey group reported that they believed seatbelts interfered with patient care; however, 95% of those responding stated that they wore their seatbelts in the cabs of the medics. The study data determined that seatbelt usage in the patient compartment was unaffected by age or experience. It further stated that being in a previous ambulance accident had no bearing on whether or not a seatbelt was currently worn. The study concluded that EMS personnel did not appreciate the frequency of ambulance accidents and the potential for injury. Alarmingly, there is approximately one ambulance crash fatality in the United States each week, and a number of additional serious injuries per fatality (Becker et al., 2003).

A report from the Center for Disease Control (CDC) by Proudfoot, Romano, Bobick, and Moore (2003) states that lap-style seatbelt restraints installed on the squad bench in most ambulances are ineffective. It describes the belts as limiting the mobility and reach of the EMS attendant, preventing him/her from having access to the patient, equipment, and compartments. The CDC further recommends that EMS employers ensure that EMS workers use these ineffective restraints whenever possible. To make matters worse, an Australian military study found that the side- facing squad benches found in most American ambulances are a hazardous mode of occupant transport (Richardson, Grzebieta and Zou, 1999).

Recommendations from NIOSH (2005), which reviewed a fatal Florida ambulance accident, calls for ambulance manufacturers and standard setting bodies to continue to improve the design, construction, and features of ambulance patient compartments.
The goal of this recommendation is to increase occupational survivability. The reports stated that occupant restraint systems, such as a lap and shoulder belt, have proven to aid crash

survivability. This was relative to the passenger compartment of the ambulance being able to maintain structural integrity during the crash.

Within the USA, there are minimal safety standards or dynamic crash testing guidelines, which adequately pertain to ambulances. The patient compartment of an ambulance is largely exempt from Federal Motor Vehicle Safety Standards (FMVSS). A National Highway Transportation Safety Administration standard described as "Lab or Test Procedure for FMVSS No. 14 'Dynamic' Side Impact Protection" (2006) specifies performance requirements for the protection of vehicle occupants in side impact collisions. The standard specifies strength requirements for side doors of passenger cars, multi-purpose passenger vehicles, trucks, and buses with GVWR of 2721.6 kg (6000 lbs.) or less. The standard exempts ambulances, rescue/medical, and firefighting vehicles.

The American National Standards Institute / American Society of Safety Engineering (ANSI/ASSE) (2006) Fleet Safety Standard, developed in 2006, may possibly be the only nationally approved fleet safety standard that is applicable to EMS vehicles in the United States. It requires that vehicles be "crash-worthy and safe," yet it does not establish or define any standards (Levick & Grzebieta, 2007). The General Service Administrations KKK (GSA-KKK) (2007) Ambulance Vehicle Specification Guideline, Version "F", is a federal standard for the purchase specifications of new ambulances. It has voluntary compliance. Instead of requiring dynamic crash testing, the GSA-KKK calls for static tests. Static testing typically consists of a modular ambulance body undergoing acceleration/deceleration sled testing at reduced levels. This is not usually performed by an independent testing facility. Simply put, the standard is neither thorough nor harsh enough in its testing. Levick and Grzebieta (2007) argue that EMS transport vehicles require crash testing at higher velocities and increased G forces.

There is evidence of a high frequency of frontal impact, right side impact, and roll-over damage in motor vehicle accidents involving medics. This type of damage is typical of intersection collisions. To test the structural reliability of modular style medics commonly used across the USA, dynamic testing should include true impact, deformation, and intrusion conditions. In theory, this type of dynamic testing will produce a more accurate safety assessment of ambulance construction and durability.

The literature review suggests that further research needs to be conducted with ambulance manufacturers. What design improvements are forthcoming? What are the solutions? Like many aspects of the fire service, answers do not come easily. Research and change are expensive. Protecting the EMS personnel in the rear of the VTFD medics will not be as simple as buying new seatbelts and harnesses. An overall improvement of the layout, equipment placement, and compartmentalization will have to be addressed. It is as much a change in attitude and philosophy as it is in hardware.

Without improving attitudes and awareness, EMS workers will minimize the improvements made in safety standards, crash testing, and design of ambulances. Properly securing loose equipment and latching doors and drawers significantly reduces injury hazards. A portion of the process for improving crew safety in the rear of the medic begins with improving the attentiveness and capabilities of the driver in the front of the medic. Many fatal and injurious accidents are occurring in intersections. As stated, the lack of seatbelt use has been a predominant cause of these injuries and deaths. It has also been documented that the cause of these accidents has often been the failure of ambulances to yield or to come to a complete stop prior to entering intersections (Becker et al., 2003). The reduction of ambulance-related accidents will ultimately reduce deaths and injuries to EMS workers.

PROCEDURES

The research design consisted of three segments: an internal survey of the VTFD membership, the review of the current styles and trends in ambulance manufacturing and an examination of the ambulances of neighboring jurisdictions. The intent of the selected procedures was to discover and to understand the characteristics of the VTFD personnel and to research the options, trends and practices of ambulance builders and other EMS providers.

The internal survey was initially pilot-tested by department officers. A final version of the survey was hand distributed to 64 department members. The survey consisted of 10 closed ended questions pertaining to the experiences and tendencies of the VTFD personnel while performing their duties onboard the medics. One additional question sought the respondent's opinion(s) or insights on potential changes to the department's EMS transport vehicles. Of the 64 surveys handed out, 57 (89%) were completed and returned.

In order to review the latest trends in ambulance manufacturing, a two-step product review was conducted. Attending the 2009 Fire Department Instructors Conference (FDIC) in Indianapolis, Indiana in April of 2009 provided an opportunity to create contacts and see first hand the newest styles and ideas in ambulance manufacturing. Additionally, on-site trips to ambulance manufacturers provided insight into construction and fabrication methods, as well as current designs by other agencies.

The final research procedure consisted of an inspection/comparison of the ambulances of the fire departments surrounding Violet Township. These departments are of similar size, run volume, and population. These agencies also have ambulances of various ages and different manufacturers. By personally examining the neighboring transport vehicles and talking to their personnel, I witnessed their safety perspectives as related to devices and layout of their medic

vehicles. Although this was an external view of the way other agencies were addressing safety in the patient compartments of their ambulances, it remained a focused look at the local region.

Definition of Terms

- Ambulance. The ambulance is defined as a vehicle for emergency medical care which provides: a driver's compartment; a patient compartment to accommodate an emergency medical technician (EMT)/paramedic and two litter patients (one patient located on the primary cot and a secondary patient on a folding litter located on the squad bench) so positioned that the primary patient can be given intensive life-support during transit; equipment and supplies for emergency care at the scene as well as during transport.
- American Society of Safety Engineering. Founded in 1911, ASSE is the oldest and largest professional safety organization. Its members manage, supervise and consult on safety, health, and environmental issues in industry, insurance, government and education.
- American National Standards Institute (ANSI). The Institute oversees the creation, promulgation and use of thousands of norms and guidelines that directly impact businesses in nearly every sector: from acoustical devices to construction equipment. ANSI is also actively engaged in accrediting programs that assess conformance to standards – including globally-recognized cross-sector programs such as the ISO 9000 (quality) and ISO 14000 (environmental) management systems

- CDC. The Center for Disease Control: a federal agency in the Department of Health and Human Services; located in Atlanta; investigates and diagnoses and tries to control or prevent diseases.
- EMS. Abbreviation for emergency medical services
- GSA-KKK. document describing ambulances that are authorized to display the "Star of Life" symbol. It establishes minimum specifications, performance parameters and essential criteria for the design of ambulances and to provide a practical degree of standardization. The object is to provide ambulances that are nationally recognized, properly constructed and easily maintained .
- Medic. Short for paramedic, a person trained in advanced first aid and advanced life-saving measures. Term used regionally, synonymous with ambulance or emergency transport vehicle.
- The National Institute for Occupational Safety and Health (NIOSH). is the United States federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness. NIOSH is part of the Centers for Disease Control and Prevention (CDC) within the US Department of Health and Human Services.
- Patient Compartment. The rear, interior area of an ambulance, where the patient is securely placed during treatment and transport to or from a medical facility.

Limitations of the Study

- This study was designed for one specific fire department in central Ohio. It may not be applicable to other EMS agencies or fire departments in other regions.
- This study is primarily focused on improving the attendants' ability to use safety restraints in the patient compartment of EMS transport vehicles. There are many aspects of ambulance safety, which were minimally discussed.

RESULTS

The internal survey identified the occupational habits and tendencies of the VTFD EMS crews. The obtained information illustrated compliance or noncompliance of the seatbelt policy. Identifying the factors dictating seatbelt use focused the research questions on applicable results. The survey identified that the EMS crews in the VTFD ambulances were riding in the side-facing bench seats 93% of the time. The survey further found mobility as the factor most likely to dictate seatbelt use by the patient attendant during transport. There was a 35% reduction in seatbelt usage when transporting critical or unstable patients. The answers to the survey remained largely unaffected by time on the department or years of EMS experience.

The first research question asked to identify restraint options that provided increased safety and operational mobility to the patient attendant(s). This question was studied by attending the FDIC conference and interviewing manufacturer's representatives. Several ambulance builders were utilizing pedestal seats, which incorporated either a four-point or five-point breakaway harness. The harness allows the restrained occupant to lean forward while remaining belted at the waist. The shoulder straps were inertia sensitive, securing the attendant's torso upright in the seat upon the detection of a sudden stop or collision. These seats were mounted on either side of the patient compartment, often in lieu of the side-facing bench seats. Additionally, several of the ambulance

makers were installing the pedestal-style seats on track systems, which allowed the attendant to slide forward and back along the long axis

of the patient's body. This added to the attendant's mobility, while decreasing the need to remove his/her seatbelt.

The second research question asked what other fire departments were doing to improve the safety of crewmembers while performing patient care during transports. This question was addressed in two separate ways: learning from the manufacturers what safety designs or enhancements are being requested, and by examining the ambulances and policies of the surrounding departments. At FDIC, it was apparent that there was an increased emphasis on creating safer patient compartments. For example, MEDTEC responded to customer demands by developing its *ActionSafe Interior Configuration.* The MEDTEC design incorporates five point safety harnesses, arm's reach equipment and controls, increased head space, cabinets that are tapered and flared to reduce impact zones and additional padding throughout .(MEDTEC, 2008).

McCoy-Miller of Elkhart, IN has created a side-loading ambulance concept. First introduced at FDIC in 2008, McCoy Miller made slight modifications to the design for 2009. The unique model focuses on keeping the EMS crew facing inline with the ambulance's direction of travel. There are no side-facing seats. The attendants face either forward or backwards. There are accessible compartments and controls for all seated positions. The vehicle incorporates track mounted pedestal seating with integrated five-point harnesses.

While there were many safety oriented changes and designs present at FDIC, there were minimal differences noted by examining the ambulances of the fire departments surrounding Violet Township. All of the agencies were utilizing modular designed ambulances. Some were

purchased new, some were previously used or had been refurbished. They were built by six separate manufacturers. Most of the ambulances were 10 years old or less. The newer vehicles had some added safety features which were absent in the older trucks. These primarily included a mounting bracket for the heart monitors, better lighting and improved storage for oxygen bottles. All of the ambulances inspected had side-facing bench seats, and most employed only lap belts. None of the medics had dual action area controls (HVAC, lighting, oxygen) , thus requiring the attendant to move unrestrained back and forth across the patient compartment. Although each of the surrounding departments had seatbelt policies in place, none professed compliance during EMS transports. Further, there were no set standards or plans in place to rectify or acknowledge this as a safety concern.

The third research question asked what the VTFD could do to improve the safety of its current EMS transport vehicles. Replacing the restraint systems of the current VTFD ambulances with four- or five-point harness systems would improve upon the safety and mobility of restrained crewmembers. Comments from the VTFD survey participants revealed a correlation between seatbelt use and the staffing levels of the medic units.

Although somewhat enhanced over the past 11 years, the VTFD has used the same ambulance design and manufacturer since 1998. Creation of this template occurred when the typical ambulance crew was comprised of three members: one driver and two care-providers. The layout of the interior of the patient compartment reflected these staffing dynamics. Having two attendants during transports allowed for a separation of duties, placing specific controls or equipment within the reach of specific positions. The crewmember typically seated on the side-facing bench seat provided most hands-on treatment, while the additional crewmember typically sat at the patient's head, charting treatment, operating radios as well as the environmental and

systems controls. Approximately five years ago, the VTFD downsized the staffing levels on EMS units from three members to two. Several factors led to this change, including the opinions that a two-person crew could capably manage most of the department's EMS calls. The quality of the provided service to the patient did not decline due to this staffing change. The interior layout of the medics did not change either. The equipment, supplies, and controls remained in the same locations. Although this design proved effective for operations with two crew members, it was not operationally efficient for a single attendant. The lone attendant had to move about the interior of the patient compartment in order to reach and perform required tasks. It is essential that the design of the patient compartments be reconfigured to reflect the needs and limitations of a single attendant.

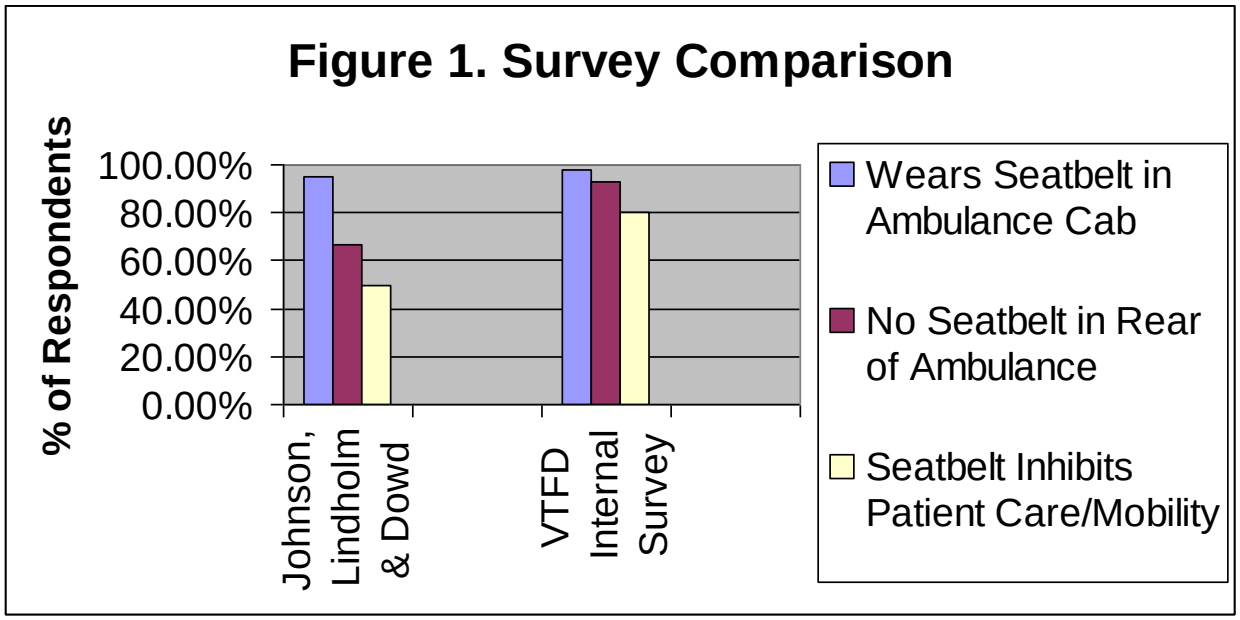
Question four asks what engineering options are available to improve the safety of future VTFD medics. The Fire Department Instructors Conference held several opportunities to research this question. Some of the new and safety-oriented designs previously discussed are obviously applicable. A Central Ohio ambulance manufacturer prepared a different plan. Horton Emergency Vehicles introduced its *Horton Occupant Protection System* (HOPS) at FDIC this year. It is the conclusion of 30 years of research, which introduces the use of airbags in the patient compartment of the ambulance. The Horton Occupant Protection System has employed extensive dynamic impact rollover testing, sled testing and direct impact crash testing. Tests were conducted to verify the integrity of body mounting, cabinet retention and seating stability. In addition to the inflatable air cushion system, HOPS improved the cushioned headrests throughout the vehicle with a progressive resistant cushion that dissipates the energy from impact such as a head strike (Horton, 2009).

Interviews with engineers of two Canadian ambulance manufacturers revealed more changes taking place on the northern side of the border. Both Demers and Crestline engineers stated that Canada has stricter construction and design specifications than the United States. Higher collision test loads, rounded corners, flush surfaces, and improved modular construction designs have been mandated to improve the safety of Canadian ambulances. By comparison, the interiors of the Canadian trucks appear to be very streamlined, simple, rugged and efficient.

DISCUSSION

It is widely known that fire suppression and EMS are dangerous professions. There are hazardous aspects of these occupations that may never be resolved. Fortunately, technology, money and persistence can reduce some of the risk. Proponents of safety are challenging the fire and EMS professions daily to make the environments that they work in safer. The fire service must rise to the challenge and change those aspects of the job that lie within its grasp. Reducing the risks within the occupational arenas is a progressive step forward. Safely securing crew members in the patient compartment of a moving ambulance is such a step.

The results of the VTFD internal survey were very similar to the findings of the survey by Johnson, Lindholm and Dowd (2006). In both surveys, over ninety-five percent of the respondents stated that they wore their seat belts while riding in the cab of the ambulances. The results of both surveys indicated that two-thirds of those answering did not wear their seatbelts while riding in the patient compartment during transports (Figure 1). Both surveys suggest that experience had little impact on seatbelt utilization.



Nearly all of the sited literature suggest a level of indifference displayed by EMS providers. Whether it is changing the interior layout of the medics or simply securing loose items, old habits are hard to break. Thirty-three percent of those answering the internal VTFD survey stated that no layout or design changes were needed in the passenger compartments of current or future VTFD medics. This was also evident when reviewing the ambulances of the departments neighboring Violet Township. There were few obvious improvements to seating and restraint configurations. Although some were newer and cleaner, most units had the same basic designs that ambulances had 20 years ago.

Throughout FDIC and the tours of the manufacturing sites, it appeared that ambulance builders are developing. Improved design and construction components are adding to the structural integrity of the passenger compartments. More head room, improved padding, restraints, seats and air bags all are collectively adding to an improved working environment for EMS crews. These changes will enhance the caregiver's maneuverability, while reducing the need to move about the patient compartment. Incorporating modern air bag technology will

further enhance the safety of these ambulances. Although these improvements have increased the overall safety of the ambulances, they have also increased their overall price. The recent down turn in the economy will have an effect on the design and the development of new EMS vehicles.

When purchasing a new fire engine, most fire departments expect the apparatus to have a service life of about twenty years. The service life of the typical ambulance is five to ten years. In the eyes of some agencies, this makes ambulances disposable. In these tough economic times, the expenditure of tax dollars is highly scrutinized. Many fire departments are much more likely to invest their budget in a vehicle that will serve their agency and community for the next twenty years. Faced with staff reductions and lay-offs, many fire departments are not focused on the available safety features of new ambulances. These departments are struggling to staff their existing vehicles.

RECOMMENDATIONS

Recommendations for restraint options that will guide the Violet Township Fire Department in decision making that can improve the safety of crew members while performing patient care during EMS transport are:

- Upgrade the existing lap belt restraints in the current medics to either four or five point inertia controlled harnesses. This would require the purchase of four harnesses per vehicle. Further research would be needed to determine if departmental maintenance staff could install the harnesses, or if installation must be out-sourced to some specifically certified technician,
- Continue researching ways to improve existing and future EMS vehicles. Currently a

new medic unit is being built for the VTFD. The specifications were modified to incorporate some of the listed results of this project. Track-mounted sliding pedestal seats replaced the side-facing bench seat. Climate and systems controls have been duplicated on each side of the interior, accessible from any of the seated positions. Increased padding and reduced strike zones have been implemented.

- A committee is being established to redesign the VTFD ambulance of the future. The committee will incorporate the needs and limitations of a single attendant. Part of this design will research new technology such as mechanical CPR devices and ventilators, which will further reduce the need for the EMS crews to place themselves in precarious positions while in transit to the hospitals.
- Increase education/awareness of the VTFD. Contact has already been made with Dr Nadine Levick, in an effort to bring her to central Ohio to lecture on ambulance safety, hazards and awareness.
- Incorporate emergency vehicle driver's training into the department's routine.
- A work-group of firefighter paramedics has been formed to adjust the placement of supplies and equipment in the current ambulances in an effort to reflect the needs and/or limitations of a single attendant.

New designs are incomplete without the acceptance of a cultural change. Safety is an attitude which must be supported by education and repetition. Accepting that the job is inherently unsafe is no longer tolerable. New seats or harnesses have little impact if we do create the habits that incorporate their use. The safest ambulance is the one not involved in an accident or transport incident.

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APPENDIX 1 – VIOLET TWP FIRE DEPARTMENT INTERNAL PERSONNEL SURVEY

Question 1: *How long have you been working in the field of EMS?*

- 0 – 5 yrs = 18%
- 11-15 yrs = 19%
- 6-10 yrs = 26%
- 16-20(+) yrs = 37%

Question 2: *How long have you been a member of the VTFD?*

- 0-5 yrs = 25%
- 11-15 yrs = 17%
- 6-10 yrs = 30 %
- 16-20(+) yrs = 28%

Question 3: What *percentage of time do you wear seatbelt when driving the Medic?*

- 100% replied 75-100% of the time

Question 4: *What percentage of time do you wear seatbelt when riding I/C in cab of the Medic?*

- 1.75% - 1 write-in of n/a – too new on Dept to be riding I/C
- 1.75% answered C - 50-75 % of time
- 96.5 % answered D – 76-100% of time

Question 5: *What percentage of time do you wear your seat belt when performing patient care in rear (patient compartment) of VTFD medic?*

- 65% replied 0-25% of time
- 10% replied 51-75% of time
- 23% replied 26-50% of time
- 2% replied 75-100% of time

Question 6: *Do you typically wear your seatbelt when responding to scene of EMS incident?*

100% replied YES

Question 7: *Do you typically wear your seatbelt when performing patient care in the rear (pt compartment) of medic when transporting a stable patient to hospital?*

37% replied YES, 63 % replied NO

Question 8: *Do you typically wear your seatbelt when performing patient care in the rear (pt compartment) of medic when responding critical patients to hospital?*

2% said YES 98% said NO

Question 9: *Where do you typically sit if you are the patient attendant during EMS transport to hospital?*

- Bench seat = 93%
- CPR seat = 2%
- Rear facing captains chair = 5%

Question 10: *Which factor is most likely to determine whether you wear a seatbelt while performing patient care during EMS transport?*

- Mobility = 81%
- Comfort = 0%
- Seated location = 16%
- Duration/length of transport = 3%

Question 11: *Based on your experience and opinion, how can the layout or design of the VTFD EMS transport vehicles be modified to increase safety and effectiveness?*

- 12% replied improved seatbelts
- 18% replied Improved seating
- 28% replied improved layout
- 3% replied Secure all loose items/equipt.
- 2% replied improve awareness, require seatbelt usage for transport of all stable patients
- 2% replied increase the ceiling height and improve the suspension
- 33% replied that no changes were needed

APPENDIX 2 – TITLE OF APPENDIX

Insert your content…

APPENDIX 3 – TITLE OF APPENDIX

Insert your content…