IDENT-A-NARC · FOUNDATIONAL EVIDENCE REFERENCE

DELAYS and MORTALITY DATA

The measurable cost of delay in time-critical emergency care

Ident-a-Narc reference document · VERSION 1.1 ·

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ADVISORY: These materials are advisory considerations and possible factors to support clinicians in making their own executive decisions. They are not diagnostic instruments. Clinical judgement always remains with the practitioner.

EXECUTIVE SUMMARY

This is a foundational reference for the Ident-a-Narc App. Its purpose is to establish, from checked and citable published evidence, a single principle: that delay to time-critical emergency treatment measurably increases death and disability. That principle underpins why the obstruction, diversion or degradation of an emergency response — whether by system failure or by the deliberate, controlling or anti-social behaviour of an individual — is not a trivial inconvenience but a quantifiable driver of harm.

The document opens with the study that prompted it — the 2024 Acute Medicine account of corridor care in a large UK hospital — and the national mortality signal now attached to crowded, delayed emergency admission. It then sets out, condition by condition, the dose–response relationship between elapsed time and mortality for sepsis, stroke, acute myocardial infarction, acute severe asthma and status epilepticus. It closes with the definitive military research on the 'Golden Hour' for survival from severe battlefield wounds, and the way that time-based principle is expressed in UK ambulance response policy.

Every figure below is referenced to a named, checkable source (PMID, DOI or published URL). This is a living reference: it is version 1.1 and is designed to be added to as further conditions and datasets are collated.

SECTION 1 CORRIDOR CARE & ED CROWDING

Corridor care and emergency-department crowding — the trigger evidence

Delayed admission from a crowded emergency department carries a measurable excess mortality.

The immediate prompt for this reference is a 2024 study in Acute Medicine describing patients cared for in the corridor of a large UK hospital. It found a cohort that was sick, elderly and distressed: around one in six carried a National Early Warning Score (NEWS) of 5 or more, roughly two-thirds were elderly or frail, and over four in ten had a history of mental-health difficulty or substance misuse. The authors also documented the 'moral injury' to staff obliged to deliver care in a corridor. An accompanying editorial observed, pointedly, that emergency-department corridors have become the new acute medical units.

The mortality signal behind this is not anecdotal. A large national study of more than five million emergency admissions in England (2016–18) established a clear association between delayed admission from the emergency department and all-cause 30-day mortality. Mortality began to rise once a patient waited beyond

five hours from arrival, and the excess risk climbed with every further hour. Expressed as a number-needed-to-harm (NNH) — the number of delayed patients among whom one extra death occurs — the study found roughly one additional death for every 191 patients delayed 4–6 hours, one per 82 delayed 6–8 hours, and one per 72 delayed 8–12 hours.

At a national scale, the Royal College of Emergency Medicine has estimated that overcrowding and corridor care were associated with circa 16,600 excess deaths in England in a single recent year — roughly a tenfold rise on the position a decade earlier. Whatever the precise figure, the direction and magnitude are not in dispute: waiting, in a crowded emergency system, can be the end of you.

TABLE 1: DELAY FROM ED ARRIVAL TO ADMISSION AND 30-DAY ALL-CAUSE MORTALITY (JONES ET AL., 2022)

Length of delay	Number-needed-to-harm (NNH)	Interpretation
Up to 5 hours	No excess detected	Baseline
4–6 hours	191	1 extra death per 191 patients delayed
6–8 hours	82	1 extra death per 82 patients delayed
8–12 hours	72	1 extra death per 72 patients delayed

SECTION 2 SEPSIS PROTOCOL

Sepsis — every hour of delayed antibiotics counts

In septic shock, survival falls by several percentage points for each hour that effective antibiotics are delayed.

Sepsis is the archetypal time-critical emergency. In the landmark 2006 study of human septic shock by Kumar and colleagues (2,731 patients), survival was 82.7% when effective antimicrobial therapy was given within the first half-hour of documented hypotension, but fell steadily thereafter — with a mean decrease in survival of approximately 7.6% for every hour of delay across the first six hours. By six hours, survival had fallen to around 42%.

Larger, more recent datasets confirm the direction while refining the magnitude in less extreme presentations. Liu and colleagues (2017), studying some 35,000 patients, found each additional hour to antibiotics carried an adjusted odds ratio for death of 1.09 — an absolute mortality increase of about 0.3% per hour in sepsis, 0.4% in severe sepsis and 1.8% in septic shock. A 2024 systematic review and meta-analysis (29 studies) found each hour of delay raised the odds of in-hospital death by about 4% (OR 1.041), rising sharply once delay exceeded one hour (OR 1.205). A separate 2024 meta-analysis (42 studies, ~190,000 patients) found antibiotics within three hours associated with an odds ratio for death of 0.80, and within six hours 0.57, relative to later treatment.

TABLE 2: SURVIVAL BY TIME TO EFFECTIVE ANTIBIOTICS IN SEPTIC SHOCK (KUMAR ET AL., 2006)

Time to effective antimicrobial therapy	Survival
Within 30 minutes	82.7%
Within 1 hour	77.2%
By 6 hours	~42%
Each hour of delay (mean)	~7.6% decrease in survival

SECTION 3 CEREBROVASCULAR ACCIDENT

Stroke (cerebrovascular accident) — time is brain

Untreated ischaemic stroke destroys around 1.9 million neurons every minute.

Saver's 2006 analysis 'Time is Brain — Quantified' remains the definitive statement of the stakes. In a typical large-vessel ischaemic stroke the untreated brain loses approximately 1.9 million neurons, 14 billion synapses and 12 km of myelinated nerve fibres every minute. Over a single untreated hour that is around 120 million neurons and 830 billion synapses — the ischaemic brain ages roughly 3.6 years for every hour treatment is withheld.

Because reperfusion therapy (thrombolysis and thrombectomy) is strongly time-dependent, every delay reduces the probability of a good functional outcome: each additional 30 minutes to reperfusion measurably lowers the odds of the patient walking out independently.

TABLE 3: TISSUE LOST PER UNIT TIME IN UNTREATED LARGE-VESSEL ISCHAEMIC STROKE (SAVER, 2006)

Elapsed time untreated	Neurons lost	Synapses lost	Accelerated brain ageing
Per minute	1.9 million	14 billion	—
Per hour	120 million	830 billion	~3.6 years

BE-FAST — STROKE RECOGNITION MNEMONIC (ATTRIBUTION)

BE-FAST — Balance, Eyes, Face, Arms, Speech, Time — extends the earlier FAST mnemonic by adding the two highest-yield anterior-circulation and posterior-circulation indicators that FAST alone misses. The BE-FAST mnemonic was formally described by Aroor, Singh & Goldstein in Stroke (2017;48:479–481; PMID 27932609) at Intermountain Healthcare, and is promoted publicly through www.BEFAST.org. Its use here is in full acknowledgement of that published work and its authors. [17]

TABLE 4: BE-FAST STROKE RECOGNITION ELEMENTS

Element	What to look for
B — Balance	Sudden loss of balance or coordination
E — Eyes	Sudden vision change, double vision, loss of vision in one or both eyes
F — Face	Facial droop or asymmetry; ask patient to smile
A — Arms	Arm weakness; ask patient to raise both arms
S — Speech	Slurred, strange or absent speech; ask patient to repeat a simple phrase
T — Time	Call 999 immediately; note time of symptom onset for clinical handover

The original FAST mnemonic (Face, Arms, Speech, Time) was developed collaboratively by the Stroke Association and ambulance services in the UK in the late 1990s and published by Harbison et al. in Stroke (2003;34:71–76). [17]

SECTION 4 MYOCARDIAL INFARCTION

Acute myocardial infarction — the ischaemic wavefront

In a heart attack, muscle dies progressively until the artery is reopened; shorter reperfusion times save lives.

In ST-elevation myocardial infarction the 'ischaemic wavefront' advances from the moment of coronary occlusion: heart muscle dies progressively until the vessel is reopened. Reperfusion — by primary angioplasty or thrombolysis — is therefore time-critical, and the greatest benefit is obtained within the first hour. Registry evidence links shorter door-to-balloon (D2B) times to lower mortality: each 10-minute reduction in door-to-balloon time has been associated with lower in-hospital and six-month mortality. Systems that shorten the pathway — pre-hospital 12-lead ECG, direct cath-lab activation and bypass of the emergency department — reduce treatment time and improve survival. (A population-level caveat is well

recognised: as door-to-balloon times have fallen nationally, aggregate mortality has not fallen in lock-step, because the treated population has simultaneously grown older and higher-risk. At the level of the individual patient, however, faster reperfusion remains clearly better.)

SECTION 5 RESPIRATORY EMERGENCY

Acute severe asthma — preventable death from under-treatment

Most asthma deaths are preventable; under-assessment of severity and delayed escalation are the primary drivers.

The UK National Review of Asthma Deaths (NRAD, 2014) found that care was frequently suboptimal before death: severity was under-recognised, there was over-reliance on reliever (SABA) inhalers that masked deterioration, personal asthma action plans were often absent, and escalation to hospital was delayed. The review concluded that a substantial proportion of asthma deaths were preventable.

The clinical gradient is stark. General in-hospital asthma mortality is of the order of 1–5%, but near-fatal asthma requiring mechanical ventilation carries a mortality of approximately 10–25%. The step from a deteriorating attack to a peri-arrest presentation is driven substantially by delayed recognition and delayed intervention — exactly the failures NRAD identified.

TABLE 5: ASTHMA MORTALITY BY PRESENTATION SEVERITY

Presentation	Approximate mortality
General in-hospital asthma	1–5%
Near-fatal asthma (mechanically ventilated)	10–25%

SECTION 6 NEUROLOGICAL EMERGENCY

Status epilepticus — the 30- and 60-minute thresholds

Treatment within 30 minutes improves outcome; delay beyond 60 minutes is associated with markedly worse survival and function.

Status epilepticus is time-critical in a way that maps directly onto elapsed minutes. Outcome is best when effective treatment is given within about 30 minutes of onset; once the latency to treatment exceeds roughly 60 minutes, functional outcomes and mortality worsen significantly. Latency-to-treatment is itself an independent determinant of outcome.

The problem is compounded in non-convulsive status epilepticus, where diagnosis depends on EEG. Reported delays to EEG (medians of the order of 11–12 hours) translate into delayed treatment and worse outcomes. Mortality is highest at the extremes of age and is very largely determined by the underlying cause — but the modifiable component, the part a responsive system can influence, is the speed of recognition and treatment.

SECTION 7 TRAUMA & COMBAT RESEARCH

The military 'Golden Hour' — definitive combat-casualty research

A mandated one-hour evacuation policy roughly halved the case-fatality rate of US combat casualties.

The concept of a 'golden hour' originates with R Adams Cowley, founder of the University of Maryland's Shock Trauma Center, who argued from the 1970s that the first hour after severe injury is decisive for survival. The definitive test of the principle came from the battlefield.

In 2009 the US Secretary of Defense, Robert Gates, mandated that combat casualties be evacuated to surgical care within 60 minutes. Kotwal and colleagues (JAMA Surgery, 2016) analysed 21,089 casualties from 2001–2014 across the policy change. Median transport time fell from 90 to 43 minutes, and the proportion of missions completed within 60 minutes rose from about a quarter to three-quarters. Over the same period the case-fatality rate fell from 13.7% to 7.6% — an effect the authors associated with an estimated 359 lives saved. Rapid blood transfusion was a further critical factor.

A complementary handoff study (casualties 2007–2015) underlines how compressed the window is: of those who died, about 90% did so within four hours of wounding and 68% within the first hour. Rapid handoff to a surgical team within one hour was associated with roughly a 66% reduction in mortality, and timely emergency surgery with about a 60% reduction. The battlefield evidence is, in short, the clearest natural experiment we have that shortening time-to-definitive-care saves lives.

TABLE 6: EFFECT OF THE MANDATED ONE-HOUR EVACUATION POLICY ON US COMBAT CASUALTIES (KOTWAL ET AL., 2016)

Measure	Before policy	After policy
Median transport time	90 minutes	43 minutes
Missions completed ≤60 minutes	24.8%	75.2%
Case-fatality rate	13.7%	7.6%

SECTION 8 AMBULANCE DISPATCH POLICY

The Golden Hour in UK ambulance policy — the Ambulance Response Programme

UK ambulance response is now built on clinically-prioritised, time-bound categories that operationalise the time-critical principle.

The time-critical principle is embedded in how UK ambulance services are dispatched. The Ambulance Response Programme (ARP) — adopted by East Midlands Ambulance Service (EMAS) on 19 July 2017 and presented to Leicester City Council in the September 2017 briefing cited below — replaced the previous response-time regime with clinically-appropriate, disposition-based dispatch ('Dispatch on Disposition' and a 'Nature of Call' pre-triage), so that the sickest patients are identified and prioritised fastest.

ARP defines four call categories with explicit time standards: Category 1 (immediately life-threatening, e.g. cardiac arrest) — mean response 7 minutes, 90% within 15 minutes; Category 2 (emergency, including suspected stroke and chest pain) — mean 18 minutes, 90% within 40 minutes; Category 3 — 90% within 120 minutes; Category 4 — 90% within 180 minutes. These standards are the operational expression of everything in the preceding sections: the system is explicitly designed around the fact that, for the most time-critical conditions, minutes change outcomes.

TABLE 7: AMBULANCE RESPONSE PROGRAMME (ARP) CATEGORIES AND TIME STANDARDS

Category	Examples	Mean	90th centile
Category 1 — life-threatening	Cardiac arrest	7 min	15 min
Category 2 — emergency	Stroke, chest pain	18 min	40 min
Category 3 — urgent	—	—	120 min
Category 4 — less urgent	—	—	180 min

PROVENANCE NOTE — REFERENCE [16] (EMAS ARP BRIEFING)

The EMAS Ambulance Response Programme briefing of 15 September 2017 (Leicester City Council document s88026) is cited from its published URL. At the time of compilation the file could not be machine-retrieved directly (the host returned an automated browser-verification challenge rather than the document). Its ARP content has therefore been corroborated against the NHS England Ambulance Response Programme evaluation and review reports, which set out the same categories and time standards. Reference [16] should be read with that provenance note in mind.

GOVERNANCE AND INTERPRETATION

This is a decision-support and evidence reference document. It does not provide a clinical diagnosis and does not, on its own, determine responsibility in any individual case. The mortality relationships described are population-level findings; they are indicative, not determinative, of the outcome of any single incident.

Where this evidence base is used within Ident-a-Narc to weigh the seriousness of interference with an emergency response, the standard exculpatory caveats apply: apparent obstruction or non-cooperation may be explained by an innocent third factor — for example a person who is delirious, intoxicated or living with dementia (the '3 Ds'). The evidence here establishes the stakes of delay; it does not attribute intent.

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