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NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C.

Patient Transport Request
Use of Autolaunch Method of Dispatching a Helicopter

Berns K.S., Caniglia J.J., Hankins D.G., & Zietlow S.P. (2003). Use of the autolaunch method of dispatching a helicopter. *Air Medical Journal,* 22(3), 35-41.
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(7 Pages)

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Use of the Autolaunch Method of Dispatching a Helicopter

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Introduction: Autolaunch is a method of dispatching whereby the dispatcher can send the helicopter to a scene, as opposed to traditional request-driven dispatch. The purpose of this study was to investigate differences in patient outcomes when autolaunch was used. A 2-year period, July 1997 through June 1999, was studied.

Methods: A case control design was used. A retrospective chart review included 17 autolaunch and 16 traditionally dispatched patients. Patients were matched using Injury Severity Scores, Glasgow Coma Scale, and age. Eight matched pairs were used for statistical analysis. Three research questions were answered.

Results: The difference in time from accident to helicopter arrival was 3.64 minutes faster for autolaunch (statistical significance $P = .336$). Mortality data showed no statistical significance difference ($P = .302$). Intensive care unit (ICU) and hospital length of stays were both decreased with the use of autolaunch, although not statistically significantly.

Discussion: Sample size was small, making statistical significance difficult to achieve despite decreased length of stays and quicker time to the scene.

Conclusion: Although statistical significance was not found with the use of autolaunch, patient outcomes still were improved by this method. Information provided could be used by helicopter programs considering implementing autolaunch.

An accident occurs on a dark country road. Law Enforcement Center (LEC) is notified and heads for the accident. The basic life support (BLS) ambulance also is dispatched. On the way, they get more details of the accident and decide they will need an advanced life support (ALS) ambulance. The BLS providers ask the LEC dispatcher to contact the ALS ambulance dispatch center and request an ALS ambulance for the accident. As the ALS ambulance is en route and more details of the accident and injuries become available, the paramedics decide that a rapid form of transport or more advanced care may be needed. They notify the dispatch center that the helicopter is needed; the helicopter is dispatched. Precious minutes have passed.

Helicopter crews across the country have expressed frustration with delays in being dispatched. A better way for this system to work is to dispatch the helicopter—if certain criteria are met, such as mechanism and severity of injuries—when the ALS ambulance is called. This method of dispatch is called an autolaunch.

In 1999, 6,279,000 motor vehicle accidents occurred in the US. Injuries were sustained in 3,236,000 of the accidents, and some of these patients required extensive rehabilitation. Deaths occurred in 41,611 of the accidents, an average of 114 each day or 1 every 13 minutes. The cost in mortality and morbidity reached $150.5 billion.[1]

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Table 1.

Autolaunch Criteria

Major motor vehicle accidents
Bicyclist, pedestrian, motorcycle, ATV, prolonged extrication, rollovers, and/or fatality on high speed roads
Logging/farm/industrial accidents
Multiple casualty incidence
Near drowning
Area not easily accessed by road
Penetrating trauma
Gunshot wound, stabbing, etc.
Major burns

The golden hour concept is widely accepted because getting an advanced level of care to the scene and transporting the patient to a trauma center quickly can reduce mortality and morbidity.[2] It also has been well documented that dispatching helicopter crews rapidly to the scene of an accident reduces transport times to the trauma center, decreasing mortality and increasing the chance for survival.[2-9] Research by Rhodes[10] on the use of standby and by Stanhope[11] on delayed requests to liftoff reviewed reasons for delays in dispatching a helicopter. The use of autolaunch can minimize the dispatch delays found in both of these studies and get the helicopter to the scene more quickly to reduce mortality and morbidity.

The dispatch center for Mayo Medical Transport is an integrated service that dispatches helicopters, fixed-wing aircraft, and ALS/BLS ground ambulances in 12 cities in Minnesota and Wisconsin. Under this system, dispatch has the ability to send both the helicopter and the ground ambulance to the scene of an accident.

Mayo One operates 3 BK 117s at separate bases that cover mainly rural areas of southeastern Minnesota, northern Iowa, and western Wisconsin. As a quality improvement process, the program reviewed ways to decrease response times for scene flights. The decision was made to use the autolaunch method of dispatch at the Rochester, Minn. base.

The purpose of this study was to review the criteria necessary for setting up an autolaunch program and analyze patient outcomes on autolaunch flights compared with traditionally dispatched flights. Throughout this article, traditional dispatch refers to flights that resulted from a request from an outside agency (LEC or ambulance) for the helicopter for a scene flight. Autolaunch dispatch refers to flights that originated when the helicopter was dispatched simultaneously with the ALS ambulance after a request was made for the ALS ambulance.

The criteria for autolaunch were basically the same criteria developed by the American College of Surgeons[3] Committee on Trauma for the appropriate use of a helicopter for trauma scene flights. The criteria Mayo One used are detailed in Table 1.

One necessary element to establish an autolaunch program is an integrated dispatch center with defined primary service areas. With this, the dispatch personnel have the ability to hear about an accident in the service area. This connection enables them to dispatch the helicopter simultaneously with the ground ALS ambulance. At the time of this study, the autolaunch process was used only in the service area around the city of Rochester. As a result of other hospitals' apprehension of this new dispatch method, Mayo One administration limited the trial to the local primary service area, which encompasses approximately 700 square miles.

When establishing an autolaunch program, a formalized education program regarding the process is essential for dispatchers, law enforcement, and prehospital personnel. To reduce confusion at the scene, law enforcement and prehospital personnel need to be aware that a helicopter may been dispatched even though they did not request it. On-scene personnel still have the ability to cancel the helicopter if the injuries are not severe. At times during this study, the helicopter arrived on scene before law enforcement, which meant a landing zone was not secured. In these instances, the helicopter circled the scene until an appropriate landing zone was set up. The helicopter pilots and crews adhered to the guidelines established in Omniflight Helicopter's 135 Operations Manual.[12]

An autolaunch program also raises the issue of an increased number of takeoffs and landings. A true organizational risk analysis should be conducted before any operational changes. Organizations need to be aware of the increased risk associated with this reality and decide if this is an alternative they want to undertake.

One transitional challenge Mayo One faced when beginning the program was dispatchers' reluctance to use the new method. To get consistency among the dispatchers, additional education was needed on the proper use of the autolaunch process. Once this education was done, the use of autolaunch improved.

The process also was inappropriately used. Initially, dispatch personnel would radio the ALS ambulance to tell them that "the helicopter was available for autolaunch." If the ambulance requested that the helicopter be launched, the matter technically became a traditional dispatch. Further education resolved this problem.

Financial Analysis

A cost analysis of any new program is warranted. As with many new modes, a low completion rate may be seen initially. For this study, it must be noted that the noncompleted flights included turndowns, canceled requests, and aborted flights.

Associated operating cost increases need to be taken into account. Expenses include direct operating costs, increased engine cycle counts, and fuel costs. Mayo One administration used Conklin & de Decker's Life Cycle Cost[13] analysis program to determine true and projected operational costs. The software takes all aviation operational expenses into account for the specific aircraft used by the flight program. The analysis was used to project increased flight time on each aircraft.

The anticipated reimbursement from this new dispatching method was given significant consideration. Most of the new

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Table 2.

Financial Breakdown

Program aviation expenditures	$7,335.00	9 flight hours x $815.00 = $7335.00
Program transports billed	$59,903.90	Liftoff fee $2374.73 x 22 = $52,244.06
Mileage rate	$37.92 x 202	sm = $7,659.84
Collections after bad debt	$53,913.51	10% bad debt from autolaunch billing
Program revenue	$46,578.51	Can be used to offset additional costs

transports would be generated from automobile accidents. As a state requirement, licensed motorists must have proof of insurance to operate a vehicle in Minnesota. Thus, the program could plan that most of the revenue would be derived from insured trauma patients. The program's historical collection on third party payer mix is greater than 90% on traditional scene flights.

During the study period, 22 patient flights were completed; approximately $60,000 was billed and $54,000 collected. The program used 4.4 hours of flight time on the 22 patient flights and 4.8 hours of flight time on 48 aborted flights; thus, the total flight time for this period was 9.2 hours. Given the proprietary nature of actual billing and expenses, regional billing and national expenditures were used. Using the Life Cycle Cost program, the hourly operational rate was factored at $815 per flight hour. The program spent $7498 on aviation expenses during this period and collected $46,578.51 to use for any additional fixed costs. A review found that the revenue generated from 1 patient flight could offset the expenditures incurred from aborted flights based on a known reimbursement base rate of $2374.73,[14] a loaded mile rate of $37.92,[14] and the Life Cycle Cost[13] program, as shown in Table 2.

Methods

The study period for the autolaunch program was July 1997 through June 1999. The purpose of the study was to investigate the outcomes of trauma patients transported by autolaunch compared with those transported by traditional dispatch. The flight database was accessed to retrieve autolaunch and traditional flight records from the study period for a retrospective chart review. The setting of the study was a hospital-based helicopter program at a Level One trauma center in a Midwestern city. The case sample was the autolaunch dispatches; the control sample was the traditional dispatches that took place in the same service area during the same period.

Inclusion criteria for the study were trauma patients transported from the scene of an accident in the autolaunch service area. Exclusion criteria included medical patients transported from a scene; patients in cardiac arrest at the scene, treated by the flight team but not transported because of death; and patients who were dismissed from the emergency department after helicopter transport from the scene. These patients were excluded because the hospital does not assign an Injury Severity Score (ISS) to patients in any of these categories. ISSs were used in the matching process and were available through the Trauma Registry.

The ISS was calculated from the Abbreviated Injury Score (AIS). The AIS classifies individual injuries by body region on a 6-point ordinal severity scale ranging from AIS 1 (minor) to AIS 6 (currently untreatable). The ISS is the sum of the squares of the highest AIS score in 3 different body regions and is calculated after the patient has been discharged from the hospital so that all tests have been completed and all injuries accounted for. The ISS gives a much better fit between overall severity and probability of survival. The range of ISS scores is 1 to 75. Clinically, a score of 15 is thought to be a significant injury.

The research questions for the study were:

- What was the completion rate of autolaunch flights during the study period?
- What was the difference in the amount of time from the accident to arrival of the helicopter when autolaunch was used?
- What were the differences in patient outcomes, ICU and hospital length of stay (LOS) and mortality when autolaunch was used?

The research design was a descriptive case control design. Statistical analysis for question #2 was done using a *t*-test with the level of significance set at .05. Question #3 was analyzed using a *t*-test for independent and matched samples for the LOS data and a χ^2 and relative risk for mortality data.

The autolaunch and traditional groups were not evenly matched. The autolaunch group had more patients with lower ISS, whereas the traditional group had more patients in the higher ranges, indicating a more severely injured patient (Figure 1). The same disparity was true with the Glasgow Coma

STUDY PERIOD REQUEST PROFILE

107 total requests meeting autolaunch criteria

22 requests completed

59 requests not completed

37 requests turned down or canceled before launching

48 aborted flights (because of patient condition or not being needed)

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Figure 1. Distribution of ISS scores

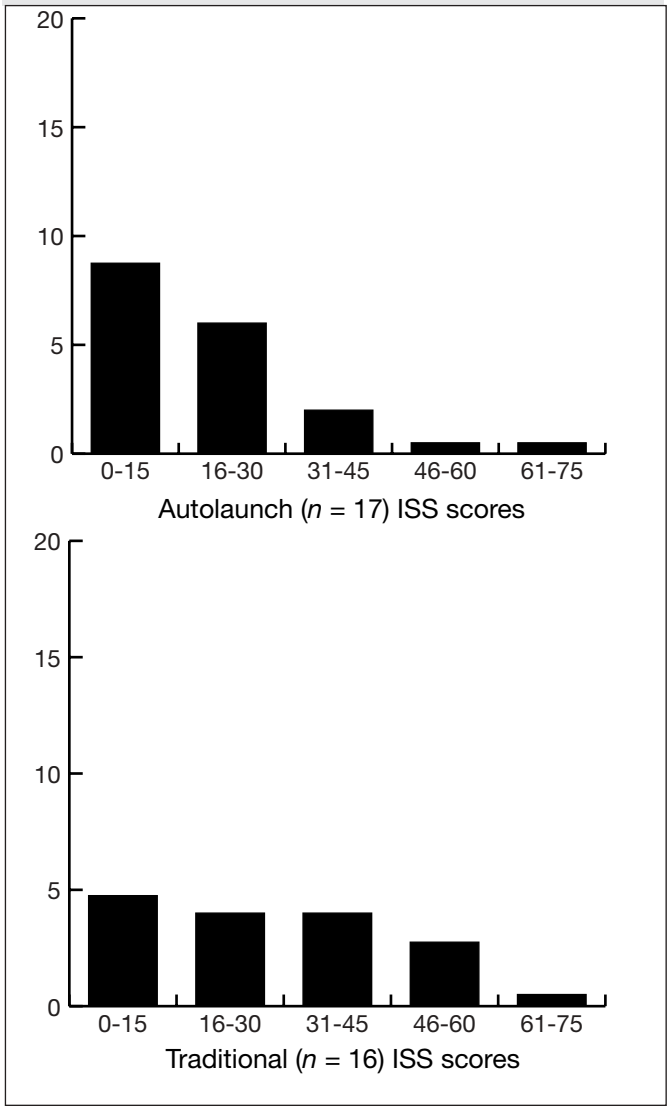
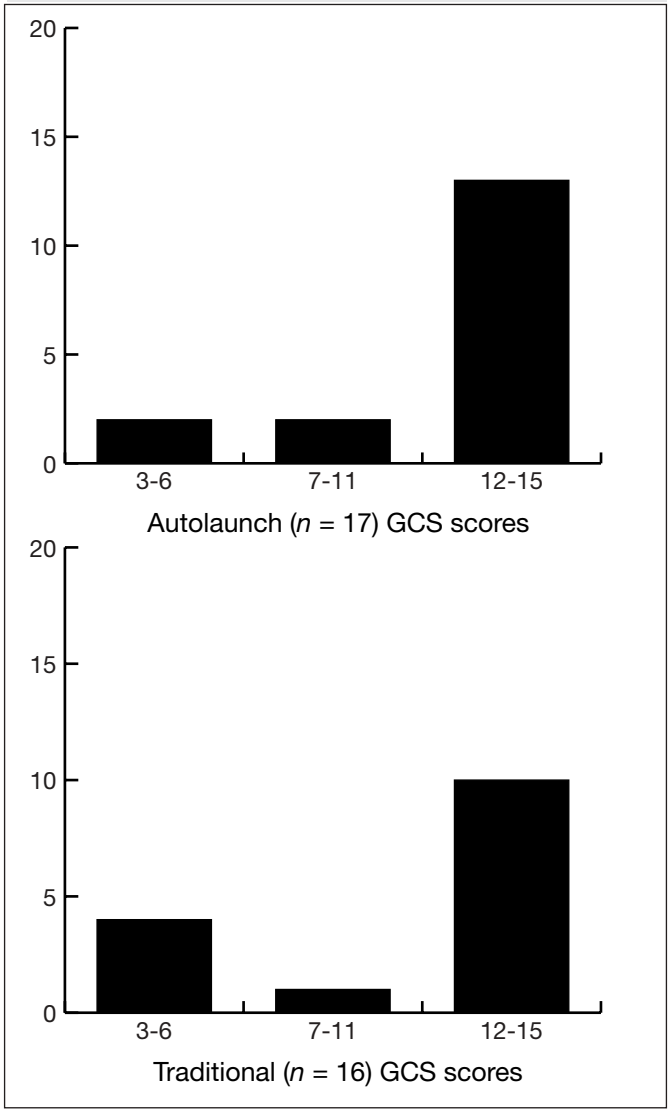


Figure 2. Distribution of GCS scores



Scale (GCS). More patients in the traditional group had lower GCS scores, indicating more severe injury (Figure 2). To make the groups similar, matching was done using ISS, GCS, and age. The ISS was used first to match with a difference of no more than 2 points. Next, the GCS score was used, again with a difference of no more than 2 points. Age was used to match adults and children (child < 6 years old; young adult < 50; older adult > 50). Eight matched pairs were found. These pairs then were analyzed using a matched *t*-test with the level of significance at .05 for LOS data and χ^2 and relative risk to analyze mortality data.

Results

During the 2 years of this study, 107 autolaunch dispatches occurred: 22 were completed, and 17 met criteria for inclusion into the study. Nineteen traditional dispatches occurred during the same time in the autolaunch service area, and 16 met inclusion criteria. The completion rate for the autolaunched flights in the designated area was 21%. The flight completion rate of all scene requests for the same time period for the entire 200-mile service area of this helicopter service was 59%.

Autolaunch (*n* = 17) had 59% male and 41% female patients with a mean age of 34. The range of ages was 5 to 60, and most patients were in the 21 to 50 range. In the traditional group (n = 16), there were 44% men and 56% women with a mean age of 33. The range was 2 to 88, and more patients were in the younger and older age ranges (Figure 3).

The response time to liftoff was the same for both groups, 4.5 minutes. Flight time to the scene of the accident was 5.9 minutes (range 3-10, SD 1.96) for autolaunch and 5 minutes (range 2-9, SD 1.98) for traditional dispatches. The distance for autolaunch was 9 nautical miles (NM) (range 5-24, SD 4.73) and 7.86 NMs (range 5-15, SD 3.24) for traditional dispatches. The ground time for autolaunch flights was 9.4 minutes (range 4-20, SD 4.68) and 12.9 minutes (3-25, SD 7.58) for traditional. In the autolaunch group, 41% of the patients were still being extricated from the vehicle on arrival of the helicopter, and the average extrication time was 21 minutes

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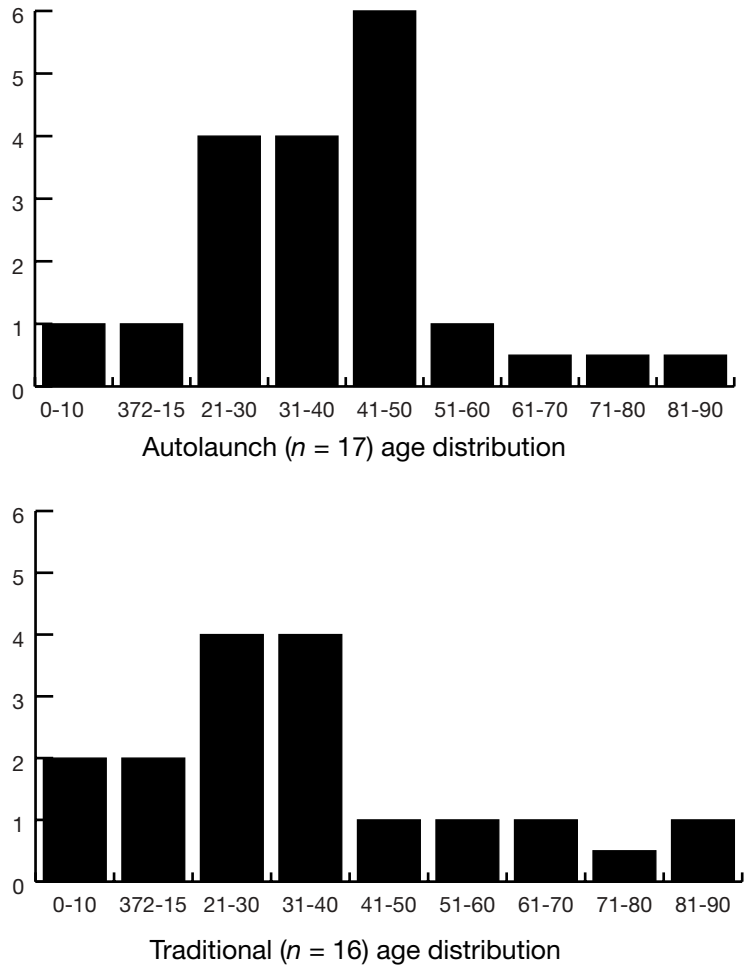
Figure 3. Distribution of age ranges



(range 10-40, SD 10.21). Twenty-five percent of the traditional patients were still being extricated on arrival with an average extrication time of 25 minutes (range 10-40, SD 14.72).

The amount of time from the accident to arrival of the helicopter was 22.24 minutes (range 9-39, SD 8.35) for autolaunch flights and 25.88 minutes (range 6-43, SD 12.45) for traditional dispatches, a difference of 3.64 minutes. An independent sample (unequal variance) *t*-test (t = 0.98, df = 26.01, *P* = .336) showed no significant difference between arrival time of the 2 groups.

The type of accidents that occurred for both groups was similar. MVAs were the most frequent type in both groups. Motorcycle, snowmobile, bicycle, and boating accidents also were common between the groups. A small number of "other" accidents make up the remainder of the groups.

Using unmatched groups, the mean ICU stay for the autolaunch groups was 4.00 days (range 0-24, SD 6.40); the mean ICU stay for the traditional group was 3.06 days (range 0-13, SD 4.97). An independent sample *t*-test (unequal variances assumed) revealed t = - 0.471, d f = 29.96, *P* = .641, indicating no significant difference.

Using matched groups, the mean ICU stay for the autolaunch group was 2.63 days (range 0-5, SD 3.46, median 1.50) and for traditional group, 3.75 days (range 0-13, SD 5.52, median 1.00)—a difference of 1.12 days. Using a matched *t*-test, no significant difference was found (t = 0.525, df = 7, *P* = .616). A Wilcoxin signed-rank test revealed t = 0.750.

The average days spent in the hospital for the unmatched autolaunch group was 14.82 days (range 2-110, SD 26.30) and, for the traditional group, 19.69 days (range 0-102, SD 35.30). No significant difference between the groups was found based on the results of an independent sample *t*-test (equality of means) (t = 0.684, df = 17.05, *P* = .503).

Analysis of the matched hospital LOS data revealed the autolaunch patients had a mean hospital stay of 9.38 days (range 2-31, SD 10.31) and the traditional group had a mean stay of 24.63 days (range 0-100, SD 37.93). The mean difference in hospital stay was 15.25 fewer days for the autolaunch group. No significant difference was found (t = 1.137, df = 7, *P* = .293). The Wilcoxin signed-rank test showed t = 0.587.

A relative risk was performed on the mortality data before and after matching. The data before matching showed 1 death in the autolaunch group and 7 in the traditional group. The relative risk for unmatched groups was found to be 1.12, showing that the risk of mortality when autolaunch was used was not different than when traditional dispatch was used.

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When matching was performed, the autolaunch group had no deaths and the traditional group had 1. A second relative risk analysis done using the matched data also showed no difference for mortality between autolaunch and traditional dispatch.

χ^2 analysis was used to compare mortality rates in the matched groups. The χ^2 value was calculated at 1.07 (df = 1, P = .302), indicative of no difference in mortality between the groups.

Discussion

As the results show, the use of similar samples is very important. Some result categories changed markedly once the samples were matched. For example, in the unmatched groups, the use of autolaunch could be seen as beneficial in reducing mortality. The traditional group had 7 deaths, whereas the autolaunch group had only 1. Once matching was done, the traditional group had 1 death and the autolaunch group had none. Autolaunch dispatch did not appear to successfully reduce mortality.

The groups do seem evenly matched in gender, mechanism of injury, type of accident, response time, and distance. The flight time was slightly longer on the autolaunch flights. Occasionally, the helicopter arrived before law enforcement and had to circle the scene until a landing zone was set up, making the flight time longer even though we are over the scene. The mean patient age was similar, although the range was larger in the traditional group. This group had more patients in the extremes of age, whereas the autolaunch group had more patients in the middle ranges. Comorbidities were examined to see if other medical conditions, especially in the traditional group that had an older population, would contribute to a longer hospital LOS. Few comorbidities were found in either group. Most patients (63%) in the traditional group had no comorbidities.

A slight difference in ground times arose between the groups. Treatments on scene and en route were analyzed and found to be similar. One explanation for the longer ground times on the traditional dispatches could be the increased severity of injury as evidenced by higher ISSs and extrication requirements. More of the autolaunch patients required extrication, although the length of extrication time was shorter. More extrication would have been expected on the autolaunch flights because the helicopter would have arrived on the scene earlier, finding extrication still in progress.

The completion rate for autolaunch flights was 21%. Although this rate seems low, program administration anticipated it. Being a new method of dispatch, the dispatchers' comfort level and education were insufficient, and additional education was needed as the program evolved. The dispatchers also are getting subjective data from the scene to determine the need for autolaunch flights. Often, no prehospital personnel are on scene, so the mechanism of injury and medical data are being relayed to LEC by layperson bystanders.

Compare this 21% completion for the small autolaunch area (the primary service area of the ALS ambulance in this city) with the scene flight completion rate of 59% for the entire 200-mile service area. The 21% completion rate does not seem unrealistic given the small service area and newness of the program. All flights, including autolaunch flights, were reviewed by two medical directors for appropriate utilization of helicopter transport. They thought all autolaunch flights were appropriate and met established criteria.

The second research question dealt with the time from the accident to helicopter arrival. A difference of 3.64 minutes emerged between the 2 groups. Though this figure was not statistically significant, it may be medically significant. With this dispatch method, the shortened amount of time from accident to arrival can make a difference in mortality or morbidity. A power analysis was done on the time from the accident to helicopter arrival. Assuming an overall standard deviation of 10, 64 patients per group were needed to have an 80% chance of detecting a difference of 5 minutes between the group means. This calculation was based on a 2-sided, 2-sample t-test assuming equal variances, equal group sizes, and a type I error level of 5%.

It is also interesting to note that the autolaunch distance was farther and response times and flight times were the same between the 2 groups, yet the time from accident to arrival of the helicopter was shorter for autolaunch. This finding could only mean that the time from the accident to launch is shortened, which is the goal of the autolaunch program. The difference in this length of time also might be shorter if the autolaunch program were used farther from the city in which the helicopter is based.

The dispatch center has ALS/BLS ambulances and the ability to hear about accidents in 12 cities in Minnesota and Wisconsin. With the autolaunch program, a recommendation could be made for implementation in these cities. Getting the helicopter dispatched more quickly when the accident is farther away will make a significant difference in time savings. Use of autolaunch may allow the helicopter to go directly to the scene of an accident and transport the patient to a trauma center rather than experience a significant delay from stabilization in a referring hospital. This plan will save not only time but also money.

Research question #3 analyzed the patient outcomes of mortality and LOS. The matched groups will be discussed at this point because the unmatched groups were found to be too different to compare. Once matching was done, no difference in mortality was found between the groups. The relative risk analysis revealed that autolaunch did not decrease the risk of mortality. The question to be answered is whether the autolaunch process would decrease mortality if it were used farther away from Rochester. This question will be analyzed when the process is implemented in other cities.

The difference in ICU LOS was little—just 1.12 fewer days for the autolaunch group. This figure was not statistically significant, although it was monetarily significant. The autolaunch process reduced the cost of the ICU stay by 1 day.

A difference in hospital LOS was found between groups, although statistical significance was not achieved. The difference was 15.25 fewer days in the hospital for the autolaunch group. Even though it is not statistically significant, this finding is monetarily and medically significant. The approximate cost of a hospital room for one day is $680, not including

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physician charges or tests. This amount multiplied by 15 days can lead to quite a cost savings. Also of importance is the patient's and family's emotional status. To be discharged from an ICU 1 day sooner and leave the hospital 15 days sooner may benefit their emotional status.

Conclusion

The autolaunch process is a method of dispatch designed to get helicopter crews to the scene of an accident more quickly. This study describes the process of initiating an autolaunch program and reviews the outcomes of patients transported under it. Autolaunch did indeed get the helicopter to the scene 3.64 minutes faster, which supports the golden hour concept to decrease mortality and morbidity. As a result of the small sample size in this study, statistical significance was not found for decreasing the time from the accident to helicopter arrival or patient outcomes. Monetary and medical significance may be implied. A larger sample may validate the findings of this study, and further research is underway. Further research also is warranted when the autolaunch process is implemented in cities where average flight times to the accident scene are longer.

Autolaunch is being implemented in a county south of Rochester and will be studied for patient outcomes. An unrealized benefit of the program was the enhanced public relations within the EMS community. Most of the prehospital and LEC services in the autolaunch area have expressed great satisfaction with the program. It has refined the working relationship between the air and ground services. In conclusion, the use of autolaunch is a beneficial dispatch method for this flight program.

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