

Analysis of nasal fracture management and subsequent surgical outcomes across demographics

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Dear Editor:

Nasal bone fractures are the most common type of facial injury and can pose significant long-term challenges if not diagnosed and treated correctly at the time of presentation, including, but not limited to, septal hematoma, infection, epistaxis, persistent nasal deformity, nasolacrimal injury, deviated septum, and even mental health issues as serious as post-traumatic stress disorder as persistent complications⁽¹⁻⁴⁾. Optimal management remains controversial and subjective based on the clinician's judgment, with many factors playing a role in the provider's decision, including the timing of treatment, the choice between foregoing treatment or choosing to undergo a closed or open reduction, and how to manage subsequent revision surgeries if necessary⁽⁵⁻⁷⁾.

Despite the numerous studies on nasal bone fracture management and outcomes, significant gaps in the literature remain regarding the influence of social determinants of health on treatment access and outcomes. Demographic factors, such as sex, race, and ethnicity, are well-known indicators of health outcomes across all medical specialties^(8,9). Given the potentially significant sequelae of nasal bone fractures, studying population trends is useful in identifying disparities within nasal fracture management.

We utilized the TriNetX database, a large repository of patient information that aggregates anonymized electronic health records from 93 participating healthcare organizations worldwide. The database includes comprehensive patient data such as demographics, diagnoses, and procedures. Patients are queried based on the temporal relationships between diagnostic (e.g. 10th revision of the International Classification of Diseases (ICD-10)) and procedural (e.g. Current Procedural Terminology (CPT)) codes, allowing us to capture the timing of interventions relative to the initial diagnosis. Subjects in our study comprised those with nasal bone fracture (ICD-10 S02.2) who underwent closed reduction (CPT

codes 21310, 21315, and 21320). We stratified subjects into two groups based on timing of their closed reduction procedure: 1) within 14 days of injury (i.e. timely treatment) and 2) 15 days to 4 weeks post-injury (i.e. delayed treatment). We then explored who underwent subsequent nasal surgery, including primary and secondary septo- and rhinoplasty (CPT 30400, 30410, 30420, 30430, 30435, 30450, 30520, and 30465). For those who received timely treatment, we investigated the prevalence of these CPT codes more than 14 days after injury, and for the delayed group, we examined them more than 15 days after injury. We further stratified the patients into pediatric (≤ 18 years) and adult (> 18 years) populations to compare between age groups.

We extracted 28,929 patients who underwent closed nasal bone reduction for nasal bone fracture in the last 20 years (Table 1). Out of these, 27,711 (95.8%) received closed reduction within two weeks of injury. Non-Hispanic patients were significantly more likely to receive timely treatment than Hispanic patients (96.1% vs. 95.2%, RR=1.009, 95% CI [1.002-1.017], $p=0.0408$). Similarly, non-Hispanic pediatric subjects were more likely to receive timely treatment than Hispanic pediatric subject (97.7% vs. 96.6%, RR=1.012, 95% CI [1.002-1.022], $p=0.0211$). Non-white pediatric subjects were more likely to receive timely treatment than white pediatric subjects (95.9% vs. 97.7%, RR=0.981, 95% CI [0.971-0.992], $p=0.0003$). Non-white adult patients were also significantly less likely to receive timely treatment compared to white patients (80.3% vs. 88.2% RR=0.910, 95% CI [0.838-0.989], $p=0.0442$).

Timely treatment was overall associated with a significantly lower rate of subsequent revisions of the closed nasal bone reduction (3.6%) than delayed treatment, which was associated with a 12.4% revision rate; this difference was statistically

Table 1. Demographic breakdown of patients (all, pediatric, and adult) with nasal bone fractures treated with closed nasal bone reduction.

	All									
	Nasal bone fracture with closed reduction	Timely treatment	Delayed treatment	Revision surgeries (All)	Revisions after timely treatment	Revisions after delayed Treatment				
Total	28929	27711	95.8%	1218	4.2%	1155	1004	86.9%	151	13.1%
Male	17957	17226	62.2%	731	60.0%	624	543	54.1%	81	53.6%
Female	10048	9616	34.7%	432	35.5%	471	419	41.7%	52	34.4%
Not Hispanic or Latino	20619	19816	71.5%	803	65.9%	809	718	71.5%	91	60.3%
Hispanic or Latino	3837	3654	13.2%	183	15.0%	156	133	13.2%	23	15.2%
White	19686	18872	68.1%	814	66.8%	843	739	73.6%	104	68.9%
Non-White (Total)	5504	5255	19.0%	249	20.4%	156	141	14.0%	15	9.9%
Black or African American	3200	3058	11.0%	142	11.7%	64	59	5.9%	5	3.3%
Asian	568	543	2.0%	25	2.1%	20	15	1.5%	5	3.3%
Native Hawaiian or Other Pacific Islander	94	84	0.3%	10	0.8%	0	0	0.0%	0	0.0%
American Indian or Alaska Native	204	194	0.7%	10	0.8%	10	10	1.0%	0	0.0%
Other	1438	1376	5.0%	62	5.1%	62	57	5.7%	5	3.3%

	Pediatric subjects									
	Nasal bone fracture with closed reduction	Timely treatment	Delayed treatment	Revision surgeries (All)	Revisions after timely treatment	Revisions after delayed Treatment				
Total	9514	9265	97.4%	249	2.6%	224	206	92.0%	18	8.0%
Male	6295	6128	66.1%	167	67.1%	139	123	59.7%	16	88.9%
Female	3009	2936	31.7%	73	29.3%	88	78	37.9%	10	55.6%
Not Hispanic or Latino	6569	6420	69.3%	149	59.8%	150	136	66.0%	14	77.8%
Hispanic or Latino	1711	1652	17.8%	59	23.7%	55	45	21.8%	10	55.6%
White	6589	6435	69.5%	154	61.8%	169	152	73.8%	17	94.4%
Non-White (Total)	1591	1525	16.5%	66	26.5%	58	48	23.3%	10	55.6%
Black or African American	726	700	7.6%	26	10.4%	20	10	4.9%	10	55.6%
Asian	215	205	2.2%	10	4.0%	10	10	4.9%	0	0.0%
Native Hawaiian or Other Pacific Islander	31	21	0.2%	10	4.0%	0	0	0.0%	0	0.0%
American Indian or Alaska Native	45	45	0.5%	0	0.0%	10	10	4.9%	0	0.0%
Other	574	554	6.0%	20	8.0%	18	18	8.7%	0	0.0%

Table 1. Continued

	Nasal bone fracture with closed reduction	Adult Subjects								
		Timely treatment	Delayed treatment	Revision surgeries (All)	Revisions after timely treatment	Revisions after delayed Treatment				
Total	19016	18057	95.0%	959	5.0%	1015	888	87.5%	127	12.5%
Male	11534	10971	60.8%	563	58.7%	545	478	53.8%	67	52.8%
Female	6786	6433	35.6%	353	36.8%	409	366	41.2%	43	33.9%
Not Hispanic or Latino	13754	13107	72.6%	647	67.5%	724	645	72.6%	79	62.2%
Hispanic or Latino	2117	1993	11.0%	124	12.9%	113	98	11.0%	15	11.8%
White	12762	12109	67.1%	653	68.1%	745	657	74.0%	88	69.3%
Non-White (Total)	3915	3717	20.6%	198	20.6%	152	122	13.7%	30	23.6%
Black or African American	2466	2350	13.0%	116	12.1%	67	57	6.4%	10	7.9%
Asian	354	334	1.8%	20	2.1%	22	12	1.4%	10	7.9%
Native Hawaiian or Other Pacific Islander	73	63	0.3%	10	1.0%	0	0	0.0%	0	0.0%
American Indian or Alaska Native	159	149	0.8%	10	1.0%	10	10	1.1%	0	0.0%
Other	863	821	4.5%	42	4.4%	53	43	4.8%	10	7.9%

significant (RR=3,422 95% CI [2.912-4.020], $p < 0.0001$). Revisions were also significantly more common among white subjects (5.0%), compared to non-white subjects, who collectively had a revision rate of 2.5% (RR=2.089, 95% CI [1.701-2.566], $p < 0.0001$). Delayed treatment among pediatric patients generally led to higher revision rates (7.2% vs. 2.2%, RR=3.251, 95% CI [2.042-5.176], $p < 0.0001$). Adults who had delayed treatment had higher (13.2%) rates of revisions compared to revision rates among those who had timely treatment (4.9%) (RR=2.693, 95% CI [2.262-3.205], $p < 0.0001$). Non-white patients (80.3%) were significantly less likely than white patients (88.2%) to receive revision surgeries if they had timely treatment (RR=0.910, 95% CI [0.838-0.989], $p = 0.0311$). This finding may be influenced by the nature of nasal bone fractures, which are typically more acute and require immediate intervention, whereas revision surgeries are often elective and may be pursued differently across demographic groups. White patients might have better access to follow-up care and elective procedures, leading to higher rates of revision surgeries, despite a greater proportion of white patients receiving timely initial surgical care. Conversely, non-white patients could face barriers to accessing these elective surgeries or may opt not to pursue them as frequently. These factors highlight the need for further investigation into the underlying causes of these disparities.

Overall, demographic disparities were most salient in rates of revision nasal surgeries following closed reduction. This is somewhat expected, as nasal fracture reduction presents acutely, while differences in subsequent revisions may be due to a lack of access to follow-up care. While early intervention appears to be a crucial factor in reducing the necessity for future surgeries, patients from various demographic groups in our study did not receive it at the same rates. Ultimately, these findings warrant further investigation into the underlying reasons for these disparities to improve access to equitable and quality care and achieve the utmost patient satisfaction.

List of abbreviations

ICD-10: 10th revision of the International Classification of Diseases; CPT: Current Procedural Terminology; 95% CI: 95% Confidence Interval.

Authorship contribution

DK: Conceptualization, Data curation, Formal analysis, Writing original draft; SP, TJO'N: Conceptualization, Data curation, Writing, review & editing; TB: Validation, Writing, review & editing; CCR: Validation, Supervision, Writing, review & editing; JJT: Conceptualization, Validation, Supervision, Writing, review & editing.

Conflict of interest

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