

**Updated Working Paper – Iran Casualty Estimation (Validated
Inputs)**

**Expanded data provenance, conservative nationwide
extrapolation, and updated injury-survivor logic**

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(Dated: Data cut-off: Friday, 23 January 2026)

Abstract

This working paper provides a transparent, conservative framework for reporting observed clinical inputs and deriving lower-bound nationwide estimates under restricted access conditions. We strictly separate (i) *validated inputs (hard data)* reported by clinical and forensic sources from (ii) *modeled components* used only where necessary to infer nationwide totals.

I. EXECUTIVE SUMMARY (WHAT IS OBSERVED VS. WHAT IS ESTIMATED)

This update incorporates newly validated city-level inputs from the clinical reporting network. Throughout, we strictly separate (i) directly observed, validated inputs (“hard data”) from (ii) modeled components required to infer nationwide totals under restricted access conditions.

Observed validated inputs (hard data; no modeling)

- Clinically registered deaths recorded in hospitals: see Table I.
- Validated eye injuries (where available): see Table I (blank cells indicate that a validated eye-injury total is not yet available).
- Eye enucleations (reported severe irreversible outcomes): ≥ 700 (hard minimum, reported across major referral centers; optional cautious context $\sim 1,000$).
- Forensic medicine–reported executions (city-level counts; no extrapolation): Tehran 468; Mashhad 214; Qom 121; Shiraz 167 (Table II).

Important: execution counts are not estimated or extrapolated here. They may overlap with the broader fatality totals and are therefore reported separately as validated, city-level observations.

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Modeled conservative nationwide estimates (based on explicitly stated assumptions)

- Nationwide deaths (estimated, conservative lower-bound model): 33,130.
- Nationwide eye injuries (estimated, conservative completion): 29,294.
- Injured survivors (estimated using eye injuries as 30% of all injuries): 97,645.

II. DATA PROVENANCE, COLLECTION PROCESS, AND CONSERVATIVE QUALITY RULES

Data sources are considered trustworthy because they originate from frontline personnel and operational stakeholders in and around hospitals, including: hospital physicians, nurses, biomedical/medical-technology staff, and hospital suppliers/contractors who are directly exposed to throughput and shortages.

Collection and verification

Eight coordinators inside Iran collected figures directly from designated contacts in the respective hospitals and, where feasible, from peripheral/affiliated clinics in each catchment area. Coordinators performed plausibility checks (internal consistency, cross-confirmation where possible, and comparison with observed constraints such as blood-product scarcity and ICU load).

Conservative counting rule

When multiple figures were received from the same institution for the same metric/time window, the smaller figure was retained for analysis. All values should be interpreted as a time-stamped snapshot rather than a final, reconciled registry.

III. VALIDATED INPUTS (HARD DATA)

Table I lists the validated city-level inputs used in this update. Eye-injury totals are available only for a subset of cities in the current dataset; blank cells indicate that a validated eye-injury total is not yet available.

TABLE I. Validated city-level inputs (hard data) used in this update.

Region	Validated deaths	Validated eye injuries
Tehran	8,354	11,900
Mashhad	2,893	2,750
Isfahan	1,935	760
Karaj	1,753	—
Shiraz	1,920	8,650
Tabriz	650	360
Qom	1,850	—
Ahvaz	1,020	—
Kermanshah	1,850	—
Urmia	350	—
Rasht	986	—
Zahedan	593	—
Hamadan	320	—
Kerman	365	—
Yazd	326	—
Ardabil	489	—
Other cities	4,650	—

Note: These execution counts are reported separately to avoid double counting. They may overlap with clinically registered deaths and other fatality categories in Table I; therefore, they are not added to the nationwide death estimate in Sec. IV.

TABLE II. Forensic medicine–reported executions (city-level; no extrapolation).

City	Executions reported by forensic physicians (count)
Tehran	468
Mashhad	214
Qom	121
Shiraz	167

IV. METHODOLOGY FOR NATIONWIDE DEATH ESTIMATES (MAXIMALLY CONSERVATIVE)

Observed inputs provide only partial coverage of national mortality. To infer a nationwide total, we apply a two-step conservative extrapolation.

Assumption 1 (geographic extrapolation)

The combined burden of locations not listed among the major cities is approximated as 30% of Tehran’s validated deaths. This intentionally avoids scaling up from peak cities to the full country and is meant as a conservative placeholder until broader coverage is available.

Assumption 2 (under-ascertainment)

Approximately 15% of deaths are not captured in the validated counts (e.g., deaths outside hospital pathways, access constraints, or incomplete reporting). Accordingly, the captured subtotal is treated as 85% of the true total.

Transparent computation

- Step A: Sum validated deaths across the major cities listed in Table I (excluding the separate “Other cities” row).
- Step B: Estimate remaining locations = $0.30 \times \text{deaths(Tehran)}$.

- Step C (conservative merge): if a partial aggregate for “Other cities” is present, retain the smaller of the rule-based estimate ($0.30 \times$ Tehran) and the reported aggregate.
- Step D: Nationwide deaths = captured subtotal/0.85.

Numbers for this update

- Tehran validated deaths = 8,354
- Remaining locations (rule-based) = $0.30 \times 8,354 = 2,506$
- Reported “Other cities” (if provided) = 4,650
- “Other cities” used (minimum of the two) = 2,506
- Sum of major-city deaths (excluding “Other cities”) = 25,654
- Captured deaths subtotal = 28,160
- Nationwide deaths (estimated) = 33,130

Scientific positioning

This is a rule-based lower-bound estimator. More sophisticated methods (e.g., multiple-systems estimation / capture–recapture) require linkable, independent lists, which are not currently available under the present access constraints. The conservative approach here is therefore designed to be transparent, reproducible, and resistant to overstatement.

V. EYE INJURIES: WHAT THEY REPRESENT (AND WHAT THEY DO NOT)

Eye injuries are counted here as treated clinical cases. This case count includes a spectrum from mild injuries managed conservatively (no surgery required) to severe penetrating trauma requiring complex interventions. Therefore, the number of eye injuries cannot be used to infer the number of blind individuals.

Only eye enucleations are certain cases of irreversible blindness. All other eye injuries require outcome follow-up (visual acuity, retinal status, optic nerve damage, and complications) before long-term visual loss can be assessed.

VI. NATIONWIDE EYE INJURIES (PARTIAL HARD DATA + CONSERVATIVE COMPLETION)

In the current validated dataset, eye-injury totals are available for a subset of cities. To avoid overstating national totals, we provide two values: (i) a hard minimum (sum of validated eye injuries where available), and (ii) a conservative completed estimate for missing cities using the lowest observed eye-injury-to-death ratio among the cities with both metrics.

- Observed eye injuries (hard minimum; only cities with validated eye-injury totals): 24,420.
- Conservative completion ratio (minimum observed eye injuries per death) = 0.393 (derived from the subset of cities with both deaths and eye-injury totals).
- Nationwide eye injuries (conservative completed estimate, including remaining locations) = 29,294 (major cities: 28,309; remaining locations: 984).

VII. INJURED SURVIVORS: UPDATED ESTIMATE USING EYE INJURIES AS 30% OF ALL INJURIES

For this update, we apply the working assumption that eye injuries represent approximately 30% of all injured survivors. This assumption is grounded in consistent clinical reporting from multiple regions that the majority of injuries are concentrated in the head and neck region. Under this scenario, the implied number of injured survivors is:

$$\begin{aligned} \text{Injured survivors} &\approx \frac{\text{Nationwide eye injuries}}{0.30} & (1) \\ &= \frac{29,294}{0.30} = 97,645. & (2) \end{aligned}$$

Important note: this is a scenario-based translation from eye-injury counts to total injured survivors. If the true proportion of eye injuries among all injuries is lower than 30%, the implied total number of injured survivors would be higher.

VIII. ENUCLEATIONS AND BLINDNESS: WHY CURRENT COUNTS MAY NOT RISE IMMEDIATELY

The network continues to report approximately 700 enucleations across the five major referral centers. We have not observed a significant increase in this figure in the most recent update window. A likely explanation is clinical timing: most enucleations occur acutely in the first hours/days after catastrophic ocular injury. Cases that may ultimately require secondary enucleation (e.g., uncontrollable infection, phthisis bulbi, or refractory pain) remain within the ongoing treatment pipeline and may not yet be reflected in updated enucleation totals.

Accordingly, enucleations should be interpreted as a delayed and partial proxy for irreversible blindness. The broader eye-injury count is not a blindness count; it is a treated-case count spanning mild to severe injuries.

IX. LIMITATIONS (EXPLICIT)

- Snapshot nature: figures reflect a time-stamped aggregation under crisis conditions.
- Under-ascertainment factor (15%) is an assumption; true undercount may vary by region and time.
- The “remaining locations = 30% of Tehran” rule is a simplifying geographic extrapolation, designed to be conservative.
- Eye-injury completion uses the minimum observed ratio; if some sites under-report eye injuries, the conservative completion will understate totals.
- Double counting risk is higher for injuries than for deaths; in this update, conservative minimum selection was applied when duplicate reports occurred.
- Without linkable lists, advanced statistical reconciliation (capture–recapture) cannot currently be implemented.

X. REFERENCES (METHODOLOGY AND CONTEXT)

- [1] D. Manrique-Vallier, M. E. Price, and A. Gohdes, *Multiple Systems Estimation Techniques for Estimating Casualties in Armed Conflicts*, HRDAG Working Paper (2012). https://hrdag.org/wp-content/uploads/2013/04/Manrique_Price_Gohdes_WorkingPaper.pdf
- [2] Z. Jamaluddine *et al.*, Traumatic injury mortality estimation using capture–recapture / multiple-systems estimation approaches, *The Lancet* (2025) – methodological example under incomplete data.
- [3] X. Wei *et al.*, A series of 777 pellet gun ocular injuries over a 4-month period, PMID: PMC9789860 (2022). <https://pmc.ncbi.nlm.nih.gov/articles/PMC9789860/>
- [4] F. Q. Shah *et al.*, Perforating ocular trauma due to shotgun pellet, PMID: PMC8186650 (2021). <https://pmc.ncbi.nlm.nih.gov/articles/PMC8186650/>

AUTHOR PROFILE

Prof. Dr. Amir M. Parasta is an ophthalmic surgeon and medical director of the MUNICH MED Group. In addition to his clinical work, he has been engaged in human rights–related medical support for victims of political violence. During the Mahsa Amini movement, he and his team treated more than 40 eye-injured, politically persecuted patients from Iran. Since then, he has been able to draw on an established network of physicians in Iran and across the diaspora to support medical documentation and continuity of care for victims of violence associated with demonstrations in Iran.

FAQS

FAQ 1 — What exactly are the “hard data” in your report?

A: Hard data are the counts directly reported by clinical personnel through our hospital network and treated as observed inputs up to the cut-off date—e.g., hospital-registered deaths by city (Table I), validated eye injuries where available, ≥ 700 eye enucleations, and

forensic medicine–reported executions by city (Table II). Everything labeled “estimated” is derived later using stated assumptions.

FAQ 2 — Where does estimation begin?

A: Estimation begins when we infer nationwide totals from partial coverage. We apply a conservative geographic completion rule (remaining locations = $0.30 \times$ Tehran) and a conservative under-ascertainment factor (15%) to account for deaths not captured in validated hospital counts.

FAQ 3 — Are the nationwide numbers “verified totals”?

A: No. They are conservative lower-bound estimates designed for transparency and to avoid overstatement under restricted access. We explicitly note that these are snapshots and not reconciled national registries.

FAQ 4 — How do you address double counting?

A: We apply a conservative counting rule: when multiple figures exist for the same institution/metric/window, we retain the smaller figure. Double counting risk is higher for injuries (transfers/re-admissions) than for deaths, but it cannot be fully eliminated without linkable identifiers.

FAQ 5 — What does “clinically registered deaths” mean?

A: It refers to deaths recorded in hospitals (ED/wards/ICU/OR pathways). It does not imply complete capture of deaths occurring outside healthcare pathways, which is why we apply a conservative under-ascertainment assumption.

FAQ 6 — Are executions included in the nationwide death estimate?

A: No. Executions are presented as separate, city-level hard data (Tehran 468; Mashhad 214; Qom 121; Shiraz 167) with no extrapolation. They may overlap with hospital-registered

deaths, so they are not added to the nationwide estimate to avoid double counting.

FAQ 7 — Why do you estimate “injured survivors” from eye injuries?

A: Because validated injury totals are incomplete, we use eye injuries as a proxy for a severe-injury subset. We present a scenario where eye injuries represent ~30% of injured survivors, producing an implied injured-survivor count. If the true proportion is lower, total injuries would be higher.

FAQ 8 — Does “eye injuries” equal “blindness”?

A: No. Eye injuries range from mild to severe treated cases. Only enucleations are certain cases of irreversible blindness; other eye injuries require follow-up to determine long-term outcomes.

FAQ 9 — What makes your data “trustworthy” if you cannot name sources publicly?

A: The report describes a structured collection process (frontline clinicians and operational stakeholders), internal plausibility checks, cross-confirmation where possible, and conservative minimum selection. Identities cannot be disclosed due to safety risks.

FAQ 10 — What would strengthen the estimates further?

A: A more rigorous approach (capture–recapture / multiple-systems estimation) would require independent, linkable lists and broader access—currently not feasible. We outline these limitations explicitly and recommend standardised reporting and list-building for future reconciliation.