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# Minneapolis bridges falling down: Emergency transfusion preparedness

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ABSTRACT

The 7/1/2007 bridge collapse into the Missisippi River was instructional from both a disaster response and a mass casualty transfusion response perspective. It is a well cited example of how community disaster response coordination can work well, especially following systematic preparation of an integrated response network. The blood center is and should be an integral part of this diaster response and should be included in drills where appropriate. We give personal perspectives on both the hospital and transfusion service response to this particularly dramatic event.



## 1. Introduction

August 1, 2007: Nobody predicted the fall of the I-35 bridge into the Mississippi River. Built in 1967 it had been rated in 2006 as "structurally deficient, but not in need of immediate replacement." In short, it was no worse than myriad other similar structures of aging infrastructure around the US. Its 2000 foot span crossed a 390 foot wide section of the Mississippi about 7 feet deep. The bridge deck was about 115 feet above the water, the center of the structural arch 64 feet. About 141,000 cars/day traversed the span, far more than when it was conceived and built. The collapse occurred at 6:05 pm as cars were in a relative stand still either on a homeward commute or travelling into the city for a 7PM Minnesota Twins baseball game, immediately adjacent to the first exit from the bridge travelling South over the river. Fortuitously, also adjacent to both the stadium and the bridge is the city's busiest level one trauma center, Hennepin County Medical Center, where one of us (JG) is co-medical director of the Transfusion Service.

The bridge collapsed in sections over seconds, as sequential portions failed (see Fig. 1). There was no redundant capacity as it was a steel bridge single arch bridge with two major supporting beams, built to avoid pillars in the river which would be problematic for the upriver lock and dam. Gusset plates, which hold the girders together, were of insufficient thickness when installed, and over time rusted and buckled. Under the extra weight of building materials placed on the bridge and rush hour traffic at a virtual standstill, one of these plates failed, triggering the collapse. The standstill traffic was, in retrospect, a blessing as cars fell straight down when the bridge collapsed, as opposed to careening off at highway speeds. The hazards were too numerous to recount, but included the fact that the collapse was ongoing, so that in some cases victims survived the fall, cushioned in their cars but later succumbed when additional bridge sections or debris fell on them as they escaped their vehicles.

The response can be summarized as follows:

- Collapse to last patient transported:
  Initial clearing of all sectors: 1 h 35 min.
  Last EMS transport: 2 h 6 min.

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**Fig. 1.** Northern portion of the 35W bridge collapse. The majority of critically injured victims were extricated from the riverbank and area below the overhanging section of the bridge where the blue van came to rest. Overall debris field was >1 mile in length. Photo courtesy of the Minneapolis StarTribune – used with permission. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

- 50 patients transported by EMS; (HCMC 23, Univ. MN 11, North Memorial, another level one trauma hospital 9 and a community hospital Abbott Northwestern 6. All of the critically injured were brought to HCMC.
- 8–13 casualties via other vehicle, usually good Samaritans who stopped by with pick up trucks, but patients were accompanied by EMTs or other emergency personnel.
- Over 100 patients treated in 24 h.
- 13 deaths.
- No serious injuries to first responders.
- 29 ambulances used in first 4 h.

The response has been reviewed in the disaster medicine literature [4,5] and has been acknowledged as an example of the success of integrated disaster planning and response [2]. It is fortuitous that the nearby large level one trauma hospital also houses the busiest EMS service in the state. In addition, it houses the Regional Hospital Resource Center (RHRC) that coordinates care among participating hospitals (and is activated on an event-specific basis) and the Medical Resource Control Center (MRCC) which coordinates routine as well as incident-specific regional EMS agency communications and response to mass casualty incidents. MRCC is the gatekeeper for the web-based statewide "MNTRAC system" which in the metro keeps live information flowing about ER status, bed availability, patient numbers and patient destinations.

## 2. Disaster planning and response

Despite nearly 1.5 miles of response zone, the incident went relatively smoothly because a plan was in place AND drilled regularly. The plan included notification of off-duty personnel, a shared incident response plan for the 24 EMS agencies, and practiced integration with Minneapolis Fire. The ability to expand/contract as needed was built into the system and exercises tested the surge capacity and systems. Through the auspices of the local disaster preparedness unit, there had been drills of various disasters (although a bridge collapse had not been among them!), that had previous coordinated responses across jurisdictions (Minneapolis and St. Paul police) across departments, fire and police and EMS and other services. John Hick MD, Medical director for emergency preparedness at Hennepin County Medical Center, quipped, "The middle of an emergency is a lousy time to be exchanging business cards." Because they had prior preparation and many of the responders had previously worked together the collaboration across jurisdictions and services was commendable.

A surge capacity model and rapid size up tool for health care facilities during the initial response has been summarized as the CO-S-TR framework [6].

Co(4) Command, Control, communication, coordination.
S(4) Space, staff, Stuff, Special (logistics).
Tr(4) Triage, Treatment, Transport and Tracking.

Focusing on the primary receiving hospital (HCMC) response, the initial information about the bridge collapse was received at about 6:10 pm when the hospital was near capacity. Only 5 intensive care unit beds were available. In the emergency room, the most critically ill patients brought in by ambulance are initially seen and stabilized in a four bed room ("stabilization room") – two of those beds were already occupied at the time of the collapse. For immediate access to additional information, the charge nurse turned on the television in patient area and in consultation with senior medical staff an "Alert Orange" was declared at 6:15 pm which automatically triggers several key functions. The alert automatically recalls key personnel, holds on duty personnel, including paging all ED staff to the hospital. In addition, patient reception areas were cleared, ED beds opened, and a hospital command center is established in a pre-designated area staffed by key administrative and clinical personnel identified by premade vests.

It was not until 6:40 that the first critically ill patients actually arrived at the hospital where they were received by an overwhelming number of staff who descended upon the ER to "see if they could help." In short, it was both staff and patients that needed initial assignment to areas in the ED.

Over the ensuing 2 h, 25 critically ill patients were received, one dead on arrival (who expired enroute to the hospital from non-survivable thoracic injuries). 6 were intubated, 5 went directly to the operating room after their ED stabilization including one for an emergent Caesarian section for fetal distress (with a good outcome for both mother and baby). Of the 24 patients, 60% were admitted. In the 45 min after the Orange alert was declared the surge capacity plan was activated and 20 additional ICU beds were made available (by calling in additional staff or transferring stable patients to the floor), 10 operating rooms were opened and staffed (instead of the two typically maintained all evening) and all three CT scanners were up and running (normally, only the one in the ER is kept open after usual business hours).

Two of the HCMC emergency department physicians are also fellowship-trained EMS physicians and responded to the collapse site per system protocol, liaisoning with the