Background:
Recently, CDC, together with the American College of Surgeons Committee on Trauma, amended the Field Triage Guidelines for Emergency Medical Service (EMS) providers to include consideration of crash vehicle telemetry data from Advanced Automatic Crash Notification (AACN) systems such as OnStar. Besides immediate notification, AACN crash messages provide crash location & severity. As part of the Alaska Emergency Medical Services Optimization (AKEMSO) Project, Alaska’s infrastructure was examined to assess readiness to fully exploit AACN. Infrastructure requirements or considerations include:
- Adequate cellular coverage (to permit completion of calls from crashed motor vehicles).
- Sufficient GPS satellite visibility (to permit accurate determination of crash location).
- Accurate geographic catalog of ground & air ambulance bases, hospitals and trauma centers (to enable auto-identification of closest medical responders for receipt of AACN crash information. The Atlas & Database of Air Medical Services (ADAMS) was developed for this anticipated application.)

Objectives of Study:
1. Assess cellular signal strength and GPS satellite visibility along Alaska roadways to determine where AACN transmissions will likely work.
2. Estimate percentage of motor vehicle crashes (MVC) whose victims might reach definitive care (within the ‘Golden Hour’) if AACN crash alerts are successfully transmitted to 911 centers and to the nearest emergency medical providers within a few minutes of crash.

Methods:
- Cellular signal strength and GPS satellite coverage were measured by driving the Alaska Highway System with 2KCellTest equipment (Fig 1).
- Data from recent OnStar crashes were acquired from Alaska’s 511 CARS system as a form of ‘truth’ data.
- Geocoded locations of 481 fatal motor vehicle crashes (2001-2007) (Fig 2) were obtained from NHTSA’s Fatality Analysis Reporting System (FARS) and used as ‘surrogate locations’ for serious injury crashes. (Validity previously demonstrated at AMTC 2008 Scientific Assembly).
- Locations of ground and air ambulance bases as well as hospitals and trauma centers were mapped (Fig 3) (Sources: AKEMSO-GIS & ADAMS).
- Expected travel times by air & ground were computed in a Geographic Information System (GIS).

Results: (Objective 1):
- About 85% of the measured 1800 mile route had cellular signal (Fig 4). GPS satellites-in-view ranged from 3 to 8.
- Over 67 weeks (2008-2009), 54 OnStar crashes were posted in AK-CARS demonstrating successful AACN message transmission. Cell strength at OnStar locations was shown to be ‘very good’ or ‘adequate’.  

Results: (Objective 2):
- 50% of fatal crashes occur in isolated highway villages or communities with no hospital.
- GIS calculations show ground travel (Base→Scene → Nearest Acute Care Hospital (ACH)) was possible in 35 minutes for 312 (65%) of FARS crashes. With inclusion of helicopter transport, travel within 35 minutes was possible for 76%.
- 141 (29%) of FARS crashes were candidates for air transport to ACH. Air travel times over an hour were not uncommon (Fig 5). Air travel saved 1 to 8 hours (relative to ground) for 53 crashes (Table A).
- For 28 (6%) of FARS crashes, air transport was the only option (i.e., no connecting roads).
- Ground travel to the only Trauma Center (Level 2 in Anchorage) within 35 minutes was possible for just 31% of FARS crashes. With inclusion of helicopter transport, travel to Trauma Center within 35 minutes was possible for 44%.

Conclusions:
Although gaps in cellular service were identified, measurements show cellular coverage is ~85% along much of the main Alaska Highway System. GPS satellites-in-view were very good. This bodes well for AACN. Mapping of crashes & medical infrastructure illustrates that many crashes occur at long distances from hospitals (and the trauma center) resulting in lengthy responder and patient travel times even under the best of conditions. Although not modeled here, a multi-mode, tiered response is often required. Given this, it is particularly important that AACN alerts be shared in a timely way with all responders involved so that preflight preparations and tiered response planning can begin in parallel with first responder activities.

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