COST BENEFIT OF PEN BASED COMPUTER SYSTEMS

ADVANCED LEADERSHIP IN EMERGENCY MEDICAL SERVICES

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ABSTRACT

The problem identified for this applied research project was that Rural/Metro Fire Department Ambulances still utilize hand written EMS patient and billing information forms. The purpose was to gather data and information in order to determine if there is sufficient return on investment to make a capital investment into a pen based electronic data capture system. This research utilized a combination of the evaluative research methodology to answer the following research questions:

1. How is EMS patient and billing information currently collected and processed?
2. What are the advantages and disadvantages to computerized pen based systems?
3. What is the cost versus financial benefits of a pen based system?

The procedure used a literature review to gather information on current widely available technologies and projected costs.

The major findings of this research indicated that mobile technology has made great improvements in recent years, and many fire departments have implemented pen based technology in the field with great success. Many benefits were identified such as improvement of data quality, faster delivery of the data to the ambulance billing department, enhanced EMS Quality Assurance, and ultimately improved ambulance billing collections.
The results of this research included a recommendation to move forward on investigating palm o/s developers to design customized software capable of integrating with Arizona ambulance billing operations. The second recommendation included that if the software can be developed within budgeted estimates, the Author recommends the implementation of a pilot study of the Pima County Rural/Metro Fire Ambulances with the TRG Pro Palm style computer system. The third recommendation was to further study the implementation of a palm computer system for the Fire Prevention Department and for certain engine company duties. The last recommendation would be to implement a study of the billing and field operations of other Rural/Metro Ambulance and Fire Operations to determine system hardware and software requirements to allow for proper budgeting if the pilot project shows sufficient benefits to warrant expansion into all areas.
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INTRODUCTION

EMS patient and billing information is vital to provide for good patient care, for defending our actions in court, and for providing the documentation necessary for insurance reimbursement. Our world is ever changing and the improvements in technology over the past 10 years has been astronomical. Great improvements have been made in wireless mobile technology that have improved the way Fire Departments operate. In order to continue our efforts to improve efficiency and do more with less we must investigate and evaluate every influence on our profession. The purpose of this paper is to gather data and information in order to determine if it is feasible to make a capital investment into a pen-based EMS electronic data capture system.

The methodology used included a literature review at the National Fire Academy’s Learning Resource Center (LRC), the Tucson-Pima Public Library, the University of Phoenix Library, and the Internet. Personal interviews were also conducted of vendor salespersons, ambulance billing supervisors, and select managers of Rural/Metro. The evaluative research methodology was utilized to answer the following questions:

1. How is EMS patient and billing information currently collected and processed?
2. What are the advantages and disadvantages to computerized pen based systems?
3. What is the cost versus financial benefits of a pen based system?
BACKGROUND AND SIGNIFICANCE

Rural/Metro Fire Department is a subsidiary of Rural/Metro Corporation. Rural/Metro is a publicly traded, for-profit corporation who provides mobile health services, including 911 and general ambulance service, fire protection and other safety-related services to municipal, residential, commercial and industrial customers in more than 400 communities throughout the United States and Latin America. The fire department division of the company runs very much like a municipal operation, but with a heightened sense of business operations.

On September 21, 2000 Rural/Metro announced its fourth quarter and year end results ending June 30, 2000. The company reported a net loss for the year of $101.3 million dollars (Rural/Metro Corporation, 2000). A large portion has been attributed to a change in accounting policy to increase the provision for ambulance bills not expected to be collected. The current environment for healthcare reimbursement is challenging with low, slow or no payment from Medicare and other insurers. Many claims are denied due to the requirement of additional documentation and delaying payment up to six months after the date of service.

On January 27, 2000, the company announced several key programs to change the business process. Some of the changes included restructuring our payer mix and eliminating operations which had particularly low collection rates. Additionally, the company has placed extraordinary emphasis on field documentation designed to ensure payment from third-party payers. In 1999 Annual Report indicates seventy five percent
(75%) of the company’s revenue was from ambulance fee collections (Rural/Metro Corporation, 2000). Documentation affects not only the speed of reimbursement, but also the insurance company’s acceptance of the claim.

The Fire Department has utilized many different forms in the past to document and bill for ambulance transportation. All of the documents are hand written, and many times we have received complaints from the various base hospital paramedic coordinators and the ambulance billing department that they are unable to read the copies of the first care form. Many times the forms are lost by the crew losing irreplaceable data. Good documentation is not necessary for the paramedic to rapidly treat the patient, however the documentation may have an effect on how the hospital continues to treat the patient. Being sued for an EMS call happens infrequently, but the effects of poor documentation can be disastrous.

Addressing this problem through the evaluative process refers to Module 3 of the Advance Leadership Issues in EMS course (NFA, 2000) of the Executive Fire Officer Program. This module presents approaches in information management and data collection.
LITERATURE REVIEW

A literature review was conducted utilizing resources from the National Fire Academy’s Learning Resource Center (LRC), the Tucson-Pima Public Library, the University of Phoenix Library, and the Internet. Additional research was conducted with personnel interviews with select individuals throughout Rural/Metro Corporation as well as pen based computer salespersons. An effort was made to capture both fire department history on pen based computer usage and current information.

Fire Computer Systems Implementations

EMS information needs have outgrown the ability to be managed entirely on paper (Hall 1994). One of the first fire departments to implement hand-held computers in the field was the Atlantic City Fire Department (Louderback, 1994). According to Louderback (1994), the Atlantic City Fire Department needed a system for their Fire Inspectors to enter and manage data more efficiently. The Atlantic City Fire Department chose a 6- by 9- inch unit with a DOS-based operating system. The Fire Inspector has all of the forms and code books built right into the computer. The system has reduced the paperwork and cut administrative time that the inspectors and clerical staff have take to prepare their reports (Louderback, 1994).

Other fire departments, such as the South County Fire Authority (California) have had tremendous success in implementing pen-based fire inspection programs (Price, 1995). Price states that the inspector begins the inspection with all of the information
such as address, business name, and after-hours telephone numbers already in the computer. Any updates or corrections can be made immediately. As the inspection begins the data is captured as the inspector writes. Contained on the form are check boxes which include the most common encountered violations and for the less common infractions the computer has the complete code book to provide instant support. Before storing the data, the system performs a validation of all the data required prompting the user to fix any errors. Back at the station the inspector attaches a phone line and transmits the data to the department network. This has alleviated a problem of stacks of forms waiting to be inputted into the network making the data prone to errors and being several months old (Price, 1995). South County Fire Authority states they have saved $30,000 a year since the implementation of their pen-based system (Price, 1994b).

The Puyallup (Washington) Fire Department has also implemented a pen-based computer system with their fire inspections (Price, 1995). The department is required to do more than 500 fire inspections during the city’s three day Spring Fair. Since there is no need for manual data entry the inspections can now be handled by a single inspector (Price 1995). Pullallup Fire Department’s software also tracks the inspection time to assess hourly fees, and balances inspection workload by automatic scheduling and rotation of assignments (Price 1995).

The Los Angeles City Fire Department just recently implemented a pen-based system utilizing the SPT 1500 Palm Computer (Zucker, 2000). The city is claiming that the system is saving them $123,000 in inspections and data entry costs per year. The new
system has delivered an 11-month pay back and a 109% return on investment that will soar to 302% after three years (Zucker, 2000).

In San Mateo County, California, six fire agencies have integrated their Computer Aided Dispatch (CAD) system with their pen-based reporting system successfully (Price, 1994a). The CAD system forwards closed incident data to a Sunpro communication server. This gateway converts CAD data into an incident report that reduces completion time by up to 80% (Price, 1994a).

Fire Inspectors and engine companies are not the only ones taking advantage of pen-based computer systems in the field. In 1989 Colorado’s state EMS office began to require that all EMS agencies submit data on every call and every patient (Hall, 1994). In September 1991, the Denver Paramedic Division (DPD) implemented the states ‘fill-in-the bubble’ form and suspended it three weeks later. It was recognized that the bubble form system was incompatible with DPD’s high call volume. Denver Paramedic Division began to work with Westech to develop quasi-customized EMS software. In January 1994, Denver implemented the new pen-based computer system.

**Current Process**

All of the forms are currently completed by hand utilizing a multi-copy carbon less style form. Typically, a crew completes the form at the hospital after each run, giving one copy to the emergency department for the patient’s records. At the end of the day crews place all the remaining copies of the run tickets into an envelope. A courier
starts at midnight and goes to all 13 fire stations, picking up the envelopes and delivering them to the communications center. If a station is on a call or forgets to set their envelope out, it may be the following night before the tickets are picked up and delivered to ambulance billing. The communications center runs a report from the Computer Aided Dispatch (CAD) to compare the number of runs to the number of tickets received. The data entry personnel in ambulance billing enter all of the information on the tickets into the AS400 computer system. Additionally, they work on getting insurance authorizations and track down missing information. The forms are separated with one form becoming a permanent record and the other form is forwarded to the base hospital paramedic coordinator.

**Disadvantages**

The one disadvantage found during research on this technology is the cost. When Miami Beach Fire Department implemented a pen-based reporting system, the original project cost of $45,102.64 almost doubled to near $80,000 (Garcia, 1994). Garcia (1994) stated that this was for 10 units. Rural/Metro Fire Department’s Fire Warehouse clerk Rhonda Reitz (personal communication, October 18, 2000) states that the current written form costs is $0.20 each. A pen-based reporting system costs much more than traditional pen and paper.
Hardware

Hardware consists of the computer and the installed operating system. Depending on the characteristics of the computer and the operating system, will dictate what commercial software will be used. Software is either customized or commercially available.

A popular fire department field computer is the Hammerhead P-233 field-hardened pen-tablet. The Hammerhead is a rugged tablet type computer that has an Intel Pentium 233 MHz processor with a Windows 95/98 operating system (WalkAbout Computers Inc., 2000). It comes with 64 MB of ram and 6.0 gigabytes (GB) hard drive. The unit can be interfaced to transmit data via telephone lines, radio or cellular. In a telephone interview of Dan Hatchet, a manufacturers representative of the Hammerhead, he stated that the cost of just the field computer is around $4500. The Hammerhead has an average life span of 3-5 years. Hatchet (personal communication, October 10, 2000) indicated that a department should expect to have approximately a 20% per year failure rate and recommends buying 5% more units than required. The units come with a one year warranty and an extended warranty is available for an additional $525 per unit. Extra batteries may be purchased at a cost of $85 each. The service department has a three day turn-around time.

The Scout 2 is a all-terrain subnotebook. Powered by a AMD K6 233 MHz processor this laptop style computer also has 64MB of ram and a 6.0 GB hard drive. This laptop has the option of running on Windows CE or Windows 95/98 (Melard
Technologies, 2000). In the Windows CE setup this system sells for approximately $2100 and in the Windows 95/98 setup sells for approximately $4500. This laptop is designed for integrated wireless communication, so that the data can be transmitted immediately to a collection point.

In examining hardware currently on the market, we find that in the computer industry there have many manufacturers, but only the strongest survive (Chen, 2000). Many of the handheld computers run on Windows CE, however in the past year three vendors have abandoned that platform (Chen, 2000). Chen (2000) speculates the reason for CE’s demise is everything from the Microsoft antitrust lawsuit to the notion that CE was deliberately crippled so it would not pose any competition to Windows 98. Chen continues to state that while CE devices may be able to do more, they are often larger, more expensive, and take a heavy toll on batteries. However the industry expects Microsoft to make a comeback in the palm-size category.

Mobile technology has rapidly progressed over the past several years. Several smaller hand held or palm style units have come into the market and were examined. The Hitachi America HPW-600ET has a larger screen than most of the smaller handheld computers. The device weighs less than 2 pounds and has a array of ports including a 56K modem. The device is equipped by a 640 by 480 16-bit color touchscreen. Chen (2000) states that the unit comes with Jot software handwriting recognition program, but it is noticeably harder to use than Palm’s Graffiti.
The Psion 5MX is a handheld computer with a small keyboard attached. The series 5MX has a 16-grayscale touchscreen and can operate 40 hours out of two AA batteries. The unit is good for basic tasks but is too underpowered for users who need connectivity (Chen, 2000). Chen (2000) believes that one of the biggest problems with this unit is the lack of communications hardware.

The Palm VII is very easy to use. The handheld is configured like the typical Palm Pilot. One feature that does stand out is its built in wireless data transmission capability. The unit has a fold up antenna that runs along the left side of the unit. To access the Internet all one does is fold up the antenna and click an icon. One drawback is that the service plans cost between $10 to $40, providing up to 300KB of transmitted data. Any data over the maximum is typically charged at $0.20 per each Kilobyte. This would be an extremely costly method of transmitting data after each ambulance transport.

The Palm Vx computer has more storage and a faster CPU than previous models of Palm Pilots. This unit has a clear high-contrast screen and an easy-to-hold tapered shape. The average battery life on two AAA batteries is 25 hours and 45 minutes. The Palm Vx has an optional modem that may be interfaced to a cellular phone or plugged into a regular phone line at the hospital or the station.

The TRG Pro is a Palm clone that runs 25% faster due to changing some wait states. It has an industry Compact Flash expansion slot that allows interfacing with a number of third party devices such as SanDisk 128MB memory cards, modems, and
IBM’s 340MB microdrive. This device is targeted to mobile users who want to access large amount of data. The hardware specifications have been summarized in Table 1.

**Software**

The Los Angeles City Fire Department has implemented a system designed by Puma Technologies (Zucker, 2000). Puma Technologies has technological strength in its Intellisync line of products (Zucker, 2000). This company is capable of writing custom software that will sync with many types of file formats.

With Palm Computing aggressively licensing its operating system, there have been six companies selling versions of Palm Operating System (OS) hardware. Not only has this caused competition to improve hardware options (Zucker, 2000), it has caused over 10,000 applications to be written for the Palm OS (Chen, 2000). Chen (2000) reports that more than 5.5 million Palm units have been sold.

There is another company that has been successful in implementing a Palm EMS reporting system. In a telephone conversation with Tom Teates of Pen Computer Solutions, Inc. (personal communications, December 4, 2000) he announced that they have developed a semi-customizable Palm program for the ambulance service called PDA Medic. Tom indicated that the system sells for $5000.00 and includes 5 unit licenses. Additional licenses are available for $75-$150 depending upon the quantity purchased. Tom also informed the author that they are capable of writing customized
software. Pen Computer Solutions has been working with American Medical Response (AMR) and are prototyping a Palm system in San Mateo, California.

Westech is a popular software program known to the Denver Fire Department Pen-Based Computer System (Hall, 1994). The program utilizes 32-bit Windows technology for collection, integration and management of EMS data (Pinpoint Technologies, 2000). The program utilizes a SQL database so it interfaces easily with other databases, devices and related software packages (Pinpoint Technologies, 2000). Due to the operating system required this device needs to run on a rugged laptop such as the Hammerhead or Scout 2.

**Interim Fix**

On August 2, 2000 Rural/Metro Fire Department instituted a policy that requires crew members to call in the basic information to the communication center’s Transport Services Department within 3 hours of completion of the call. The Transport Coordinator enters the basic information into the CAD system. If information is missing or an insurance plan is identified that requires pre-authorization immediate action can occur. In an interview with John Roberts, lead Transport Coordinator, he explained that all non-emergency calls are closely scrutinized and insurance information is collected. John Roberts (personal communication, October 14, 2000) stated that sometimes they get information that the crews do not get and sometimes the crews get information that Transport Services cannot get. On 911 calls the Transport Coordinator can follow-up with the hospital for any information the crew could not obtain. This is especially useful
when the patient is critical and information is non-existent, or when the crews are called away for another emergency prior to being able to collect all of the required information.

Based upon the information received, the Transport Services Department can initiate a Medifax. Medifax is a system designed to determine a persons eligibility in the Medicare system, Blue Cross/Blue Shield, or Arizona Health Care Cost Containment System (AHCCCS). Mr. Roberts (personal communication, October 14, 2000) stated that there have been several times that his department has run a Medifax on a patient only to find out the information was different than initially communicated and the Transport Coordinator had to do immediate notification of the patients health plan. The key role for the Transport Services Department is to ensure future payment of the ambulance calls.

Bill Kordsiemon, Support Service Manager for Rural/Metro EMS in Pima County (personal communication, October 18, 2000) states that since implementing the call in system it has raised the percentage of correctly filled out tickets from 60 to 80%, and raised the amount collected from third party payers in the first 30 days by 3%. This is a significant number.
EMS Quality Assurance

Another operational area that would see improvement with the implementation of a pen based computer system would be an EMS Continuous Quality Improvement (CQI) program. In an interview with Pam Stallard, Northwest Medical Center’s Paramedic Coordinator, she stated that one area which a pen-based computer system would be extremely useful would be in an EMS Continuous Quality Improvement program. Stallard (personal communication, October 10, 2000) noted that the only CQI that is being done is that she is required to do a chart review on all code arrests, all in field death pronouncements, 5% of the patient refusals, and 5% of the total calls. There is no tracking of individual skills or adherence to protocols (Stallard, personal communication, October 10, 2000). Stallard (2000) stated that with a paper system and over 1,100 telemetry’s a month it is impossible to have a through CQI analysis.

PROCEDURES

This research project utilized the evaluative research methodology to gather and analyze data on pen based system costs, options and features. This was done in order to determine whether or not the implementation of a pen based reporting system would provide benefits worth the cost.

A literature review was initiated in March 2000 at the National Fire Academy’s Learning Resource Center (LRC). Additional visits to the Tucson-Pima Public Library and the University of Phoenix Library were conducted between April 2000 and October
2000. The literature review targeted trade journals, magazines, and newspapers relating to pen based reporting systems.

Personal and telephone interviews were conducted in September, October and December 2000 with Ms. Pam Stallard of Northwest Regional Medical Center, Tucson, Arizona; with Mr. John Roberts of Rural/Metro Fire Department Communications Center, Tucson, Arizona; and Mr. Dan Hatchet of WalkAbout Computers, Inc.; with Mr. Bill Kordsiemon of Rural/Metro EMS in Pima County, Tucson, Arizona; and with Mr. Tom Teates with Pen Computer Solutions, Incorporated.

This study focused on pen based system costs and benefits. The findings of those sources were summarized in the literature review section of this research paper.

**Definition of Terms**

AMD – Advanced Micro Devices, Inc. A manufacturer of computer processors.

APC – Average Patient Charge.

EMS – Emergency Medical System.

MB – Megabytes. A unit of computer information storage capacity equal to 1,048,576 bytes.

MHz - Megahertz. A unit of frequency equal to one million hertz. A measurement of a computer microprocessor speed.

Palm – Trademark name for palm sized computers.

PC – Personal Computer.

RAM – Random Access Memory.
Limitations

During the course of research, several limitations were encountered. The first limitation was that the author found that most of the examples of the fire department successes on pen based implementations were with fire prevention departments and not their ambulances. An assumption was made that fire prevention personnel can often utilize pull down menus that list common violations. These reports seldom require very little narrative to be entered. Ambulances and EMS have different needs that is required for their documentation. The author found no information on the potential increase in collection rate. The collection rate increase is estimated and this estimate could be more or less than predicted.

Another limitation is that mobile technology is advancing daily. There have been dozens of other pen and computer systems introduced into the market. It was impossible to evaluate all of them. The author only examined current well known hardware at the time of research.

Results

Answers to Research Questions

1. How is EMS patient and billing information currently collected and processed?

Research indicated that EMS patient and billing forms are completed by hand utilizing a multi-copy carbon less style form. The Paramedic completes the form at the
hospital after each call. A copy is given to the emergency department for the patient records. At the end of the day the crews place all of the run tickets in an envelope and a courier starts at midnight and goes to all 13 fire stations, picks up the envelopes and delivers them to the communications center. The communications center runs a report from the Computer Aided Dispatch (CAD) system to compare the number of runs to the number of tickets received. Data entry personnel then compile all of the information from the run ticket and CAD into the AS400 computer system. If there is missing information, the data entry personnel work on getting insurance authorizations and track down missing information. The forms are separated with one form becoming a permanent record and the other form is forwarded to the base hospital paramedic coordinator.

2. What are the advantages and disadvantages to computerized pen based systems?

There are many advantages and a few disadvantages with a pen based system. The Pen Based System can be designed to capture and transmit data upon completion of the call. This would eliminate the delays associated with a courier service delivering the tickets to ambulance billing from 8 to 32 hours or more after the transport occurred. This would allow ambulance billing to have all of the data immediately and seek out any missing information from area hospitals.

The pen based system would also improve accuracy of data. Programs typically identify required information and then notifies the user of any information that is missing. A spell checker could check the Paramedics narrative and correct embarrassing mistakes.
The data would also be typed and ambulance billing and paramedic coordinators would no longer have to decipher each individual’s handwriting.

Another benefit would be that the data could be loaded into the AS400 which would eliminate the need of data entry clerks retyping information from the no carbon forms. This would allow the ambulance billing department to either reduce staffing or redirect efforts on efficient collections.

The last benefit identified was that EMS Quality Assurance would be enhanced. The data from the carbon less style forms are unmanageable. Data from an electronic data capture system could be manipulated to provide for enhanced statistics and quality assurance.

The main disadvantage identified was cost. The Hammerhead unit was priced at $4500.00 per unit with a 20% failure rate per year. Additionally more upfront money was going to be needed for system integration, pen communication by either radio or cellular, and training. With the advances in pen based technology, the price of the smaller units are very reasonable with prices starting around $330.00.

3. **What is the cost versus financial benefits of a pen based system?**

The costs to implement a pen based system varies widely from a personal computer (PC) type of system to a palm sized type system. The costs identified that
relates to the implementation of this technology includes the initial hardware, a percentage of computers that will fail each year, software and training costs.

Research has indicated that to implement a twelve ambulance prototype system with the Hammerhead computer system total costs would be approximately $76,000 for the first year and $10,788 for each subsequent year. Depending on the actual improvement of ambulance revenue collection would determine the rate of return. An improvement between 1% and 3% represents $25,920 to $77,760 in additional revenue. The rate of return on investment for the Hammerhead system would be approximately 34% to 102% for the first year, increasing to 59% to 180% for the second year. Cost estimates have been summarized in Table 2 and Table 3.

In examining the cost to implement a palm type system for the twelve ambulances, the total first year cost would be approximately $18,000. The rate of return on investment for this system would be approximately 144% to 432% for the first year representing between $7,900 and $60,000 improvement in collections revenue. The second years rate of return would be between approximately 260% and 780%. This represents between $31,920 and $135,600 improvement in collections revenue.

Additional savings may also realized by eliminating clerical staff positions which input ambulance run tickets into the AS400. Each staff position eliminated, depending upon region, saves approximately $24,000 per year in wages.
DISCUSSION

The Emergency Medical System has changed dramatically over the last 25 years. With the introduction of Paramedics, communities have seen additional skills and drugs that can be accomplished and administered in the pre-hospital setting. Additionally, EMS information needs have outgrown the ability to be managed entirely on paper (Hall, 1994).

Information technology has also exploded over the last several years. Only a short time ago only large businesses had computer systems. Today it is common to find a computer system in most households. Emergency services use of computers systems has also gained popularity. Fire departments across the country have added computer systems into the fire stations and some have even implemented in field computer systems.

An example of the list of success stories is the Los Angeles City Fire Department (LACFD). LACFD just recently implemented a pen-based system utilizing the SPT 1500 Palm Computer (Zucker, 2000). The city is claiming that the system is saving them $123,000 in inspections and data entry costs per year. The new system has delivered an 11-month payback and a 109% return on investment that will soar to 302% after three years (Zucker, 2000).

There are many benefits to implementing in field computer systems. However there is no exact way of estimating the potential financial benefits. The Hammerhead system requires a very large investment and it appears from the research that handheld
computer system technology has progressed sufficiently to do the same job but with much less costs. Some departments have discovered the costs of implementing a pen based system to be higher than anticipated. The Miami Beach Fire Department implemented a pen-based reporting system for ten units. The original project cost of $45,102.64 almost doubled to nearly $80,000 (Garcia, 1994). In order to determine whether a pen based computer system has value or not, a department must examine both the costs and the benefits.

The are several identified potential benefits of a pen based computer system. The first benefit is the improved accuracy of the data. Paramedics in the field would be typing in the information. Information would not be lost due to not pressing hard enough on the NCR forms or by illegible words. Spell check would eliminate embarrassing mistakes. The next benefit is that the crew could plug into a phone line and transmit the data directly to ambulance billing eliminating the 8 to 32 hour wait until the form is delivered to ambulance billing. The third benefit identified was that EMS Quality Assurance could be enhanced. The data from the carbon less style forms are unmanageable. Data from an electronic data capture system could be manipulated to provide for enhanced statistics and quality assurance. The last benefit identified is derived from the combination of all other benefits. The author expects an improvement in ambulance collections. While it is impossible to determine exactly how much of an improvement would occur, efforts in Pima County requiring the Paramedics to call in the basic billing information within three hours has raised the percentage of correctly filled out tickets from 60 to 80% (Kordsiemon, personal communications, October 12, 2000).
This procedure has also raised the amount collected from third party payers in the first 30 days by 3%.

**RECOMMENDATIONS**

Due to mobile technology advances in the past several years, it is recommended that Rural/Metro Fire Department Pima County move forward on investigating palm o/s developers to design customized software capable of integrating with Arizona ambulance billing operations. If software can be developed within budgeted estimates the Author recommends the implementation of a pilot study of the Pima County Rural/Metro Fire Ambulances with the TRG Pro Palm style computer system. A pilot program will allow a cost effective examination and evaluation of the actual costs and benefits derived from the implementation.

The next recommendation is to further study the cost and benefit of implementing a Palm style reporting system for Fire Prevention and certain engine company duties such as hydrant inspections and occupancy inspections. Many other fire departments have reported tremendous benefits and return on investments.

The last recommendation would be to implement a study of the billing and field operations of other Rural/Metro Ambulance and Fire Operations to determine system hardware and software requirements to allow for proper budgeting if the pilot project shows sufficient benefits to warrant expansion into all areas.
References


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<th>Hitachi HPW-600ET</th>
<th>Psion Series 5MX</th>
<th>Palm VII</th>
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<td>Optional</td>
<td>Wireless Radio</td>
<td>Optional</td>
<td>Optional</td>
</tr>
<tr>
<td>Ports/Slots</td>
<td>IrDA, 3 serial, 1 USB, 1 parallel, keyboard</td>
<td>Type 3 PC Card Slot, serial, parallel</td>
<td>Audio, IrDA, microphone, serial, sound, stereo, Type II compact flash, Type II PC card</td>
<td>IrDA</td>
<td>IrDA</td>
<td>IrDA</td>
<td>IrDA Compac Flash Memory Serial</td>
</tr>
<tr>
<td>Dimensions</td>
<td>11 x 7.75 x 1.5</td>
<td>2.8 x 6.5 x 9.2</td>
<td>1.1 x 8.6 x 6.3</td>
<td>.6 x 6.2 x 3.1</td>
<td>.7 x 3.2 x 5.2</td>
<td>.6 x 3.1 x 4.4</td>
<td>.8 x 3.3 x 4.8</td>
</tr>
<tr>
<td>Weight</td>
<td>4.2</td>
<td>5.5</td>
<td>2.1</td>
<td>.5</td>
<td>.4</td>
<td>.3</td>
<td>.4</td>
</tr>
<tr>
<td>Price</td>
<td>$4495</td>
<td>CE - $2,100 95/98 - $4500</td>
<td>$1,199</td>
<td>$399</td>
<td>$449</td>
<td>$399</td>
<td>$330</td>
</tr>
</tbody>
</table>
# TABLE 2

## Cost Benefit Analysis

*Based upon pilot project of 12 Ambulances - Palm Type System*

<table>
<thead>
<tr>
<th></th>
<th>Cost</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware</td>
<td>$4800</td>
<td>12 Ambulances times $400 each (one time cost)</td>
</tr>
<tr>
<td>Hardware Failure</td>
<td>$1920</td>
<td>Conservative 40% failure rate (reoccurring cost)</td>
</tr>
<tr>
<td>Software</td>
<td>$10000</td>
<td>Estimate</td>
</tr>
<tr>
<td>Training of Paramedics</td>
<td>$1279.50</td>
<td>2 hours of training for 50 Paramedics</td>
</tr>
</tbody>
</table>

**Total** $17999.5  
**Total Cost**

*Based upon pilot project of 12 Ambulances - Hammerhead based system*

<table>
<thead>
<tr>
<th></th>
<th>Cost</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware</td>
<td>$53940</td>
<td>12 Ambulances times 400 each - (one time cost)</td>
</tr>
<tr>
<td>Hardware Failure</td>
<td>$10788</td>
<td>20% failure rate (reoccurring cost)</td>
</tr>
<tr>
<td>Software</td>
<td>$10000</td>
<td>Estimate</td>
</tr>
<tr>
<td>Training of Paramedics</td>
<td>$1279.50</td>
<td>2 hours of training for 50 Paramedics</td>
</tr>
</tbody>
</table>

**Total** $76007.50  
**Total Cost**
### Table 3

#### Financial Benefit

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Ambulances</td>
<td>12</td>
</tr>
<tr>
<td>Average number of</td>
<td>2</td>
</tr>
<tr>
<td>Calls/shift</td>
<td></td>
</tr>
<tr>
<td>Number of Days</td>
<td>30</td>
</tr>
<tr>
<td>Total Calls in Month</td>
<td>720</td>
</tr>
<tr>
<td>Total Calls in 1 year</td>
<td>8640</td>
</tr>
<tr>
<td>Average Patient Charge (APC)</td>
<td>$300.00</td>
</tr>
<tr>
<td>Estimated Gross Revenue</td>
<td>$2,592,000.00</td>
</tr>
<tr>
<td>Improvement 1% collections</td>
<td>$25,920.00</td>
</tr>
<tr>
<td>Improvement 2% collections</td>
<td>$51,840.00</td>
</tr>
<tr>
<td>Improvement 3% collections</td>
<td>$77,760.00</td>
</tr>
</tbody>
</table>

#### Estimated Rate of Return - First Year

<table>
<thead>
<tr>
<th></th>
<th>Hammerhead</th>
<th>Cash</th>
<th>Palm Type</th>
<th>Cash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvement 1% collections</td>
<td>34.10%</td>
<td>-$50,087.50</td>
<td>144.00%</td>
<td>$7,920.50</td>
</tr>
<tr>
<td>Improvement 2% collections</td>
<td>68.20%</td>
<td>-$24,167.50</td>
<td>288.01%</td>
<td>$33,840.50</td>
</tr>
<tr>
<td>Improvement 3% collections</td>
<td>102.31%</td>
<td>$1,752.50</td>
<td>432.01%</td>
<td>$59,760.50</td>
</tr>
</tbody>
</table>

#### Estimated Rate of Return - Second Year

<table>
<thead>
<tr>
<th></th>
<th>Hammerhead</th>
<th>Cash</th>
<th>Palm Type</th>
<th>Cash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvement 1% collections</td>
<td>59.73%</td>
<td>-$34,955.50</td>
<td>260.25%</td>
<td>$31,920.50</td>
</tr>
<tr>
<td>Improvement 2% collections</td>
<td>119.45%</td>
<td>$16,884.50</td>
<td>520.49%</td>
<td>$83,760.50</td>
</tr>
<tr>
<td>Improvement 3% collections</td>
<td>179.18%</td>
<td>$68,724.50</td>
<td>780.74%</td>
<td>$135,600.50</td>
</tr>
</tbody>
</table>