Iowa Trauma Registry Report

December 2023

Public Health
Iowa HHS

Acknowledgements

Data Citations:

State of Iowa Department of Health and Human Services. Bureau of Emergency Medical and Trauma Services. *2022 Iowa Trauma Registry Report.* Des Moines: Iowa Dept. of Public Health, 2023. Web. https://hhs.iowa.gov/public-health/emergency-medical-services-trauma/trauma-data-registry. Access date – day month year.

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The Bureau of Emergency Medical and Trauma Services would like to acknowledge the Trauma System Advisory Council and the System Evaluation Quality Improvement Subcommittee for ongoing support and mentorship in the development of this report. Special thanks to Josh Jungling (Bureau of Health Statistics), and Dr. James Torner (University of Iowa) for all their support and technical assistance.

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Executive Summary

The 2022 Iowa Trauma Registry Report is the product of an analytics project on data reported to the Iowa Trauma Registry, including reporting on inpatient and outpatient events. Additionally, this report contains data analyzed from Iowa death certificates and the Center for Disease Control and Prevention's (CDC) available death statistics. This report can be helpful to users interested in understanding Iowa's trauma system, data driven decision-making related to the trauma system, process improvement related to the trauma system, and the reduction of morbidity and mortality from trauma.

OVERVIEW

In 2022, Iowa's trauma system demonstrated its resilience and dedication to the health and well-being of its citizens. The data extracted from the Iowa Trauma Registry provide valuable insights into the state's healthcare landscape. With 118 facilities actively contributing to this registry, the state's commitment to trauma care is evident. This report delves into the key data points, highlighting trends and challenges faced by the Iowa trauma system.

PATIENT INCIDENTS

A total of 26,602 incidents were reported in 2022, underscoring the critical role these hospitals play in the community. These incidents included 23,823 patients, emphasizing the system's reach and impact. While various incident types were reported, falls dominated the statistics, constituting a staggering 59.2% of incidents (n = 15,751). Transport crashes, including motor vehicle (18.6% - n = 4,936) were also documented. Work-related incidents accounted for 4.8% (n = 1,271) of incidents, while farm-related incidents comprised 1.8% (n = 469).

Trauma activations numbered 10,103, showcasing the swift response of Iowa's healthcare system. Among these, 2,748 were Level 1 activations and 7,355 were Level 2 activations, reflecting the hospitals' tiered approach to mobilizing trauma care resources. Additionally, there were 1,084 trauma service consultations not included in the total count of activations. The data revealed 400 self-inflicted injuries, emphasizing the importance of mental health support. Moreover, 1,053 assault injuries were reported, highlighting the need for community-based violence prevention programs. Lastly, there were 2,611 reported incidents of transfer delay.

DEMOGRAPHIC DISTRIBUTION

Gender

The gender distribution of patients was nearly balanced, with 45.6% being female and 54.3% male, underscoring that trauma affects individuals of all genders. A small number of incidents involved individuals where the gender was not recorded (0.1% of incidents).

Age

The age distribution among the data show a wide range, with a substantial proportion falling within the 60-69 and 70-79 age groups, each representing approximately 13.6%, and 16.5% respectively. The 80-89 age group also accounts for a substantial share, comprising about 16.7%. Meanwhile, those aged 20-29 and 50-59 make up approximately 8.3% and 8.7%, respectively. The younger age groups, 0-9 and 10-19,

contribute to about 5.8% and 7.8% respectively. The 30-39 and 40-49 age groups each represent around 7.8% and 6.7%. Individuals aged 90-99 constitute around 7.7% of the data, and those aged 100+ are a small percentage at approximately 0.3%. Additionally, there are 16 incidents with missing or unreported age data, making up roughly 0.06% of the total.

Race

In the context of trauma hospital incidents in Iowa during the year 2022, the racial distribution of patients is as follows: the majority of patients are White, accounting for 86.41% of incidents. Patients with race recorded as "Black or African American" make up 4.47% of incidents, followed by "Not Known/Not Recorded" at 4.31% of incidents. Hispanic patients represent 1.69%. Incidents involving patients documented as "Other Race" make up 1.68% of the registry. American Indian or Alaska Native patients account for 0.61%. A smaller percentage includes Asian patients at 0.58%, and Native Hawaiian or Other Pacific Islander patients at 0.24%.

EMERGENCY MEDICAL SERVICES

In the realm of emergency medical services (EMS), Iowa experienced a significant surge in activity during 2022, resulting in 459,892 EMS Incident Reports, signifying a substantial increase from the previous year. These reports document responses by EMS programs to medical emergencies and crises. In 2021, there were 446,241 such reports, representing a noticeable increase from 2020 as well. The increases in EMS runs seen in 2022 compared to 2020 and 2021 may be related to the policies put into effect during the years 2020-2021 to address the public health emergency surrounding COVID-19.

A modest increase was observed in 2022 with 303,182 EMS transport incident reports, reflecting an increase of approximately 1.58% compared to the 297,815 reports documented in 2021. Additionally, 64,448 trauma-related incident reports were documented in 2022. Please note that there was a change in calculation to focus on first responder reports of the nature of incidents instead of the dispatcher's reported reason for the call. Trauma-related transport incident reports reached 45,984 in 2022. Caution should be taken not to compare the trauma transports with 2021 for the same reasons cited related to the trauma responses just above.

CONCLUSION

The data from the Iowa Trauma Registry exemplify the dedication and expertise of Iowa's trauma care facilities. As the state continues to address the diverse range of incidents and injuries, it is evident that a collaborative approach involving healthcare facilities, public health initiatives, and community engagement is crucial. These insights serve as a foundation for improving trauma care and enhancing the overall well-being of Iowa's residents, ensuring that the healthcare system remains prepared and responsive in the face of trauma-related challenges. Furthermore, the surge in EMS activity underscores the need for strategic planning and resource allocation to effectively manage the growing demands on the healthcare infrastructure. It is imperative that Iowa's healthcare system continues to adapt and progress to meet the evolving needs of its citizens, maintaining the highest standards of care and safety.

List of Acronyms

Abbreviation	Name
ACS	American College of Surgeons
AIS	Abbreviated Injury Scale
ATLS	Advanced Trauma Life Support
CDC	Centers for Disease Control and Prevention
GCS	Glasgow Coma Scale
HHS	Iowa Department of Health and Human Services
ISS	Injury Severity Score
RTS	Revised Trauma Score
SEQIS	System Evaluation Quality Improvement Subcommittee
TSAC	Trauma System Advisory Council

Trauma in Iowa

OVERVIEW

In 1995, the Iowa Trauma Care System Development Act was enacted by the state legislature, signifying a pivotal moment in Iowa's healthcare landscape. This legislative milestone entrusted the Iowa Department of Health and Human Services (HHS), formerly known as the Iowa Department of Public Health, with the role of spearheading system development and implementation. To facilitate informed decision-making and assessment, the Act instituted the Trauma System Advisory Council (TSAC), an entity designed to offer counsel to Iowa HHS and evaluate the efficacy of the trauma system. Moreover, the legislation ushered in the State Trauma Registry, thereby mandating the statewide reporting of injuries as a reportable condition. On January 1, 2001, the Iowa Trauma System achieved full operational status, marked by the establishment of a comprehensive committee structure for oversight and evaluation and the robust implementation of the State Trauma Registry. This framework hinges on the active participation of emergency departments, hospitals, ambulance services, and the professionals that serve in these programs.

In 2015, the American College of Surgeons-Committee on Trauma (ACS) conducted a consultative visit to assess the Iowa trauma system. The ensuing ACS review yielded a multitude of recommendations, emphasizing the imperative to enhance the utilization of data for both driving and documenting trauma system improvements. The complete ACS Trauma System Consultation Report is accessible at this link. Substantial strides have since been taken to align with ACS's data reporting and other counsel.

The enduring objective of the trauma system remains unwavering – to deliver timely, specialized care by aligning the needs of trauma patients with suitable resources, spanning from the moment of injury through rehabilitation. Attaining this objective necessitates a harmonious collaboration among trauma care providers and resources across the state, encompassing every facet of trauma care. An integrated system approach acutely acknowledges this continuum of care and has been empirically demonstrated to curtail overall costs, disability, and fatalities stemming from traumatic injuries. To expedite the already commendable progress in reducing morbidity and mortality linked to traumatic injuries, the triad of injury control components – prevention, acute care, and rehabilitation – must harmonize their efforts.

STATE TRAUMA REGISTRY:

The foundation of the State Trauma Registry can be traced back to the enactment of Iowa Code Chapter 147A and Iowa Administrative Code 641 Chapter 136 (IAC 641-136) in 1996. Trauma was duly recognized as a reportable condition, with a "trauma patient" being defined as an individual who has suffered an external injury resulting in major or minor tissue damage or destruction, stemming from intentional or unintentional exposure to thermal, mechanical, electrical, or chemical energy, or due to the absence of heat or oxygen. Chapter 136 - Trauma Registry was updated in July 2018, solidifying the registry's role in collecting and analyzing patient data concerning the incidence, severity, and etiology of trauma.

The Iowa Trauma Registry Data Dictionary (January 2017) prescribes inclusion criteria and reportable patient data appropriate for submission to the trauma registry.

The aggregated data serve as the foundation of this annual report, encapsulating the magnitude of injuries within Iowa, the configuration of trauma care, the quality of care rendered, and the definitive outcomes for injured individuals across the state. A dedicated arm, the Trauma System Advisory Council's (TSAC) System Evaluation and Quality Improvement Subcommittee (SEQIS), routinely scrutinizes these data to formulate recommendations for system enhancement. Hospitals employ this dataset to inform their performance improvement initiatives and injury prevention efforts. Furthermore, aggregate data from the registry informs overarching enhancements to the trauma system within various trauma service areas. This invaluable data resource has found applications in the creation of the Burden of Injury Report, state-level injury prevention campaigns, and research endeavors. Please note that the SEQIS indicators toward the end of this report are reported by Hospital Preparedness Service Area and at the state level. Hospital Preparedness Service areas are regional planning areas that include hospitals, public health, emergency medical services, and emergency management personnel funded by Iowa HHS to develop integrated hospital preparedness plans in order to effectively respond to disasters and other emergencies.

Trauma Hospitals

In 2022, Iowa's trauma care landscape remained deeply committed to inclusivity and patient-centric care. The state boasts a robust network of 118 hospitals, all meticulously verified to function as trauma care facilities at varying levels. For the purposes of this report, Iowa's 3 pediatric hospitals are combined with their parent hospitals. These institutions are categorized into four distinct levels of trauma care, each designed with varying resources to meet the specific needs of patients based on the severity of their traumatic injuries.

Level I facilities stand equipped with the comprehensive resources required not only to deliver optimal trauma care and system development, but also to advance trauma care through research. Level II facilities, while mirroring Level I in their capacity to provide optimal initial definitive trauma care, may not be actively involved in research endeavors. Nevertheless, they remain instrumental in the continuum of trauma care delivery. Level III facilities provide definitive care, including surgical services, for patients with mild to moderate injuries and have processes in place to transfer patients to a higher level of care when available resources are expended. Although they may not possess the full spectrum of resources needed for the most critically injured patients, they remain indispensable in the regional trauma care framework. Lastly, Level IV facilities are primed to rapidly assess, stabilize, and often transfer patients with traumatic injuries, though are capable of administering definitive care to those with minor injuries. Their expertise in managing less severe incidents plays a pivotal role in relieving the burden on higher-level facilities.

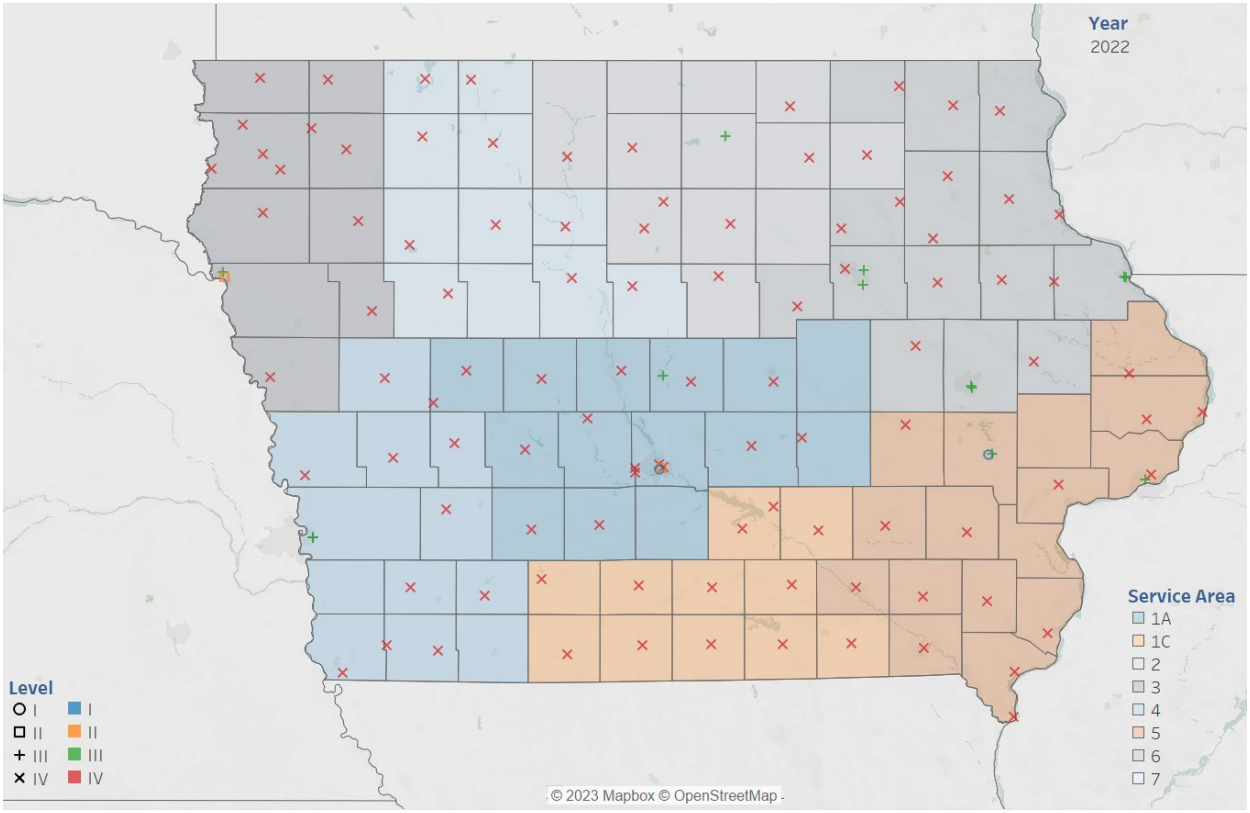

Figure 1: Map of trauma care facilities

TRAUMA FACILITY COUNT

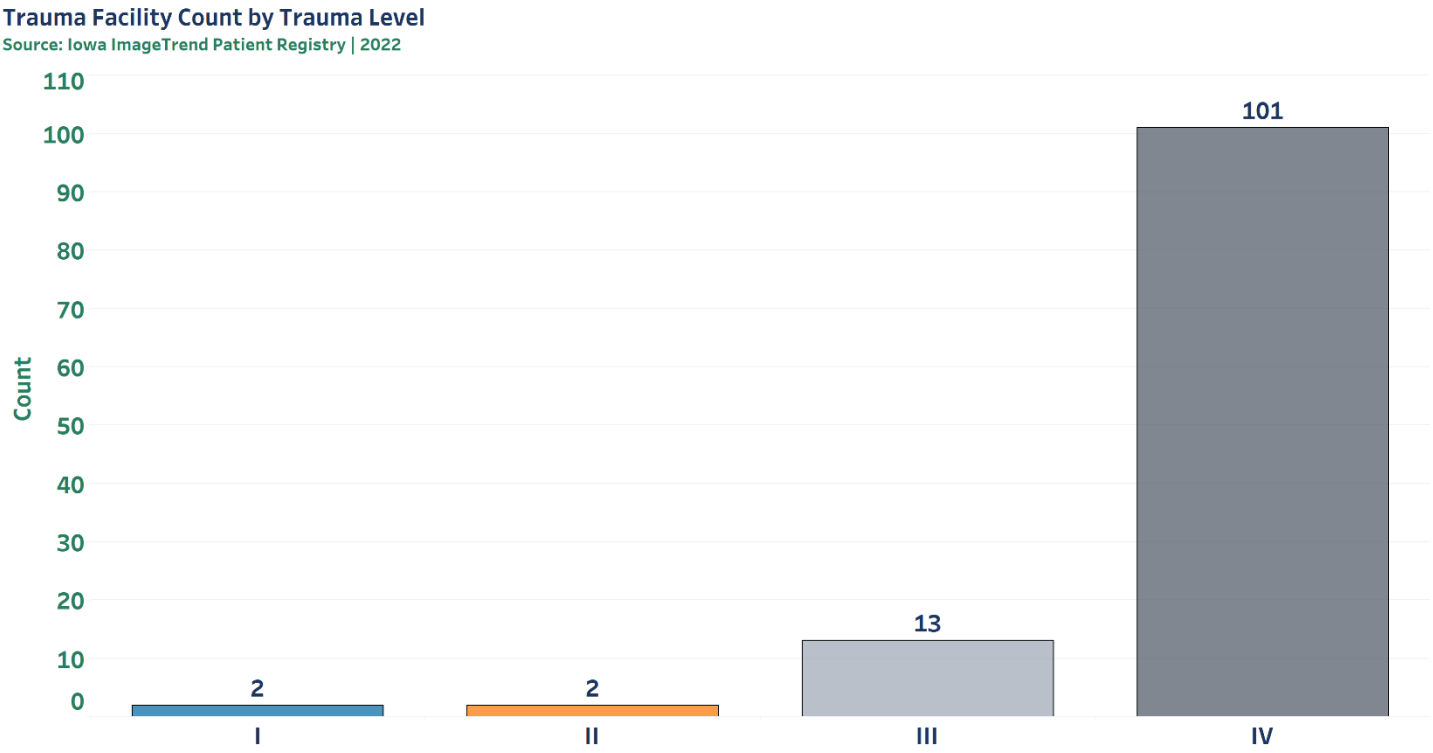

Figure 2: Trauma facility count by trauma level

All 118 adult trauma care facilities and 3 pediatric trauma care facilities situated within the state of Iowa are mandated to furnish data to the State Trauma Registry. Among these, all Level I and II facilities have received verification as trauma care facilities from the American College of Surgeons (ACS). The remaining healthcare institutions in Iowa have obtained their verification status as trauma care facilities through a comprehensive process overseen by HHS in conjunction with the Iowa Trauma Verification Survey Team.

The Iowa Trauma Verification Survey Team is composed of a consortium of healthcare professionals contracted by Iowa HHS to evaluate trauma care facilities, ensuring their adherence to established trauma criteria. This interdisciplinary team consists of highly qualified individuals, including trauma surgeons, emergency medicine physicians, and trauma nurses, representing diverse healthcare regions across the state of Iowa. The Iowa Trauma Verification Survey Team also includes out of state survey team members from Nebraska who play a critical role, as well. Their evaluations are grounded in the criteria delineated within the Iowa Administrative Code 641 Chapter 134 - Trauma Care Facility Categorization and Verification, serving as the benchmark for the verification process.

DISTRIBUTION OF INCIDENTS ACROSS FACILITIES

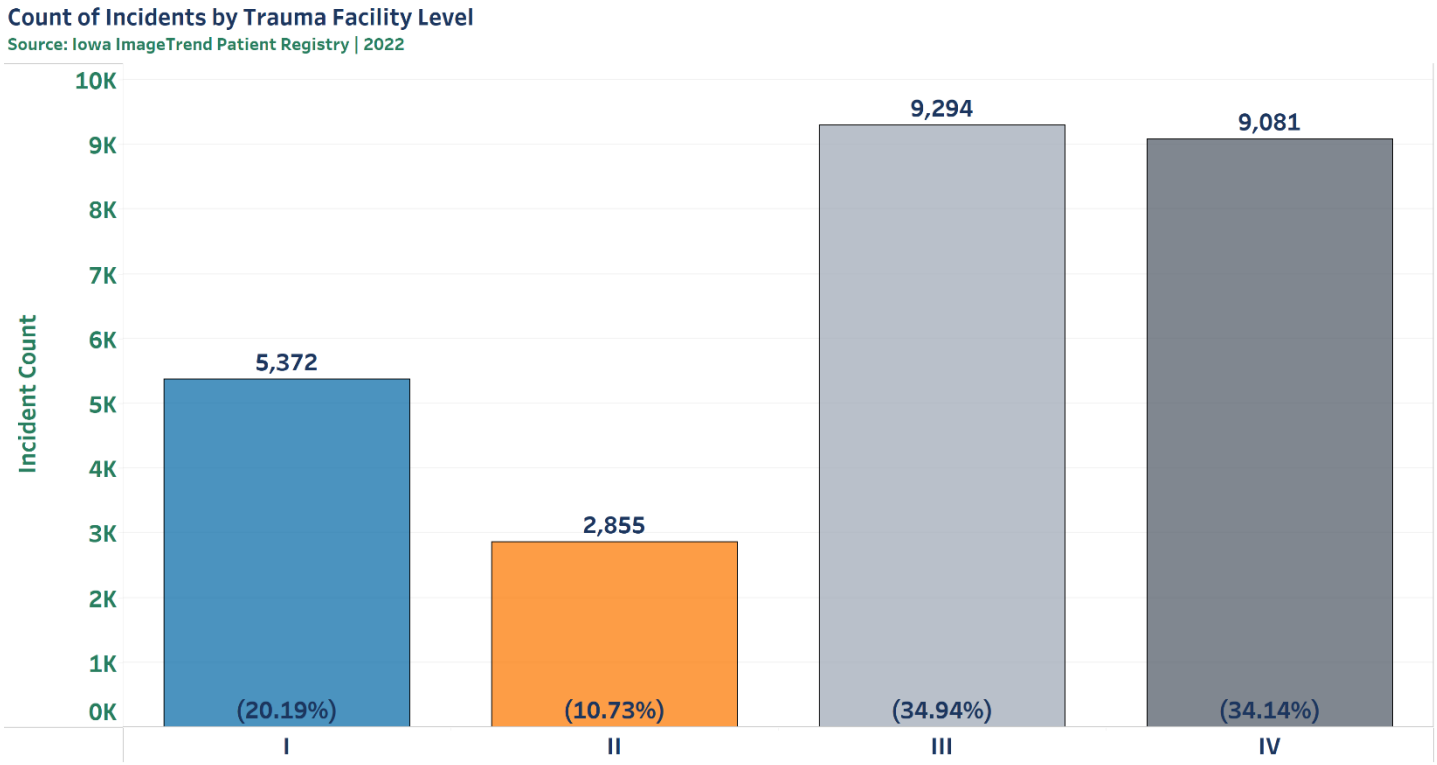

Figure 3: Number of trauma incidents reported through Image Trend Patient Registry

In the year 2022, all trauma care facilities, with the exception of one, reported patient data. HHS remains steadfast in its commitment to supporting hospital data reporting through ongoing education and training initiatives. It is worth noting that the total number of trauma incidents reported in 2021 was at the highest recorded level, signaling a substantial increase compared to previous years. In this context, the 26,602 incidents in 2022 is yet another peak for the state in terms of trauma incidents. This increase represents a significant shift from the stable incident counts observed over the past five years, demonstrating the evolving landscape of trauma care data reporting in Iowa. One level III facility transitioned to level IV status, and so there was an increase in level IV trauma incidents. In 2022, trauma facilities experienced the following:

- A 2.79% increase in trauma incidents at level I facilities (n = 146)
- A 2.88% increase in trauma incidents at level II facilities (n = 80)
- A 2.64% increase in trauma incidents at level III facilities (n = 243)
- A 14.7% increase in trauma incidents at level IV facilities (n = 1165)

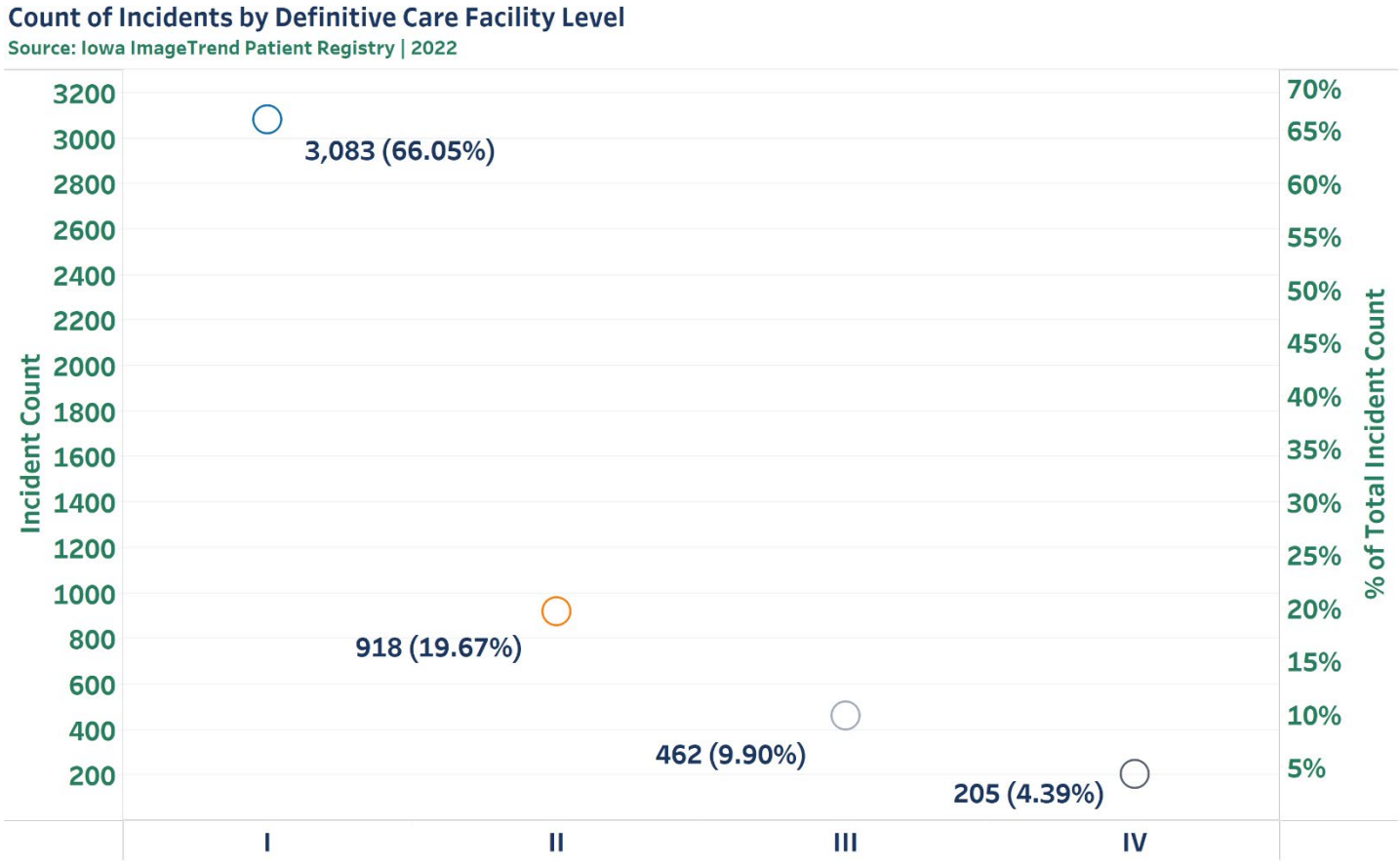

Figure 3: Count of transfer incidents by receiving trauma facility level

Each hollow dot, by its color and place, corresponds to a specific trauma level category. For example, hospitals among level I facilities documented 3,083 trauma incidents that were transfers in to their facilities, which constituted 66.05% of all transfers. A total of 4,668 trauma incidents were documented as arriving from the referring hospital (transfers). The visualization above demonstrates that the majority of transfers go to level I and level II hospitals, with level III and level IV facilities caring for less than 15% of total transferred trauma patients in the state. While transfers to level I and level II facilities for definitive care are standard given the advanced medical capabilities of these facilities, there is concern at the same time for the decreasing number of higher levels of care in the state of Iowa. In the year 2022, Iowa has the same number of facilities providing trauma care at levels I and II. Now, even fewer facilities are providing level III trauma care as compared to the year 2021. While the year over year decreases in facilities at levels I through III are not staggering, the decrease has been steady and incremental. With the availability of levels of care shifting in Iowa, the trend in the trauma incident count continues to edge upward.

Response to Trauma

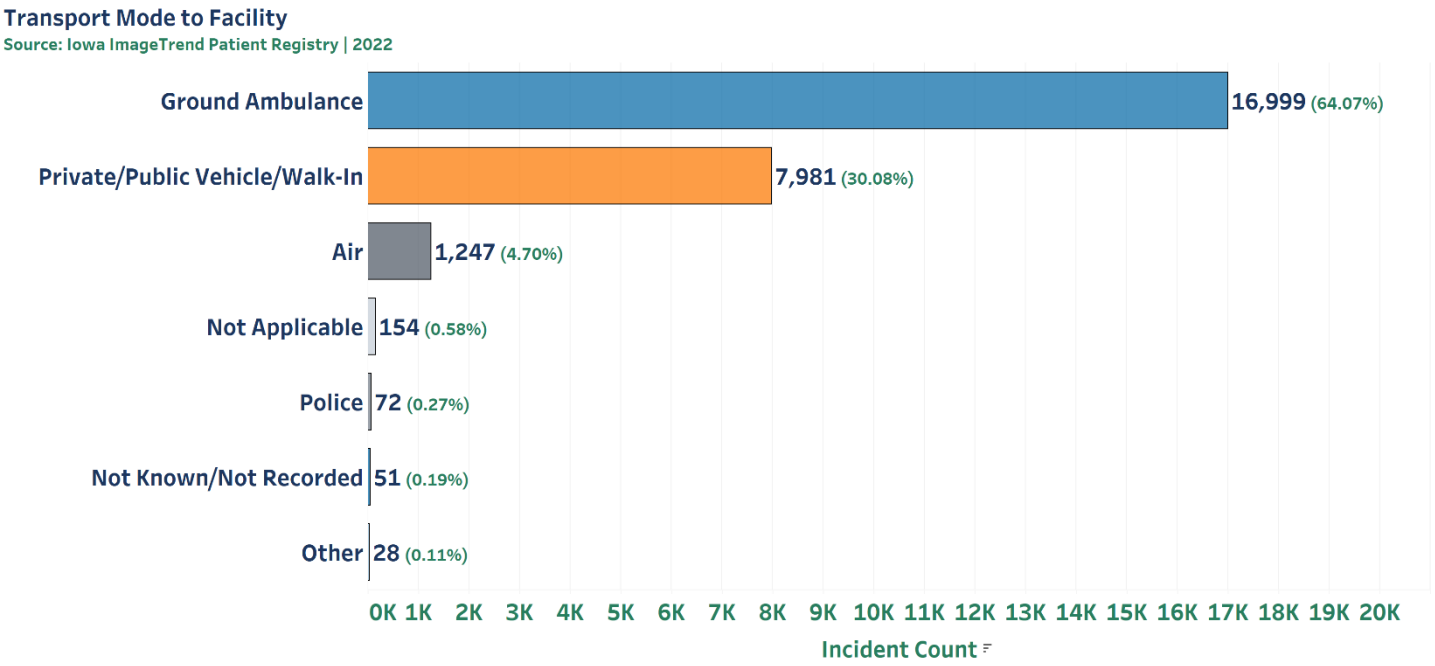

Figure 4: Method used to transport trauma patients to emergency care

In the year 2022, the transportation of trauma patients to hospitals in the state of Iowa exhibited a diverse range of methods, as documented by the Iowa Trauma Registry. Ground ambulance transport emerged as the predominant mode, accounting for approximately 64.07% of the total incident count, with 16,999 incidents. Private or public vehicles and walk-in patients constituted around 30% of the incidents, totaling 7,981incidents. Aerial transport, involving helicopters and fixed-wing aircraft, played a significant role in trauma care, representing 4.7% of the total incident count, with 1,247 incidents.

In 2022, 0.5% of incidents were categorized as either "Not Applicable" or "Not Known/Not Recorded," comprising 154 and 51 incidents, respectively. Police transportation and other methods each constituted less than 0.3% of incidents, totaling 72 and 28 incidents, respectively. These statistics illuminate the varied approaches employed in trauma patient transportation, emphasizing the critical role of ground ambulances, private/public vehicles, and air transport in facilitating access to essential trauma care services throughout the state of Iowa.

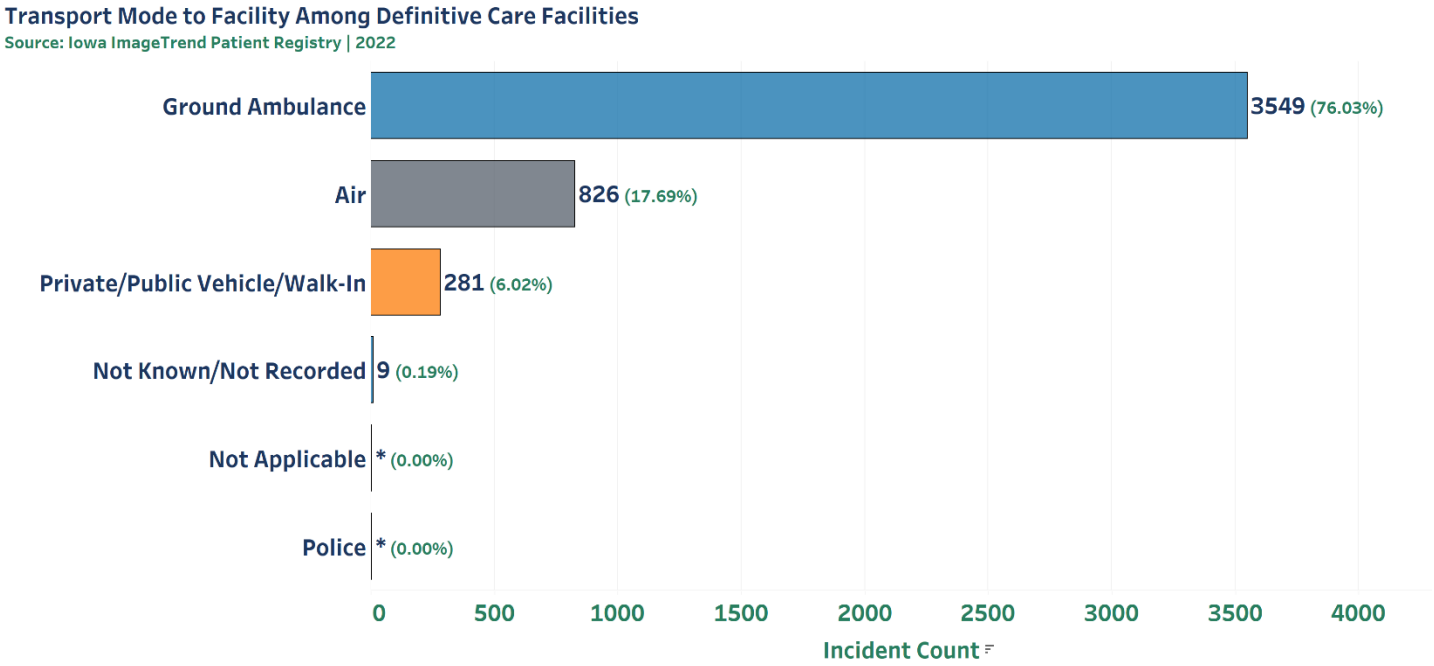

Figure 5: Count and percent of transfer incidents by transport mode category

This visualization is similar to Figure 4 in that it depicts the count and percent of trauma incidents by their mode of transport. In this use case, the data were filtered down to only transfer incidents where the patient was documented as having arrived from the referring hospital (n = 4,668). One would expect that the majority of trauma cases would arrive to a trauma facility by ambulance (see Ground Ambulance, Private/Public Vehicle, and Air above). Given that the transport of patients is an important part of any state's trauma care system, the method in which patients are arriving to receive definitive care is an important metric to track in order to understand the health of a trauma system (i.e. the quality of its functioning). In this context, a finding worth investigating more is the proportion of transfer incidents that arrived to definitive care by public or private vehicle, or walk-in (6.02%). Note that for confidentiality purposes, categories with counts less than six were masked to preserve patient confidentiality.

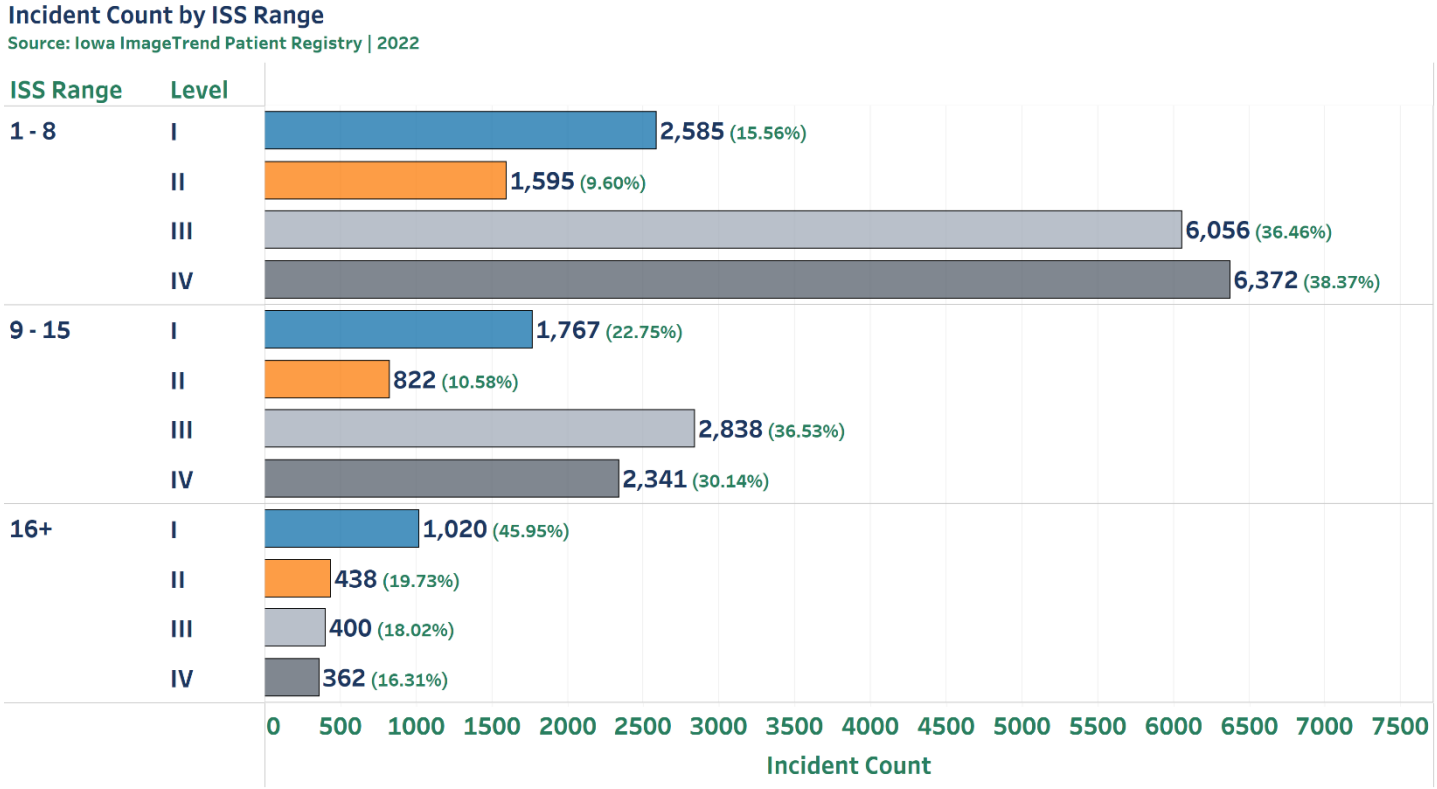

Figure 6: Incident count by calculated ISS Range

The Injury Severity Score, or ISS, is a method used to rate the severity of the patient's injury. It correlates with morbidity, mortality and hospital length of stay for injured patients. This score is based on the patient's diagnosed injuries. ISS scores can range from 0 to 75. Any score greater than 15 is considered major trauma, also known as polytrauma. A score of 1-8 is considered minor trauma, and scores ranging from 9-15 are considered moderate trauma. The data above can be interpreted as showing the number and percent of incidents grouped by ISS Range and reported at the level of the hospital facility's trauma level designation (e.g. 15.56% of cases in the ISS Range of 1-8 were seen in level I facilities, each ISS Range category totals 100%).

In the chart above, the data are from all levels of hospitals, and do not solely depict data from hospitals that provided definitive care for the trauma patient. Level IV and some Level III facilities provide stabilizing care for significantly injured trauma patients before transferring that patient to a definitive care hospital that is able to perform a higher level of treatment. The ISS is retrospective and based on all the patient's diagnosed injuries. The ISS ratings for patients seen at Level IV and Level III facilities are likely to be artificially low. The Level IV and Level III facilities may not identify all of the trauma patient's injuries before transport. Level IV and Level III facilities may only identify the most critical injuries that require stabilization before transport. This may impact the reported ISS of some patients seen at Level IV and Level III facilities who are then transported to a definitive care facility for a higher level of treatment.

Trauma registry data show 52% of incidents at Level I facilities had an ISS over 8 and Level II facilities had 44% of incidents with an ISS over 8. Level III and Level IV facilities had 35% and 29% of incidents with an

ISS over 8, respectively. These percentages do not show a significant change or trend compared to data from 2019 through 2021.

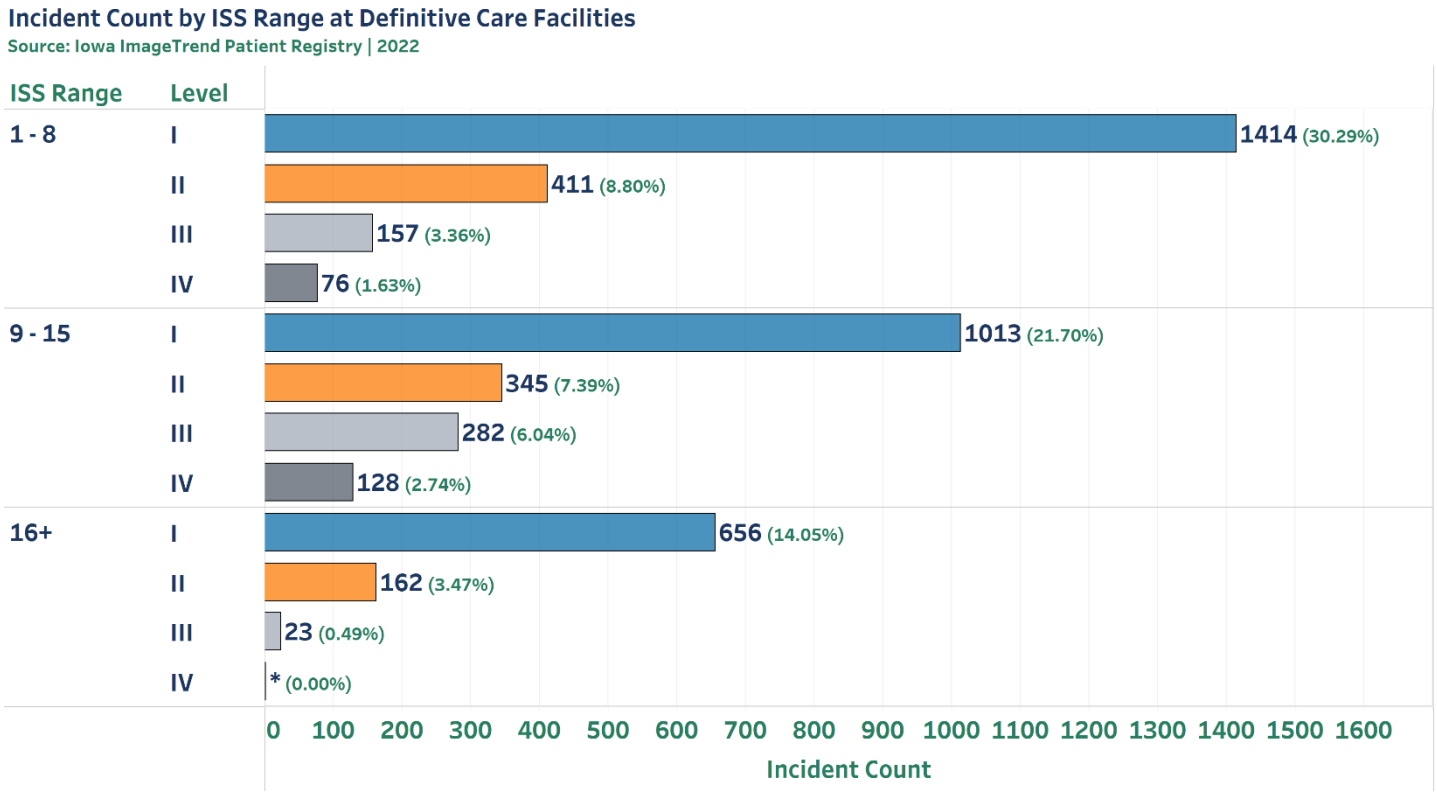

Figure 7: Transfer incidents by ISS Range and trauma facility level

Continuing the investigation of transfer trauma incidents, it can be seen from the visualization above that the majority of transfer incidents are going to level I hospitals. Furthermore, level I hospitals are seeing more than three-fold trauma incidents in all ISS Ranges compared to even level II hospitals, with a more than five-fold difference existing among the highest severity trauma cases when comparing level I and level II facilities to level III and IV facilities. These data demonstrate the burden on Iowa's facilities that are providing the highest levels of care with regard to transfers into these facilities. At the same time, the incidence of traumatic injury in Iowa seems to be on the rise. Note that for confidentiality purposes, categories with counts less than six were masked to preserve patient confidentiality.

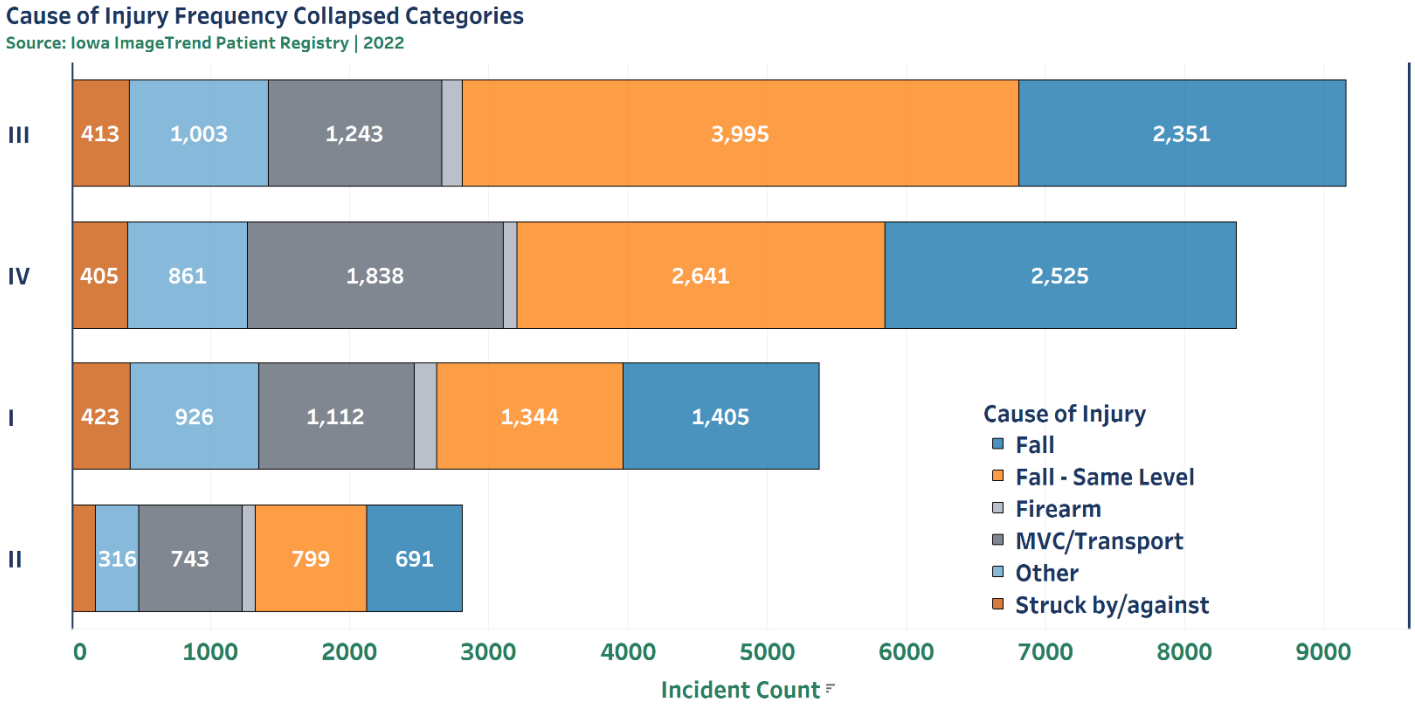

Figure 8: Stacked bar of collapsed cause of injury categories by trauma level

Please note that as the colors descend in the legend from top to bottom, so are the colors ordered in the bars from right to left making it easier to find the category you are looking for. The size of the bars provides an approximate, but not exact, representation of the proportions of each category among the total incidents reported for each hospital level. Above, Figure 8 refers to the count of unique incidents by cause of injury category (collapsed), and by trauma level. There are 1,409 unique incidents that are not represented in this table given that a category was not able to be assigned due to missing data or incompatible diagnosis (5.3% of incidents). Falls continue to be the most prevalent category, with falls on the same level and all other falls consisting of 15,751 total injury diagnoses by unique incident, or 59.2% of all injuries.

The prevalence of falls in the state of Iowa is a cause for serious concern and warrants immediate attention through enhanced prevention efforts. Falls may lead to traumatic brain injuries (TBIs), and the data from the Iowa Trauma Registry for 2022 underscore the urgency of this issue.

Cause of Injury Frequency Treemap with Expanded Categories

Source: Iowa ImageTrend Patient Registry | 2022

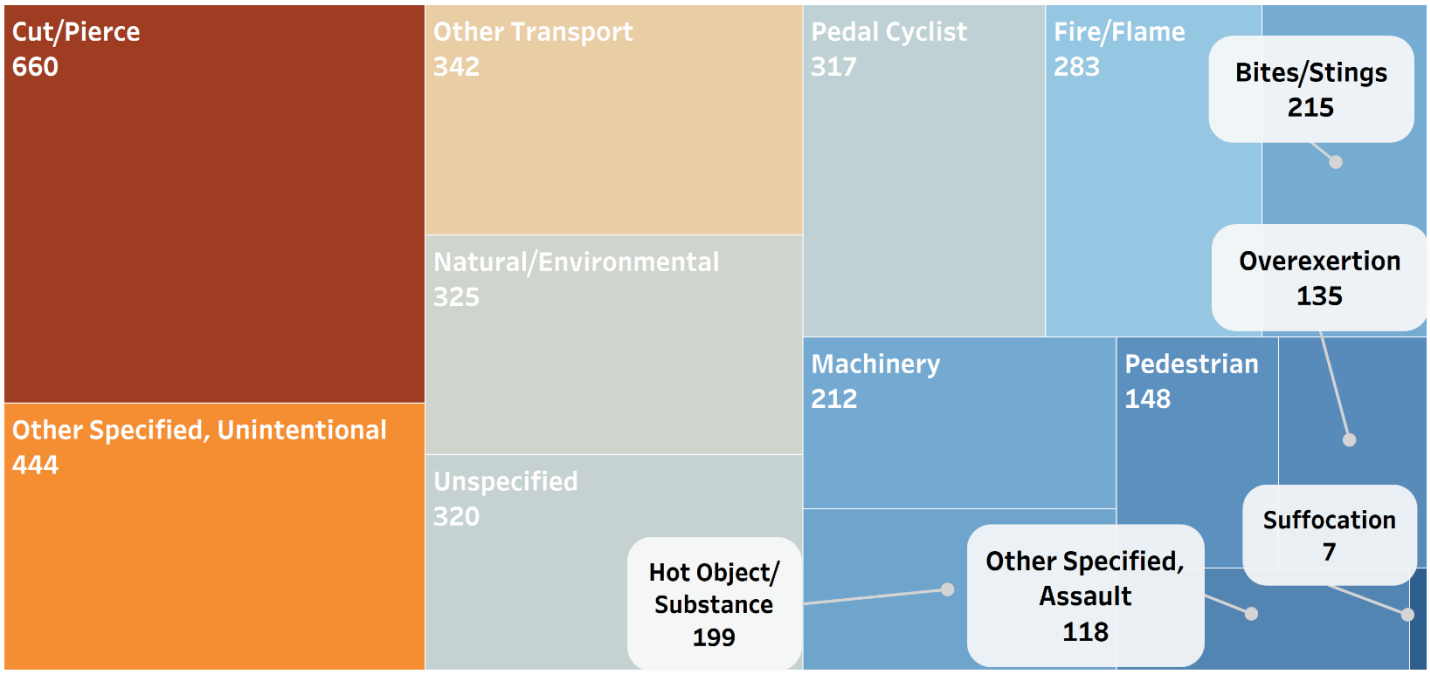

Figure 9: Treemap of injury frequency by expanded injury category

The data above purposefully do not include any falls, motor vehicle accidents, struck by or against, or firearm injuries as those categories were depicted in the last visualization. Note that the size of the boxes does correspond to an approximate representation of the proportion of each category in the context of this subset of the injuries, not the larger context of the total injuries. In 2022, trauma hospital visits in Iowa presented a diverse range of challenges for practitioners within the state's trauma system.

Particularly concerning were incidents involving pedal cyclists (317 incidents) and unspecified traumas (320 incidents), both posing complex challenges for trauma practitioners due to the diverse nature of injuries. Cut and pierce injuries (660 incidents) were notably high, indicating a substantial burden on healthcare resources.

Moreover, the trauma system faced significant pressure from incidents involving machinery (212 incidents), bites and stings (215 incidents), and fire/flame-related injuries (283 incidents). These cases required specialized care and often involved severe injuries, demanding immediate attention and resources from the trauma healthcare providers. Additionally, natural/environmental incidents (325 incidents) and other transport-related traumas (342 incidents) underscored the diversity of challenges faced by practitioners, encompassing accidents from various modes of transportation and environmental factors.

The data highlight the vital need for a robust and adaptable trauma response system in Iowa. Practitioners must continuously update their skills and resources to meet the demands of such a wide array of trauma cases. Comprehensive training, advanced equipment, and effective coordination among healthcare providers are crucial to managing the diverse challenges presented by these trauma incidents effectively.

Transfers Out by Trauma Level

Source: Iowa ImageTrend Patient Registry | 2022

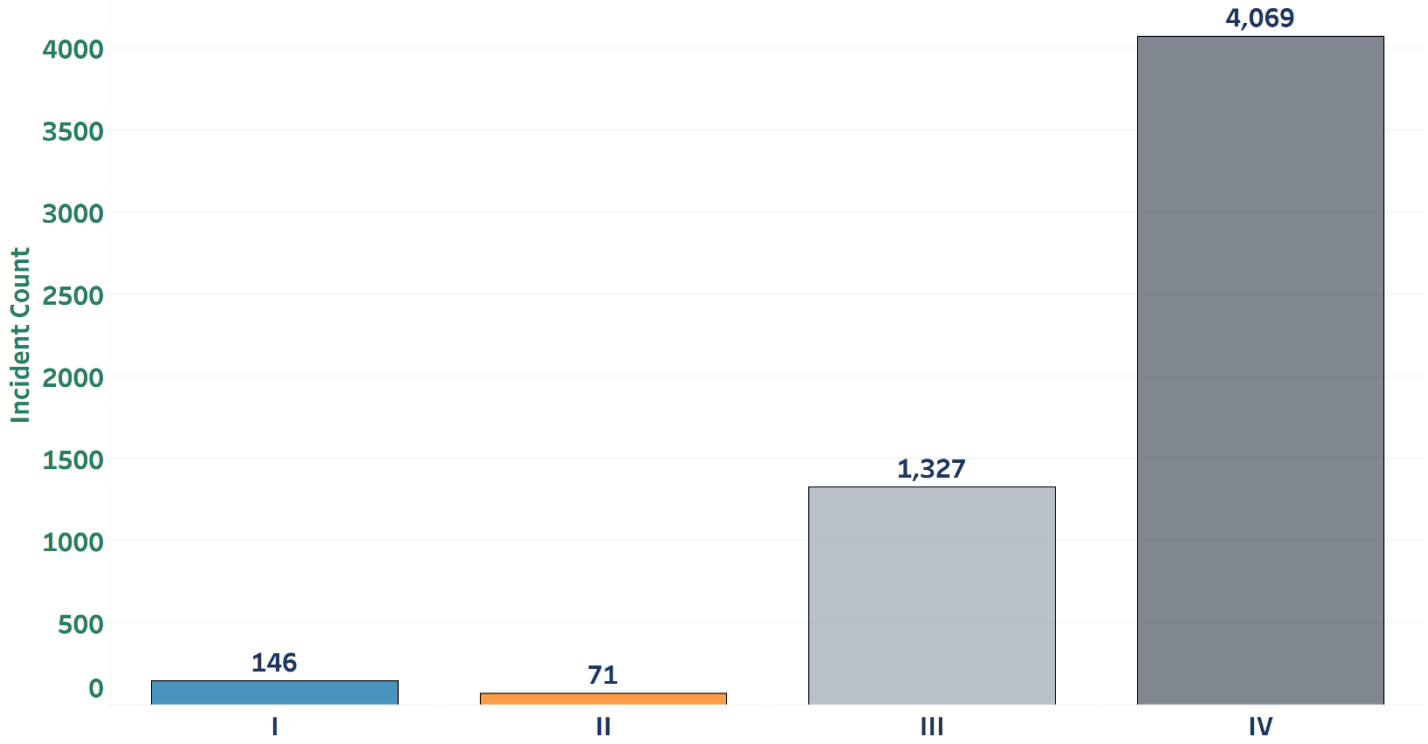

Figure 10: Transfers out by Trauma Hospital Level

Efficiently transferring trauma patients to facilities offering definitive care is critical to decreasing morbidity and mortality. This visualization represents patient transfers, focusing on Iowa in 2022. The key factors include the reasons behind transfers, their frequency, and the source facilities. Patients in dire need of unavailable resources at their initial treatment facility often require transfer to higher-level trauma care facilities. Such transfers are less common in Level I and Level II facilities, which are resource-rich, but may occasionally lack specialists or equipment.

In 2022, Iowa recorded 5,613 trauma patient transfers across healthcare facilities. Compared to 2021, this a decrease by 130 transfers (5743 transfers in 2021). Transfers in 2021 were 6 fewer than in 2020, and 300 fewer than in 2019, reflecting a decreasing trend. Analyzing the origins of transfers, 72.49% in 2022 (69.9% in 2021) came from Level IV facilities, often in remote areas with limited resources. Level III facilities contributed 23.64% of transfers (26.3% in 2021), offering a higher care level but lacking specialized capabilities for complex cases. The remaining 3.87% (3.8% in 2021) originated from Level I and Level II facilities, which are well-equipped but witnessed rare transfers due to unique circumstances.

Average ED Stay Prior to Transfer by ISS Range

Source: Iowa ImageTrend Patient Registry | 2022

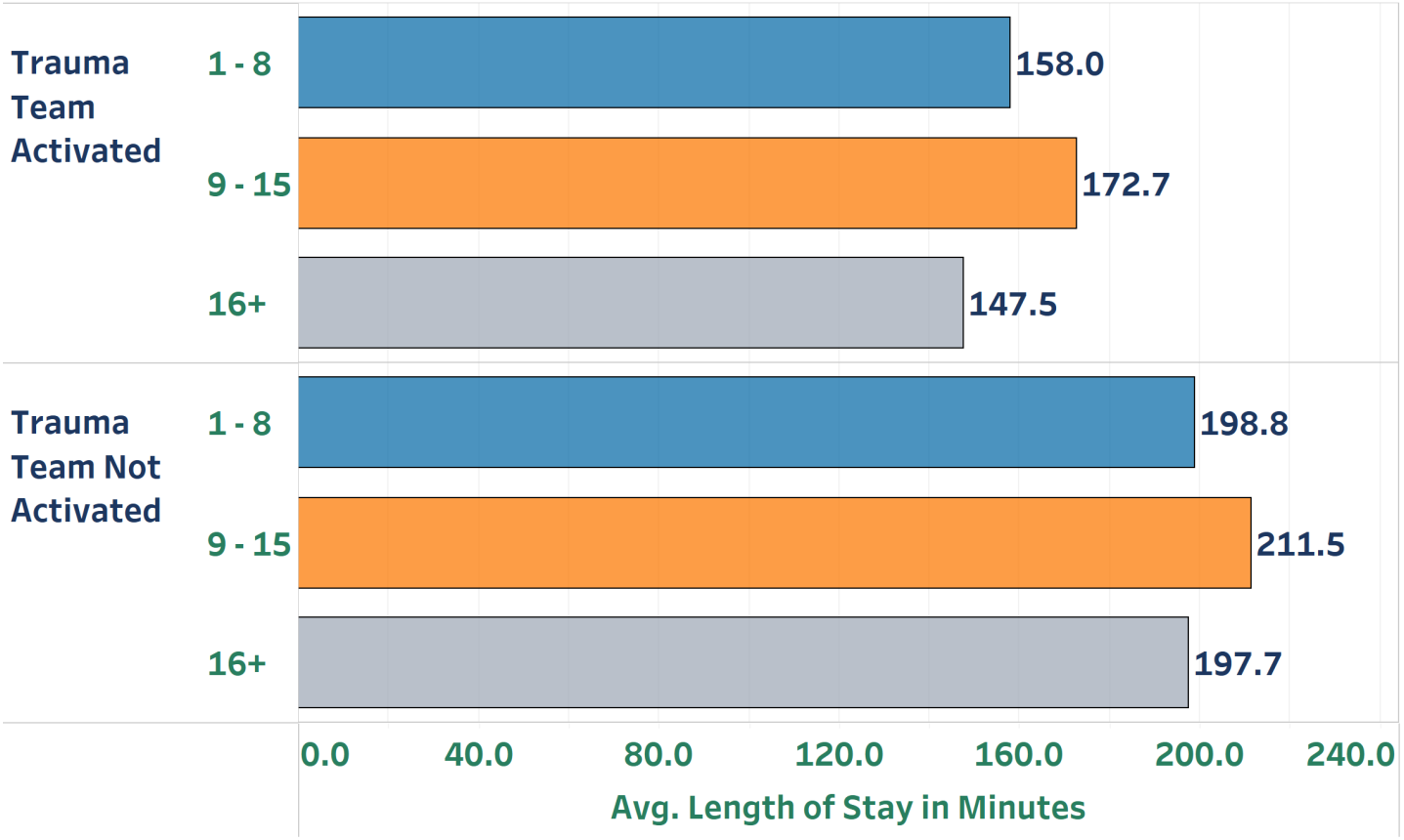

Figure 11: Average ED stay in minutes for transfer patients prior to transfer

On average, patients who were transferred to a subsequent trauma care facility for definitive care stayed in the initial hospital's emergency department for 3 hours and 12 minutes (an increase from 2021 of 3 hours and 4 minutes). Of these transfers, 38% had a trauma team activation (up from 28.2% in 2021). When the trauma team was activated, patients stayed 43.3 fewer minutes in the emergency department on average compared to patients who did not have a trauma team activation.

When split into the given ISS ranges, it is clear that patients of all injury severities have shorter stays in the emergency department when the trauma team is activated. Patients with an ISS between 1 and 8 had lengths of stay decreased by 40.8 minutes on average when the trauma team was activated. For ISS between 9 and 15, the difference was 38.9 minutes, and 50.2 minutes for ISS of 16 or greater. It is worth noting that all 3 subcategories under non-trauma team activation shown in the graph had longer times than in 2021. This indicates a concerning trend in increasing wait times in the ED for patients to be transferred to definitive care, especially when a trauma team is not activated.

Calculations for average length of stay ignored any calculated emergency department length of stay (in minutes) in the dataset that were less than zero or greater than 500 (i.e. values 0 to 500 minutes) and only looked at transfers.

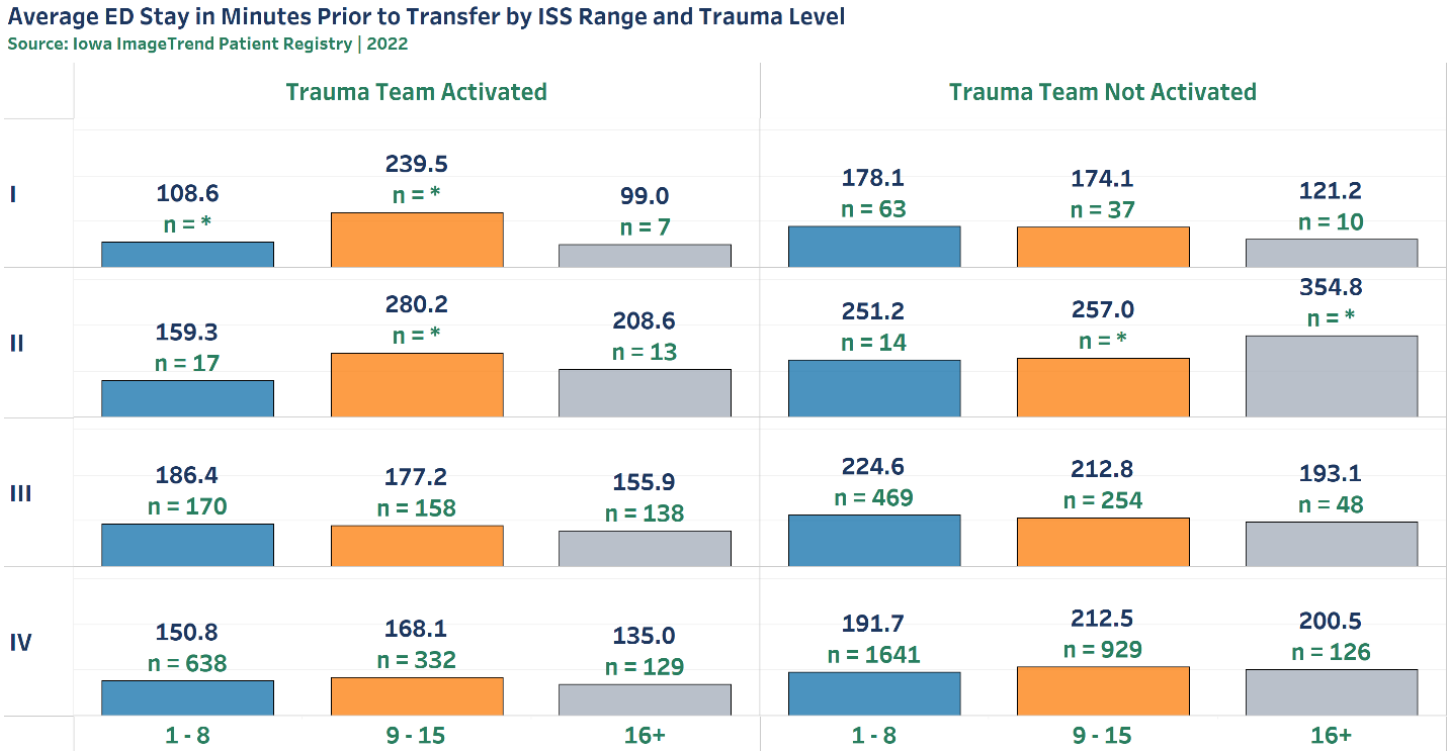

Figure 12: Average length of stay in minutes in the emergency department for patients transferred to subsequent definitive care facility

The data visualization above facilitates insights into the average emergency department (ED) stay durations for trauma patients across different trauma levels, based on trauma team activation and injury severity score (ISS) categories.

In the context of trauma team activation, for Level I trauma patients, the average ED stay ranges from 99.0 to 108.6 minutes, with shorter stays observed in the highest ISS category (16+).

Level II trauma patients experience longer ED stays, ranging from 159.3 to 280.2 minutes, with the middle ISS category (9 - 15) having the longest stay.

Level III and IV trauma patients generally have shorter ED stays compared to Levels I and II, with varying durations based on ISS categories.

When trauma teams are not activated, ED stays are generally longer across all trauma levels, with Level II patients experiencing the longest stays, particularly in the highest ISS category.

Levels III and IV patients still have relatively shorter ED stays compared to Levels I and II.

These findings highlight the importance of trauma team activation in expediting care and reducing ED stay durations, especially for higher trauma levels and severe injuries. The data underscore the need for efficient triage and resource allocation to optimize trauma patient outcomes.

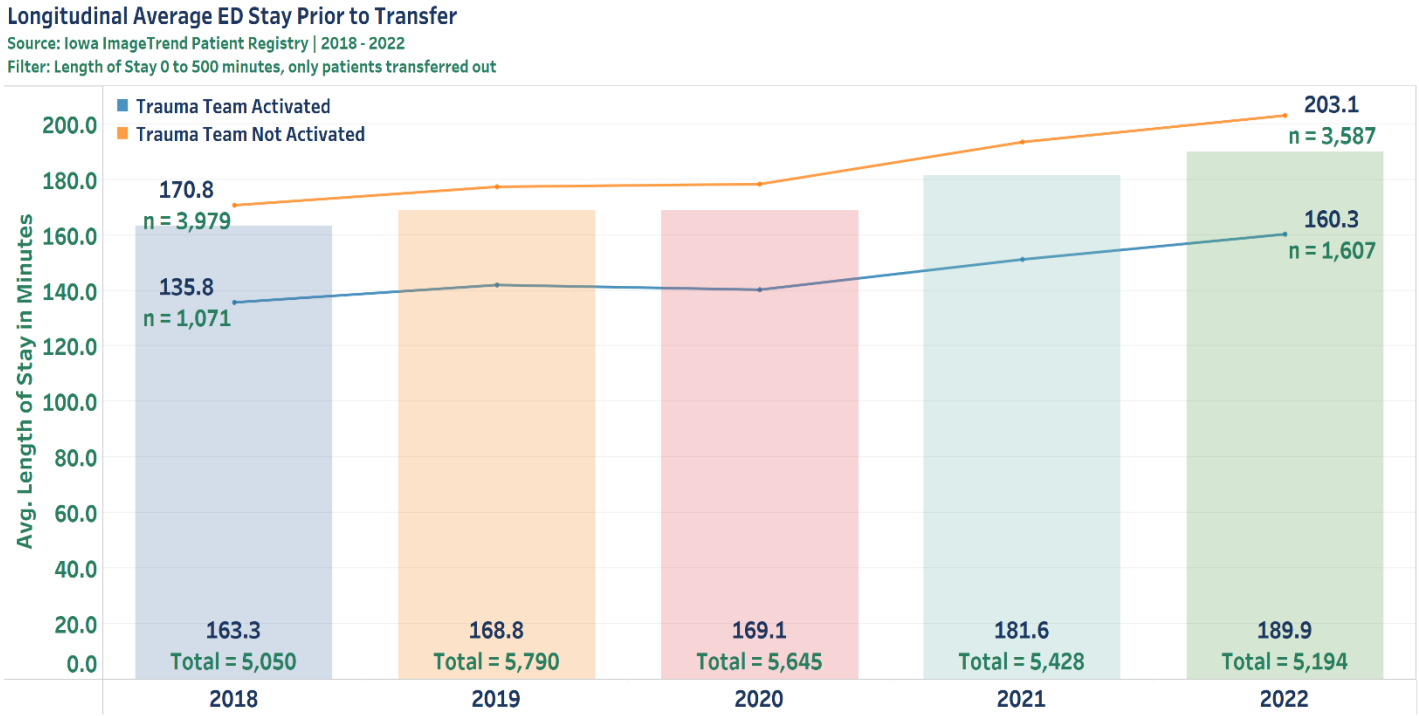

Figure 13: Longitudinal view of average ED stays in minutes year over year

For the totals and averages presented above, please note that the data are filtered by cases with a length of stay between and including 0 and 500, and only patients transferring out. Given this, the totals may not match other reported totals of transfers. In the data visualization provided, the trajectories delineating the two distinct categories of trauma activations, namely those necessitating trauma activations, and those not requiring such intervention, are evident. The bars depict the average Emergency Department (ED) stay in minutes for each year, and serve as a robust indicator of the prevailing trends. Observe that the top of the bars represents the average length of stay for the year, and the y-axis measures average length of stay in minutes. The numerical annotations at the beginning and end of each line denote the corresponding averages for 2018 (beginning) and 2022 (end). These numerical values signify the average ED stays in minutes and illustrate the progressive evolution in average ED stays across these years.

Upon analysis of the chart above, a discernible pattern emerges. It becomes clear that incidents within trauma hospitals where trauma teams are not activated have exhibited a discernible upward trajectory. This observation echoes findings from previous state reports. Similarly, ED stays for trauma incidents that have accompanying trauma activation appear to exhibit an upward trend. A point of note is the consistent positioning of average ED stays for trauma activations below the yearly average. This is in stark contrast to non-trauma activations, where average ED stays surpass the average for each recorded year.

These trends are not mere statistical fluctuations but rather significant indicators of the evolving landscape within trauma hospital scenarios. They underscore the critical importance of vigilant monitoring and analysis of ED stays concerning trauma incidents, providing insights for healthcare administrators, policymakers, and clinicians.

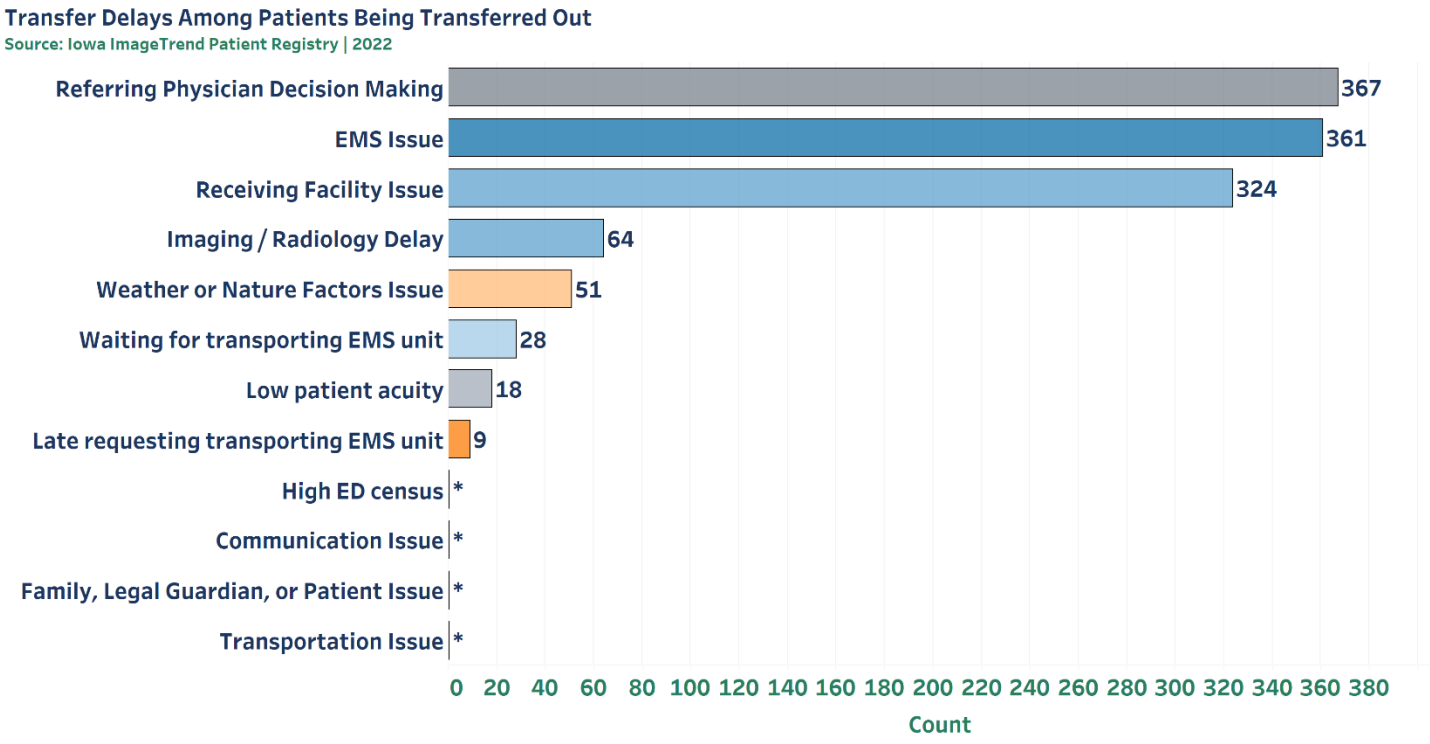

Figure 14: Transfer delay reasons for patients being transferred out to definitive care

In 2022, analyzing transfer delay reasons among patients leaving trauma hospitals in Iowa provides crucial insights into the healthcare system. Referring Physician Decision Making and EMS Issues were predominant factors, with 367 and 361 cases, respectively. This underscores the significance of efficient communication and decision-making processes among healthcare professionals and addressing the strained EMS system.

Receiving Facility Issues and Referring Hospital Issue-Radiology were significant hurdles, with 324 and 64 cases, respectively, pinpointing challenges in inter-facility coordination and radiological services. Weather or Nature Factors and Waiting for transporting EMS unit accounted for 51 and 28 cases, revealing the impact of external factors and logistical challenges on patient transfers. Furthermore, Low patient acuity (18 cases) and Late requesting transporting EMS unit (9 cases) shed light on the complexity of assessing patient urgency and timely EMS requests.

These data highlight the multidimensional nature of transfer delays, emphasizing the need for streamlined protocols, enhanced inter-agency collaboration, and improved decision support systems. Addressing these issues is imperative for expediting transfers, optimizing patient outcomes, and fortifying the efficiency of Iowa's trauma care network. Note that for confidentiality purposes, categories with counts less than six were masked to preserve patient confidentiality.

Iowa Trauma Patient Reinjury

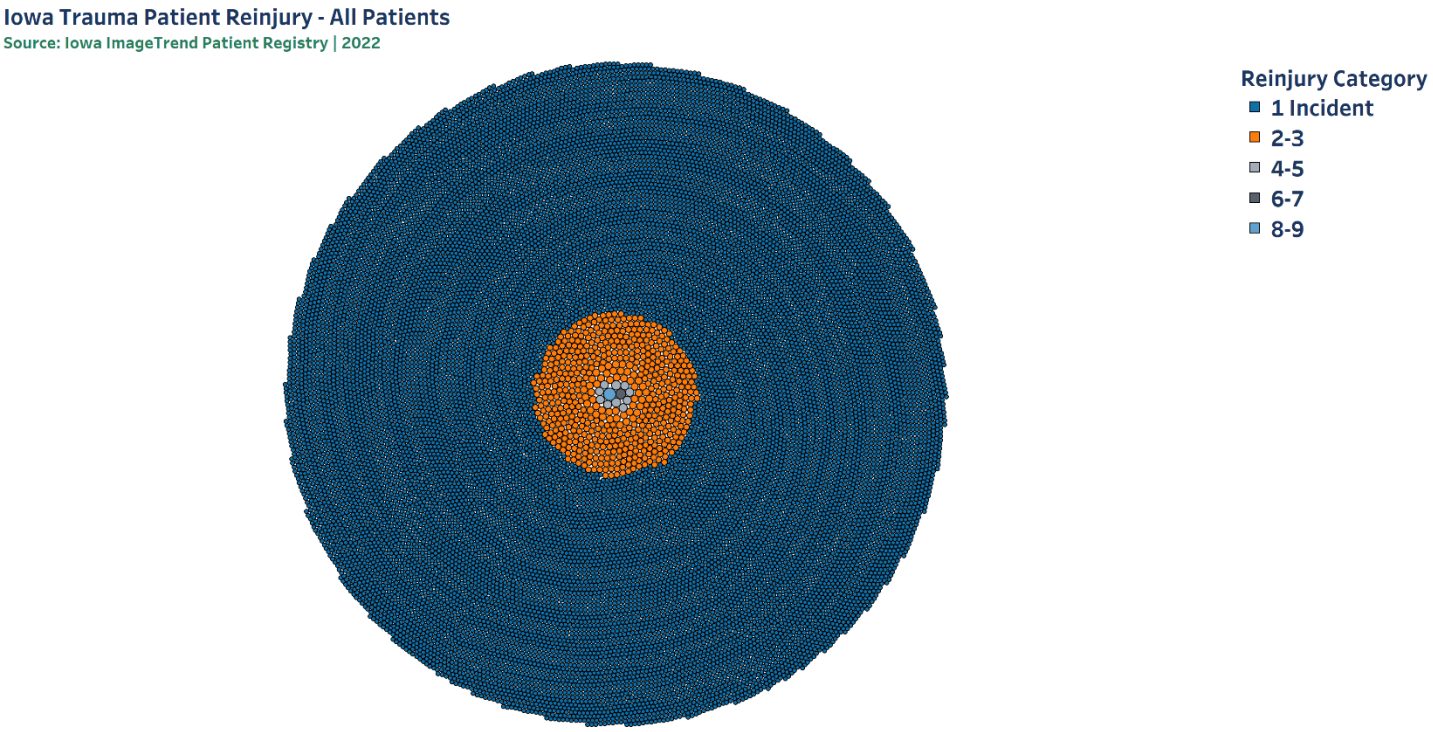

Figure 15: Distribution of Iowa trauma patients by reinjury category

The chart above refers to definitive care episodes, so there is no duplication due to transfer(s). A subset of 1,284 patients in Iowa had two or more unique trauma incidents in 2022. From the bubble chart above, it is possible to see the distribution of reinjury across patients. Here, the bubbles function to show the viewer the proportion of patients in the registry in each reinjury category among definitive care episodes. The bubbles do not represent individual patients in order to preserve confidentiality. The majority of trauma patients in Iowa had one incident in the whole year (19,705 patients), while 1,227 had two to three incidents, 42 had four to five incidents, six patients had six to seven incidents, and nine patients had 8-9 incidents. Reinjury is a critical aspect of trauma care, as it can significantly impact patient outcomes and healthcare resources. The data are summarized in the table above.

Understanding these categories is helpful for healthcare professionals and policymakers to develop effective strategies for trauma care, injury prevention, and resource allocation. Patients with multiple reinjuries may require specialized and more intensive care, highlighting the need for tailored rehabilitation programs and injury prevention initiatives.

These data underscore the importance of continuous monitoring and support for trauma patients, especially those at risk of recurrent injuries, to enhance their overall recovery and quality of life. Further research and analysis can provide valuable insights into the factors contributing to reinjury and inform evidence-based interventions for trauma care in the state of Iowa.

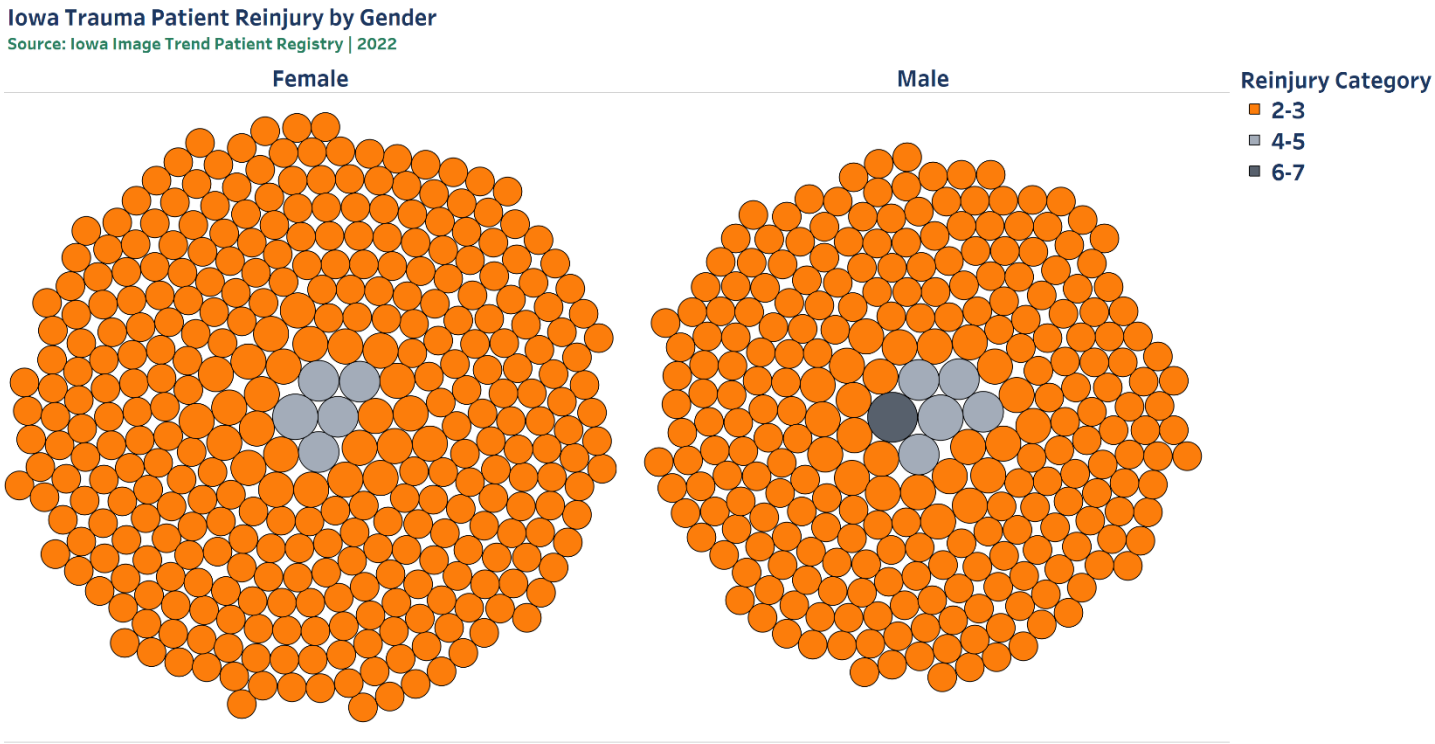

Figure 16: Patient reinjury by gender

As in the larger bubble chart above, the bubbles do not correspond to individual patients but show the proportion of patients in definitive care episodes within the trauma registry by reinjury category. While male patients had a lower count of reinjuries in 2022 as compared to females, male patients had a greater number of reinjuries in the year as compared to females. Overall, males had more injuries than females as discussed previously.

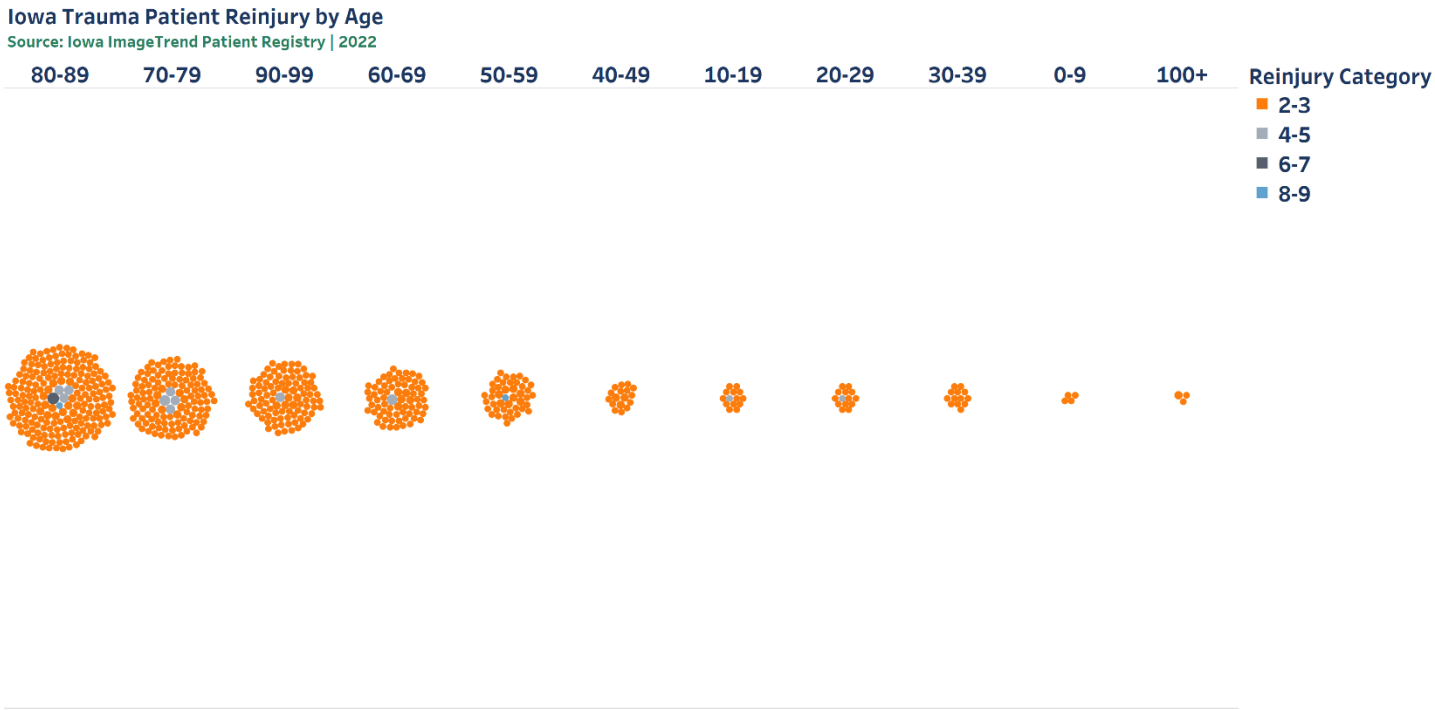

Figure 17: Patient reinjury by age range

A look at the plot above shows that individuals ages 50-99 were more much more likely to experience multiple trauma visits in 2022. Individuals under the age of 50 and individuals 100+ years of age constituted 11% of reinjuries in 2022, while individuals ages 50 to 99 constituted 89% of total reinjuries.

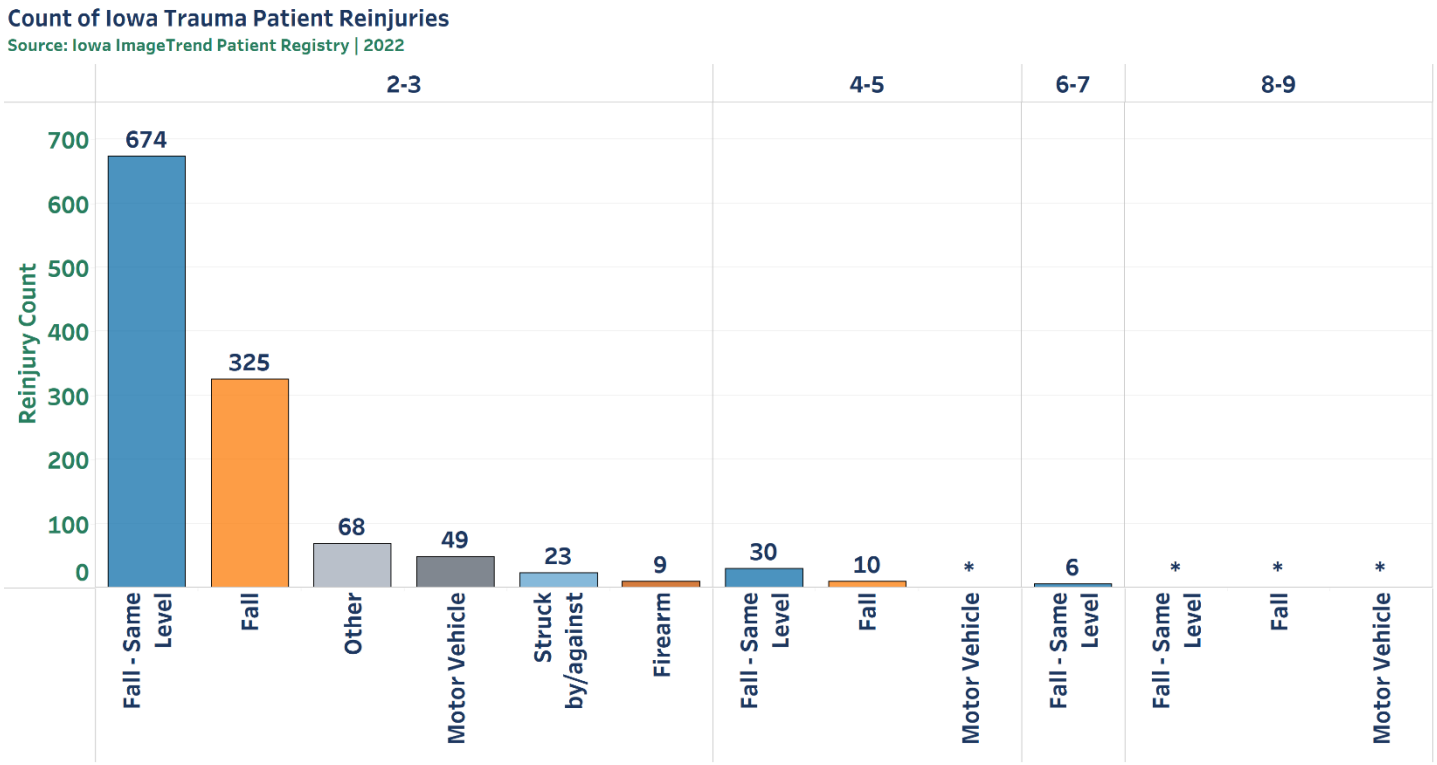

Figure 18: Unique patient count by reinjury category and injury category

To maintain patient confidentiality, categories with values less than 6 are masked with asterisks. Iowa trauma hospitals reported various traumatic injury mechanisms, with the most common causes being "Fall on Same Level," "All other Falls," and "Motor Vehicle" incidents. In the context of trauma hospitals in Iowa during the year 2022, the Figure 17 above categorizes traumatic reinjuries by their respective mechanisms. This information is crucial for healthcare professionals and policymakers to understand the primary causes of injuries and allocate resources effectively. These data highlight the diversity of traumatic injury causes seen in Iowa's trauma hospitals in 2022. It underscores the need for comprehensive injury prevention strategies, such as fall prevention programs and road safety initiatives. Additionally, it serves as a valuable resource for healthcare providers to anticipate and address the specific types of injuries that may present in trauma cases, ultimately improving patient care and outcomes. Further analysis could delve deeper into the circumstances and risk factors associated with each injury mechanism to inform targeted interventions.

These findings have crucial implications for injury prevention. "Fall on Same Level" injuries highlight the importance of reducing tripping hazards and promoting awareness of fall risks, particularly among vulnerable populations. "All other Falls" emphasize the need for targeted interventions to address specific circumstances contributing to falls, including education and environmental modifications. Overall, understanding these patterns allows for resource allocation and intervention design to enhance patient outcomes and reduce healthcare system burdens.

Hospital Admissions

Hospital admissions data are derived from the Iowa Hospital Association's Inpatient and Outpatient (IPOP) Data Registry. Inclusionary criteria for the statistical dataset referenced below mandate that a trauma injury serves as either the admitting and/or principal diagnosis. This stringent criterion ensures precision and relevance. The classification of a trauma injury hinges upon diagnosis codes falling within the specified ICD-10 ranges, detailed on page 10 of the Trauma Registry Data Dictionary, and available in the Trauma Inclusion Criteria for ICD-10 document. It is imperative to consult this authoritative source for comprehensive understanding and accurate interpretation of trauma-related data in the state of Iowa. Adherence to these standardized protocols guarantees the integrity of future analyses and forms the foundation of informed decision-making processes within the realm of healthcare policymaking and practice.

In 2022, Iowa hospitals experienced a substantial surge in trauma patient admissions, based on analyses of data derived from the Iowa Hospital Association's Inpatient and Outpatient (IPOP) Data Registry. Accordingly, 12,620 patients were identified with trauma diagnosis codes as either their admitting or principal diagnosis for initial hospital admissions in Iowa facilities. This marked an increase from the 11,309 patients recorded in 2021. It is important to note that the 2021 total represented a decrease of 349 patients compared to 2020, and the 2020 total was more than 1,000 patients fewer than in 2019.

This context underscores a significant escalation in the burden faced by Iowa hospitals in caring for trauma patients in 2022 when compared to the preceding three years. The 12,620 patients registered in the IPOP database accounted for a total of 14,837 visits, encompassing both inpatient and outpatient interactions, along with subsequent follow-up appointments. These data illuminate the growing challenges faced by healthcare facilities and emphasizes the imperative need for comprehensive and proactive healthcare strategies in Iowa.

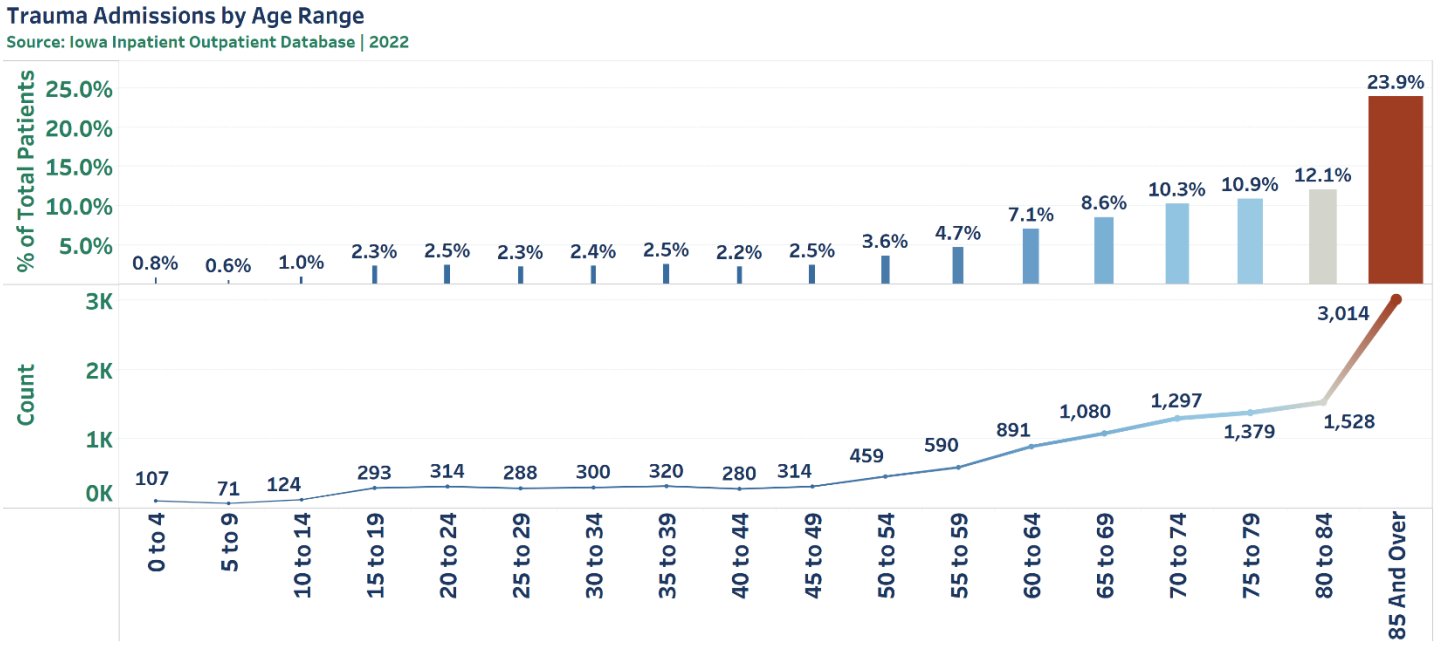

Figure 19: Trauma Admissions by age range

The age bands utilized in Figure 19 align with the U.S. Census Bureau age bands. These age bands are different from those utilized in previous reports, and so comparisons will need to be made with attention to the categorical differences. As in previous years, patients ages 65 and over account for the majority of trauma admissions.

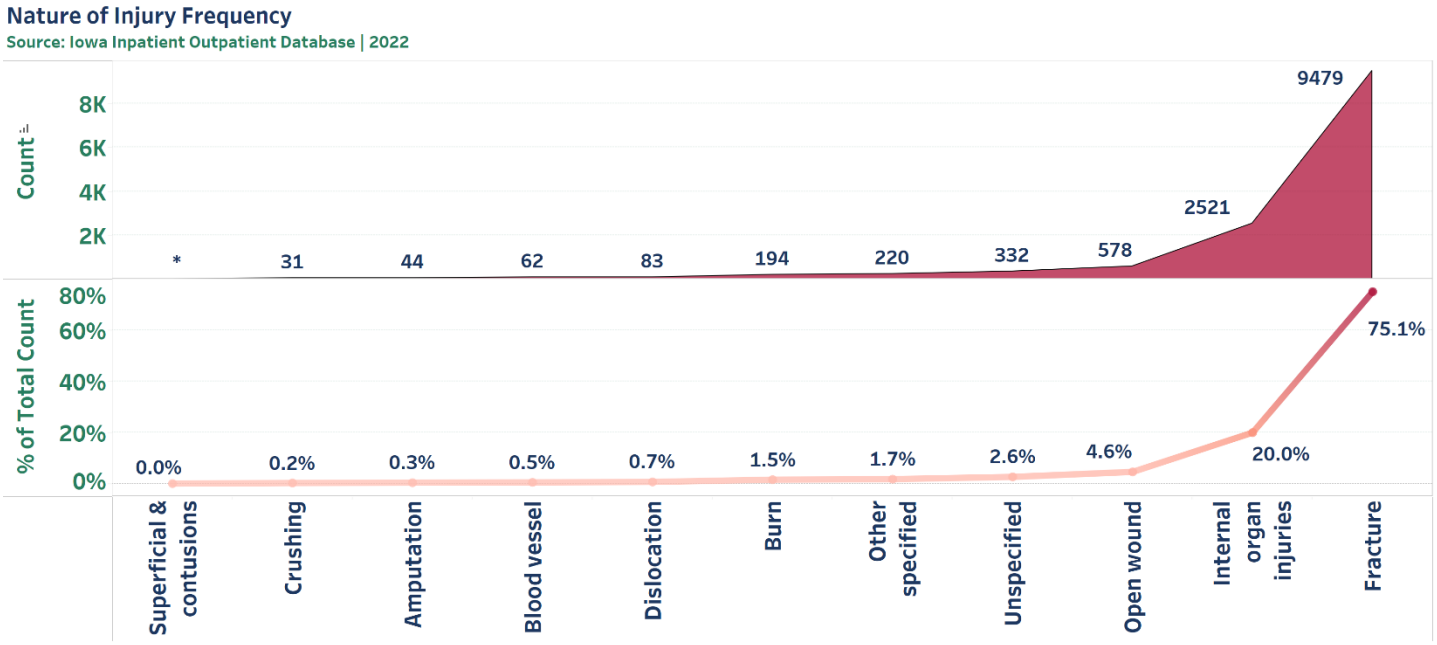

Figure 20: Frequency of injury by injury description

Fractures constitute a predominant portion, encompassing more than three-fourths of primary trauma diagnoses among admitted patients. The specific nature of these injuries is discerned through analysis of the ICD-10 diagnosis codes, ensuring precision and clinical relevance in the state's healthcare assessments. As a reminder, any counts lower than a 6 are suppressed to preserve patient confidentiality.

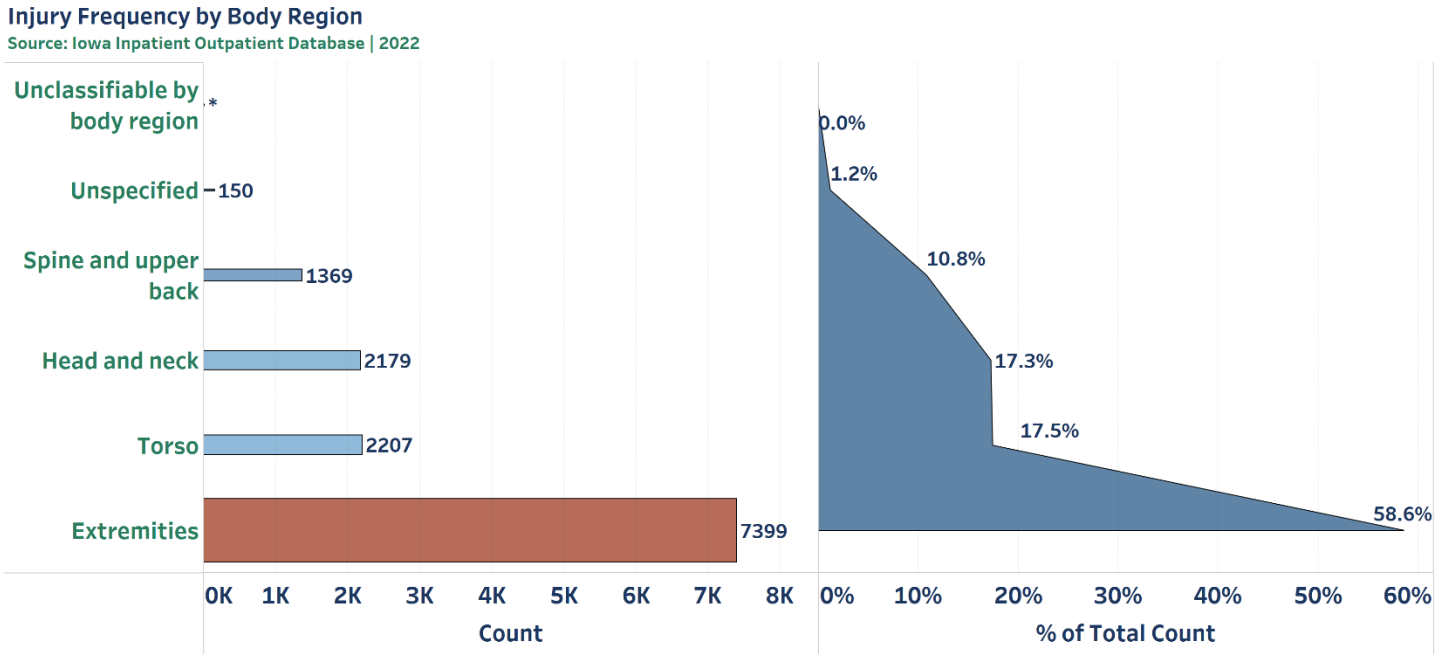

Figure 21: Injury frequency by body region

The determination of the body region affected by trauma is extracted from the ICD-10 diagnosis codes, ensuring accuracy in the state's medical assessments. A significant majority of primary diagnosis codes pertaining to trauma injuries are attributed to the extremities, underscoring their prominence among traumatic injuries in Iowa in 2022. Looking at other charts provided in this report on the trauma registry specifically, it seems to follow well that the extremities would make up such a large proportion of total reported injuries given that falls predominate regarding the mechanism of injury. Remarkably, less than 1% of admissions lacked specificity, with unspecified body regions noted for primary diagnoses, emphasizing the overall continuing precision and thoroughness of data collection. For reasons of confidentiality, counts (and corresponding percentages) are masked.

Deaths

The following two visualizations were created after compiling data from reports available through the Centers for Disease Control and Prevention's Wide-ranging ONline Data for Epidemiologic Research (WONDER) platform.

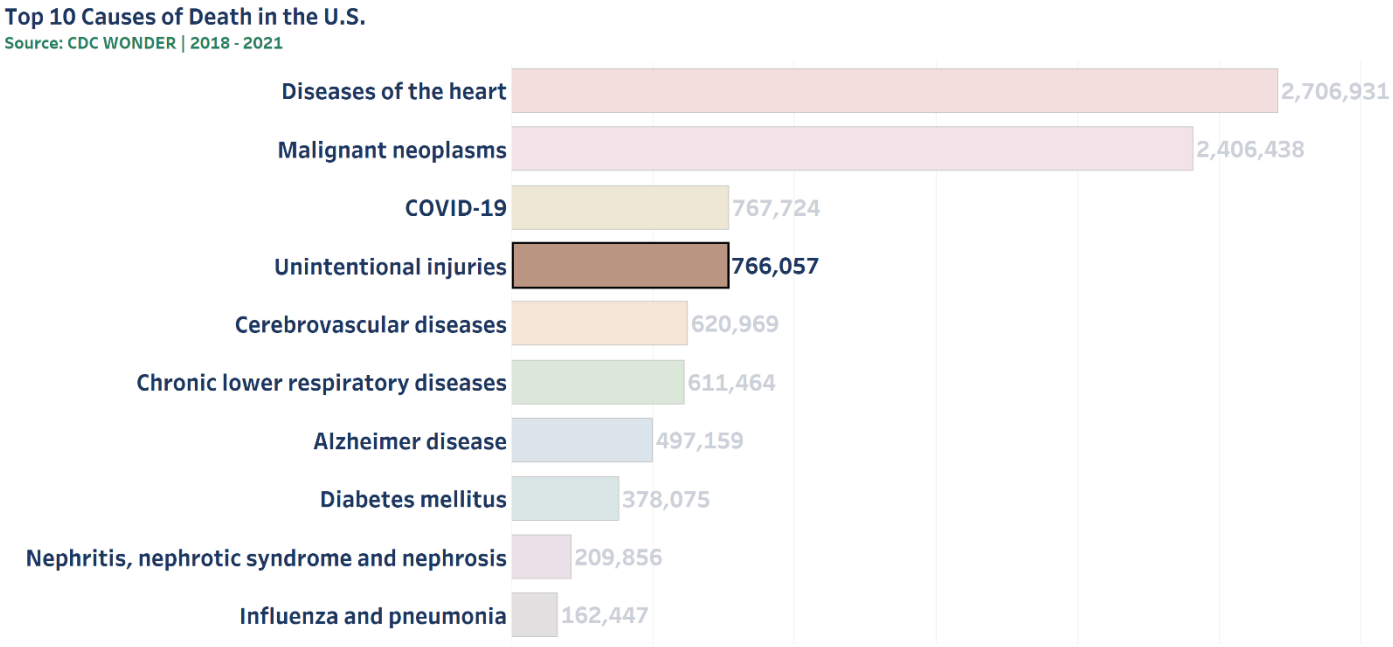

Figure 22: Leading causes of death in the United state among all age groups

Between 2018 and 2021, the United States faced significant mortality challenges. Heart diseases and malignant neoplasms remained leading causes of death, claiming 2,706,931 and 2,406,438 lives respectively. The emergence of COVID-19 in 2019 resulted in 767,724 deaths during this period, highlighting its substantial impact. Unintentional injuries, including accidents, led to 766,057 fatalities. Cerebrovascular diseases (620,969) and chronic lower respiratory diseases (611,464) were prominent causes as well. Alzheimer's disease affected 497,159 individuals, while diabetes mellitus was a factor in 378,075 deaths. Nephritis, nephrotic syndrome, and nephrosis contributed to 209,856 fatalities, and influenza and pneumonia were responsible for 162,447 deaths. These data emphasize the diverse range of health challenges faced by the U.S., underscoring the need for comprehensive public health strategies to address these varied causes of mortality. Additionally, these data provide a context with which to understand deaths in Iowa (especially unintentional injuries), which will be shown after a view of the leading causes of death in the U.S. among the 1-44 age group.

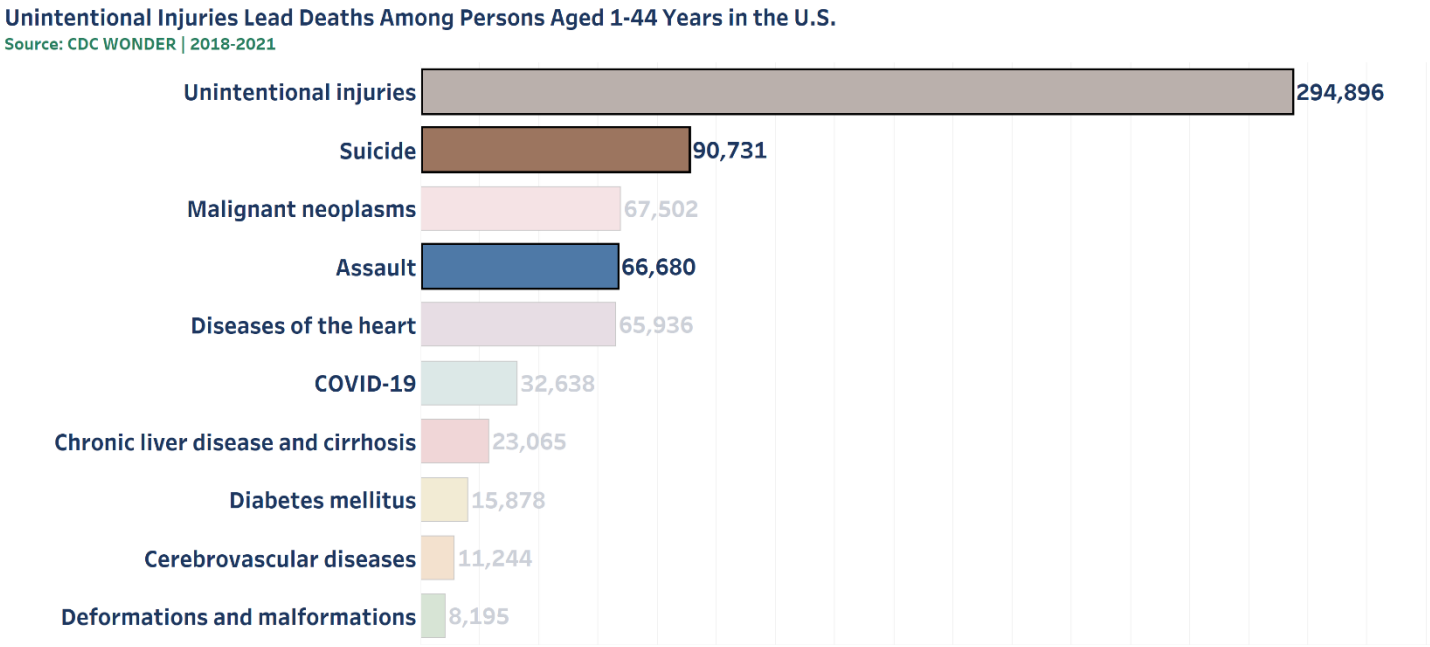

Figure 23: Unintentional injuries lead deaths among persons aged 1-44 years in the U.S.

Between 2018 and 2021, the United States witnessed a concerning trend in deaths among individuals aged 1-44, with unintentional injuries leading as a major cause. In this age group, unintentional injuries claimed 294,896 lives, indicating a significant public health challenge. This trend is echoed in Iowa's 2022 data, where unintentional injuries were responsible for 1,815 deaths, underlining the persistent nature of this issue.

In Iowa, despite a slight decrease in total deaths from 2021 to 2022, unintentional injuries remained a leading cause of mortality. The high number of deaths due to accidents emphasizes the need for targeted prevention strategies, especially among younger individuals. Public health initiatives focusing on injury prevention, education, and safety measures can play a vital role in addressing this ongoing concern, ensuring a safer environment for Iowans and potentially reversing this troubling trend in the coming years. In the next visualization, there will be more discussion related to Iowa specific deaths.

The epidemiologist for this report compiled publicly available reports from the Iowa Bureau of Health Statistics to create the following chart and the analyses below it.

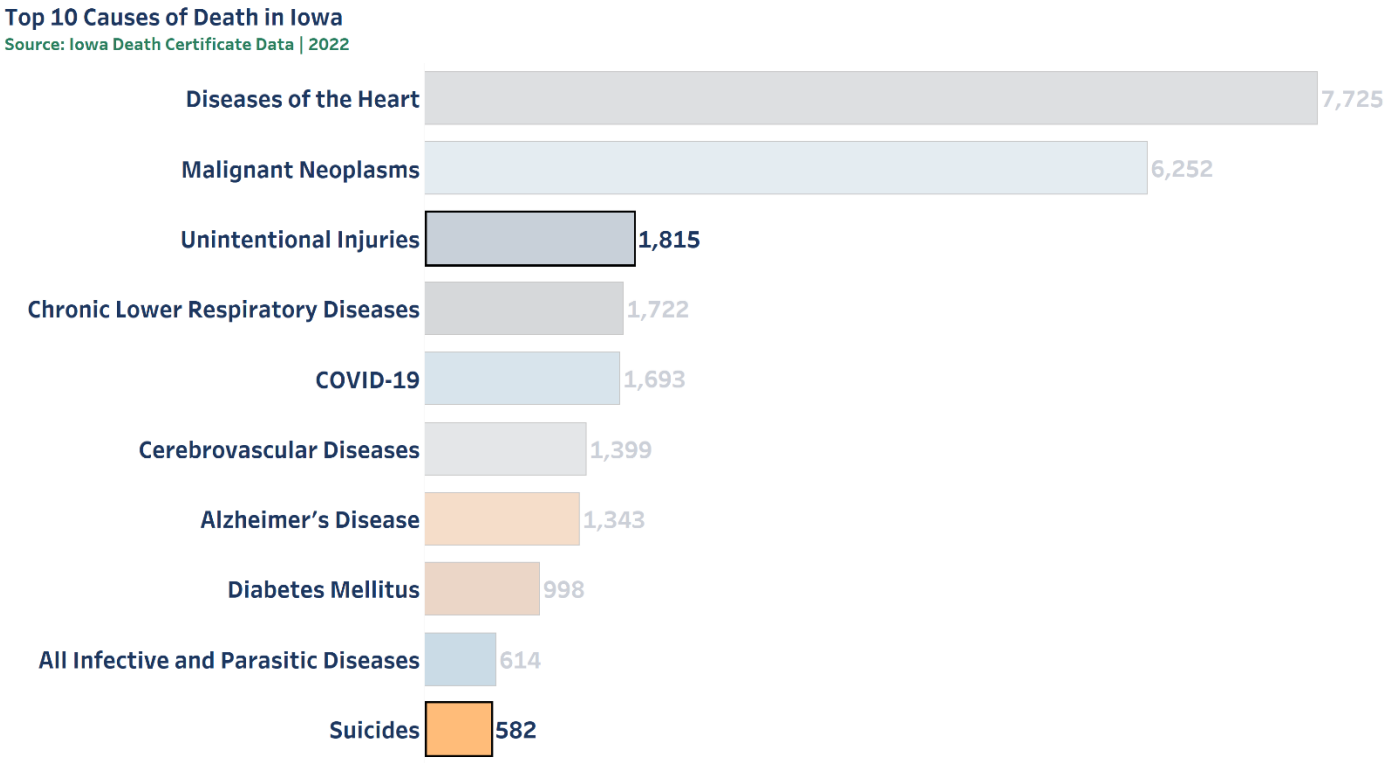

Figure 24: Leading causes of death in Iowa

In 2022, Iowa faced notable health challenges. Heart diseases and malignant neoplasms were major causes of death, claiming 7,725 and 6,252 lives respectively. Unintentional injuries resulted in 1,815 deaths, making this cause of death the third leading cause of death among all ages in Iowa. Chronic lower respiratory diseases and cerebrovascular diseases accounted for 1,722 and 1,399 fatalities respectively. COVID-19 remained a concern, causing 1,693 deaths in the state. Alzheimer's disease affected 1,343 individuals, and diabetes mellitus contributed to 998 deaths. Infective and parasitic diseases were responsible for 614 fatalities, while suicides tragically accounted for 582 deaths. These statistics highlight the diverse array of health issues impacting Iowa in 2022, emphasizing the importance of targeted public health efforts and interventions to address these specific causes of mortality.

Iowa experienced a fluctuating pattern in annual deaths from 2018 to 2022. The number of deaths increased from 30,527 in 2018 to 35,975 in 2021, signifying a concerning rise. However, in 2022, there was a slight decrease to 34,216 deaths. These data suggest a potential stabilization after the notable spike in 2021, but the state still faces substantial health challenges. Major contributors to mortality include heart diseases, cancers, and unintentional injuries, with COVID-19 remaining a significant concern. The varied causes of death underscore the complexity of public health issues in Iowa. While the decrease in 2022 is a positive sign, sustained efforts are crucial. Targeted interventions addressing heart diseases, cancers, injuries, and infectious diseases are vital. Continuous monitoring and proactive public health initiatives are essential to ensuring a healthier future for Iowa's residents.

Trends in Cause of Death

In the following graphs and table (i.e. Figures 23 through Figure 27 and Table 2), finalized death certificate data have been used, which were submitted to and returned by the CDC, to ensure comparability between Iowa level and national level statistics. Given that, the death estimates below do have infinitesimal differences to other death estimates that may be published by the Bureau of Health Statistics in other reports. The descriptive statistics and trends will not be affected significantly.

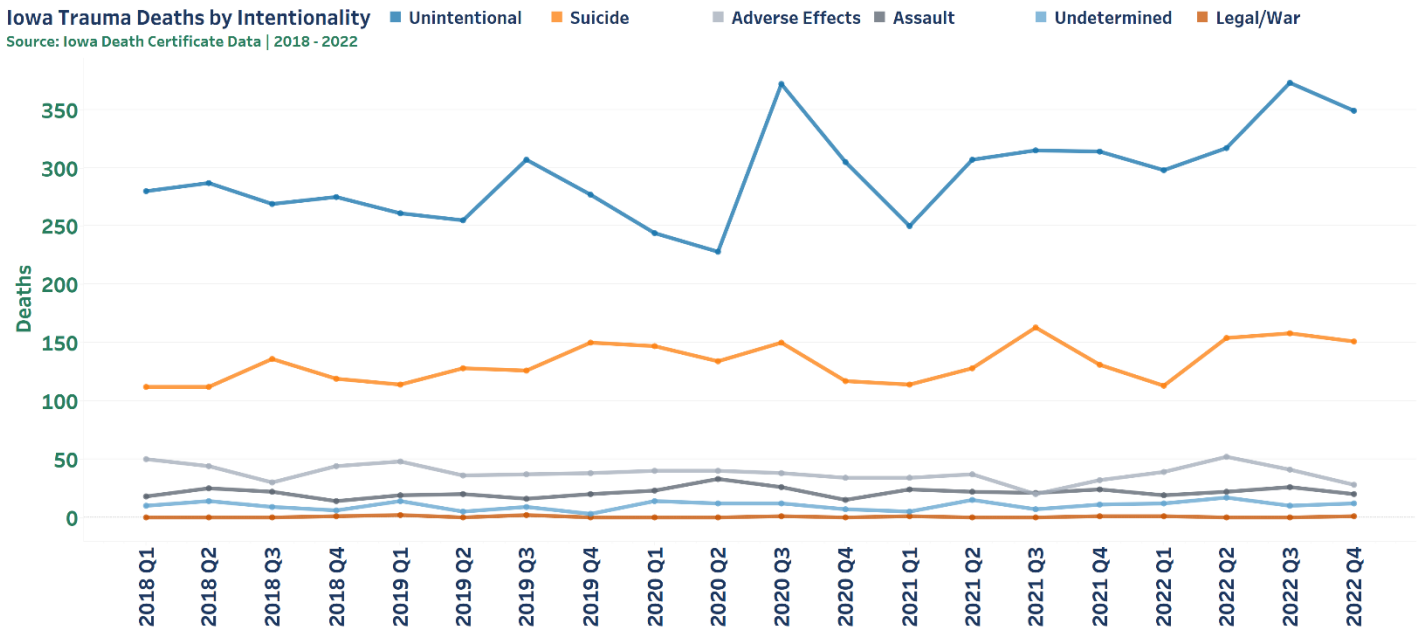

Figure 25: Iowa trauma deaths by intentionality

Iowa recorded a range of intentional and unintentional injury-related deaths in 2022. Unintentional injuries were the most common, showing fluctuations throughout the year, with a peak of 373 in Q4. Suicides remained relatively stable, ranging from 113 in Q2 to 163 in Q3. Adverse effects, including drug-related incidents, varied from 20 in Q2 to 52 in Q4. Assault-related deaths saw fluctuations, reaching 33 in Q3. Deaths classified as undetermined remained consistent, ranging from 6 to 17 throughout the year. There were minimal counts for legal/war-related deaths, reaching 1 in Q4. These data highlight the varied nature of injury-related deaths in Iowa in 2022. Unintentional injuries, including accidents and falls, were a major concern, showing a significant increase in Q4. Suicides remained a consistent concern, while adverse effects fluctuated, indicating potential challenges related to substance abuse. Assault-related deaths peaked in Q3, emphasizing the need for violence prevention strategies. Deaths of undetermined intent maintained a steady rate, suggesting ongoing investigation and classification challenges. Legal/war-related deaths were extremely rare.

The data reveal a consistent pattern of increased trauma-related deaths in Iowa during Q3 of each year. This seasonality aligns with the warmer months, marked by increased outdoor activities and social events, which can contribute to a rise in injuries and fatalities.

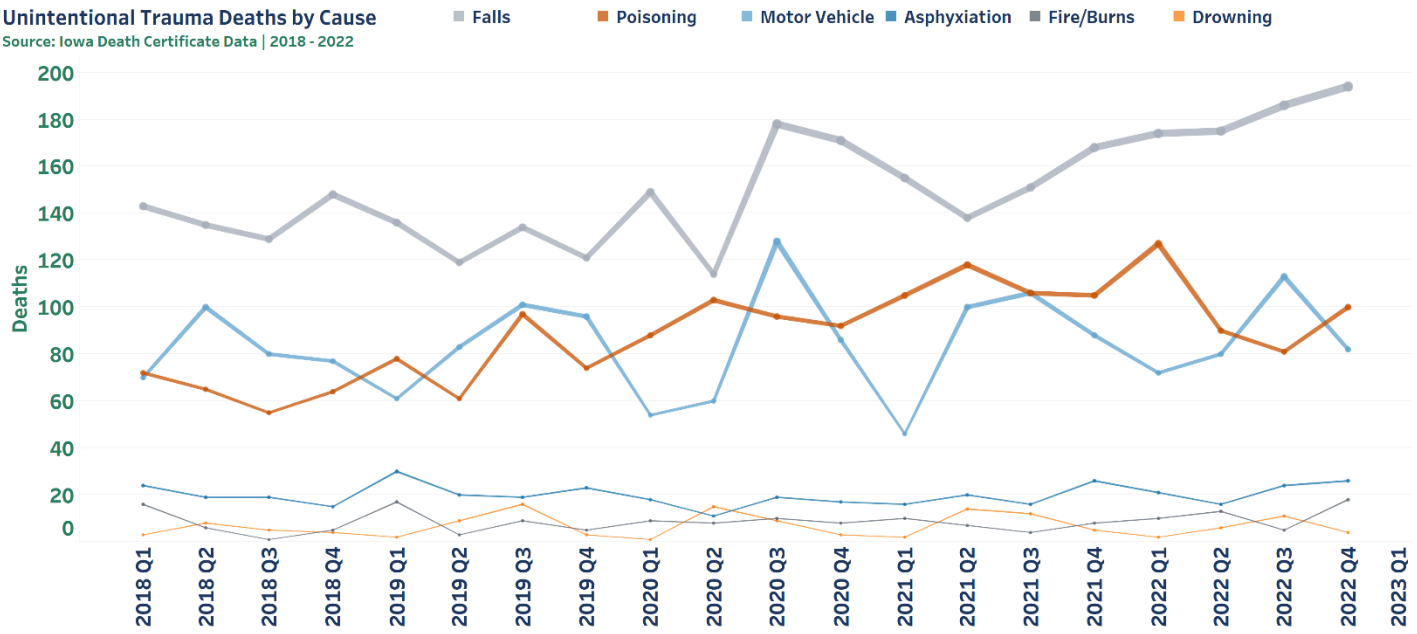

Figure 26: Unintentional trauma deaths by cause

In 2022, unintentional injury deaths in Iowa revealed several notable patterns. Falls were the most common cause, consistently increasing from 143 in 2018 Q1 to 194 in 2022 Q4. Poisoning-related deaths fluctuated, peaking at 127 in 2022 Q1. Motor vehicle accidents saw a notable rise from 70 in 2018 Q1 to 113 in 2022 Q3. Asphyxiation deaths remained relatively stable, averaging around 20 per quarter. Fire and burns caused 18 deaths in Q4 2022, contrasting with a low of 16 in Q1 2018. Drowning-related deaths varied, reaching 16 in 2019 Q3. These figures underscore the diverse nature of unintentional injuries, emphasizing the need for targeted preventive measures, especially focusing on falls, poisoning, and motor vehicle accidents to reduce fatalities and enhance public safety in Iowa.

The data reveal a noticeable pattern of increased unintentional injury deaths during quarter 3, which aligns with the seasonal uptick in outdoor activities. During this period, individuals are often more adventurous, participating in outdoor sports and recreational activities. Increased travel and outdoor events, coupled with potential risk-taking behaviors, contribute to the spike in unintentional injuries and fatalities. The data underscore the importance of awareness campaigns and safety measures during this period, emphasizing the need for caution, responsible behavior, and proper safety equipment. Public health initiatives focusing on injury prevention, especially during the active outdoor months, can significantly reduce the incidence of these tragic events, ultimately saving lives.

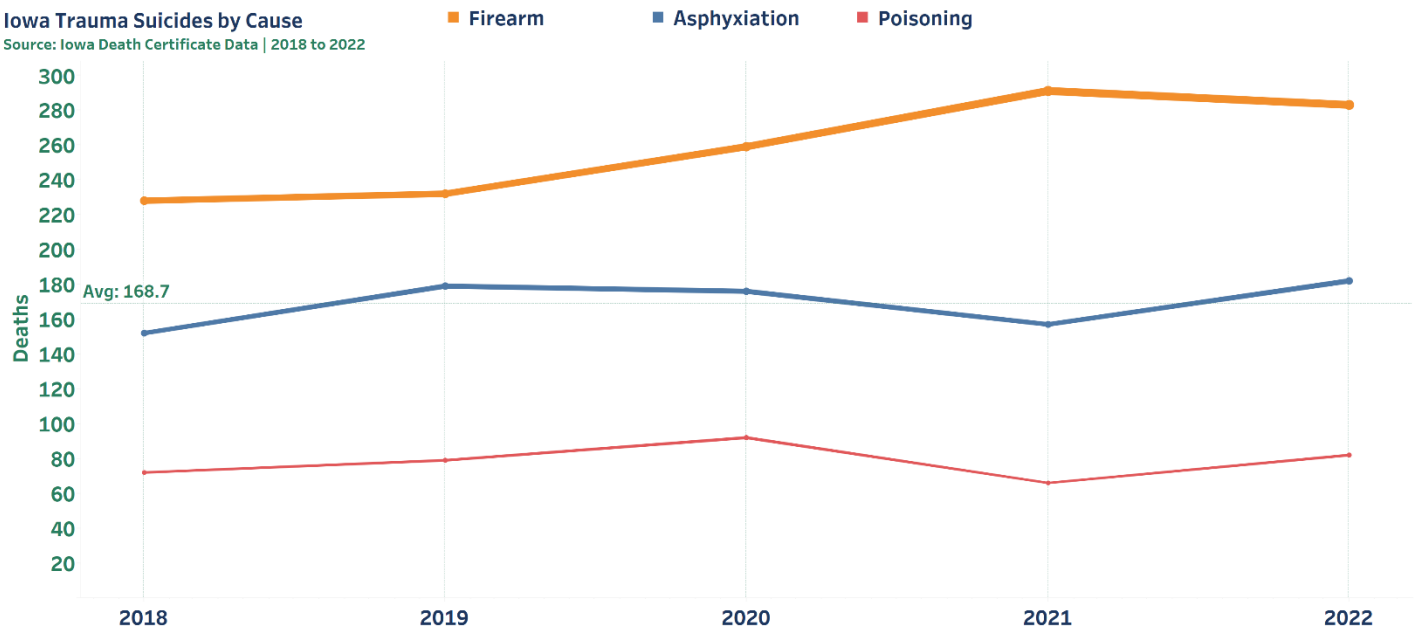

Figure 27: Iowa trauma suicides by cause

In the five-year period spanning from 2018 to 2022, Iowa witnessed a concerning trajectory in trauma suicides, reflecting the profound impact of mental health challenges within the community. Analyzing the data, a notable rise in suicides by firearms is present, peaking at 291 cases in 2021, before slightly decreasing to 283 in 2022. Asphyxiation-related suicides displayed a fluctuating pattern, reaching their zenith in 2019 at 179 cases, followed by a gradual decline and a subsequent rise to 182 cases in 2022. Poisoning-related suicides exhibited a consistent rise, ascending from 72 cases in 2018 to 92 cases in 2020, and subsequently, a decrease to 82 cases in 2022.

These trends underline the imperative need for targeted mental health initiatives and community interventions. The increase in firearm-related suicides demands urgent attention, emphasizing the necessity for public education efforts, firearm-specific suicide prevention education, and enhanced mental health support for individuals at risk. Additionally, the fluctuating patterns in asphyxiation-related suicides indicate the complex nature of these incidents, necessitating in-depth research to understand underlying causes.

In conclusion, these insights highlight the critical importance of continued efforts in mental health awareness, accessible counseling services, and comprehensive preventive measures. It is essential that policymakers, mental health professionals, and communities collaborate to create a supportive environment, ensuring the well-being of every individual in the state of Iowa.

Trends in Causes of Death
Source: Iowa Death Certificate Data | 2018 to 2022

	Five-Year Average	Reporting Year Count	Percent Difference from Five-Year Avg.
Fire/Flame	40.8	50	22.55%
Fall	610.2	740	21.27%
Poisoning	449.2	497	10.64%
Asphyxiation	255.6	275	7.59%
Motor Vehicle	339.6	348	2.47%
Drowning	38.4	36	-6.25%

Table 1: Trends in causes of death in Iowa over five years

Table 1 above shows deaths from the six listed categories, regardless of intentionality. Notice that the colors of the cells are in descending order of percent change, with the darker orange color indicating a higher positive change. Over the five-year period (2018 through 2022), data reveal varied trends in trauma-related fatalities. Asphyxiation incidents exceed the five-year average by 7.59%, contrasting the 6.25% difference in drownings. Falls exceed the five-year average by 21.27%, while fire/flame-related fatalities differ by 22.55%. Motor vehicle incidents experienced a modest 2.47% uptick. Notably, poisonings saw a significant 10.64% increase as compared to the five-year average. These findings underscore the importance of targeted prevention strategies, particularly addressing the concerning rise in falls and poisoning-related fatalities. Active initiatives are crucial to curbing these trends and ensuring public safety.

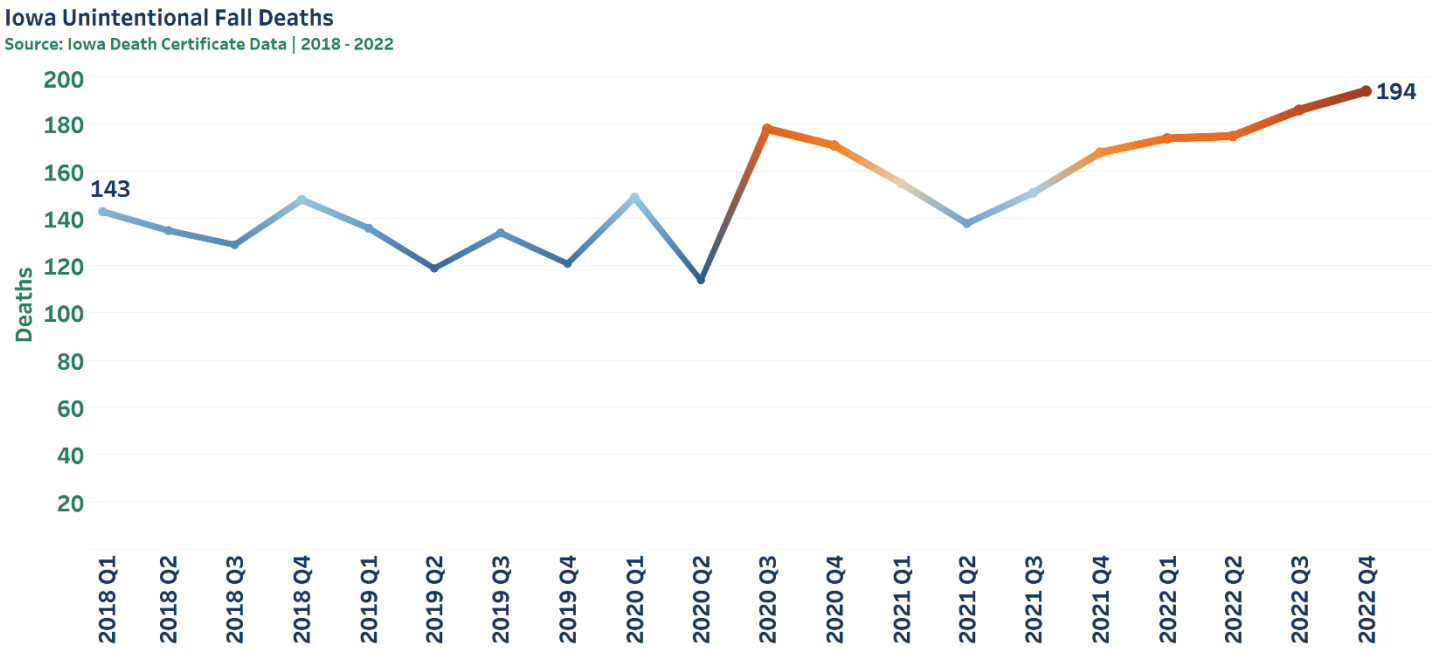

Figure 28: Unintentional fall deaths in Iowa

The color change from blue to orange, and the increased size of this line both indicate an increase in deaths. Examining unintentional fall deaths in Iowa from Q1 2018 to Q4 2022 reveals noteworthy patterns at the quarter level. Across the years, there is a consistent increase in fall-related fatalities during the colder months (Q4 and Q1), reaching peaks in Q4 of 2018, 2020, and 2022. Conversely, a decline is observed in Q2 (with the exception of Q2 2022), indicative of potential seasonality influenced by weather conditions. The data points to a concerning trend of higher fall-related deaths during fall and early winter, underlining the importance of fall- and winter-specific safety measures and awareness campaigns. While efforts to reduce fall-related fatalities should be year-round, targeted interventions and public education campaigns in the fall and winter months are critical. These findings emphasize the necessity for comprehensive strategies aimed at preventing falls, particularly in colder weather, to safeguard the well-being of the residents of Iowa.

Performance Indicators

The System Evaluation and Quality Improvement Subcommittee (SEQIS) of the TSAC has implemented a comprehensive framework to gauge the performance trends within Iowa's statewide trauma system. This evaluation involves the extraction of data from the state trauma registry, followed by processing in accordance with the prescribed Hospital System State Indicators document (see Appendix 1). Subsequently, these processed data are disseminated to all reporting facilities.

These indicators serve as invaluable tools, enabling trauma programs to assess their performance relative to peer institutions of similar levels and, importantly, in comparison to the state's overall performance. The results, delineated in four columns in the center of the table, also categorize data based on trauma facility levels, notably combining levels I and II for comprehensive analysis. The goal for each outcome, as applicable, is documented in the far-right column to provide a benchmark.

Provided to every Iowa hospital bi-annually, these trauma indicators data play a pivotal role in steering performance improvement initiatives and guiding preventive programs. By scrutinizing these reports, hospitals and service areas gain vital insights, enabling them to monitor fluctuations within the trauma system effectively. This systematic approach not only facilitates internal benchmarking but also fosters a collaborative environment wherein institutions collectively contribute to the enhancement of Iowa's trauma care standards.

Please note: Indicators 1a-1c are not calculated for Level IV facilities, and Indicator 6a is not calculated for Level I and II facilities (No Calc is shown for these). Any NA values below indicate that there was not sufficient data to provide a calculation. In addition, caution needs to be taken with direct comparisons to previous SEQIS indicator reporting. A unique approach was taken starting in 2023 to analyze these data that may produce results that introduce an artificial increase or decrease in some areas that may cause alarm. It will be important to delay direct comparisons until 2024 when the results coming from the same statistical methods can be compared. Another consideration has to do with the timeliness of reporting especially among facilities that utilize a third-party upload to ImageTrend. This needs to be taken into consideration when interpreting Other Indicator 1.

Indicators Calculated for 2022	Level I & II	Level III	Level IV	State	Goal
Indicator 1a - Trauma Surgeon Responding Within 15 Minutes	95.2%	85.4%	No Calc	89.3%	80.0%
Indicator 1b - Trauma Surgeon Responding Within 30 Minutes	97.8%	97.9%	No Calc	96.7%	80.0%
Indicator 1c - Trauma Surgeon Response Time Unknown	7.7%	6.7%	No Calc	9.1%	0.0%
Indicator 1d - Physician Responding Within 5 Minutes	79.2%	57.1%	68.0%	65.9%	80.0%
Indicator 1e - Physician Responding Within 20	95.1%	90.7%	91.0%	91.8%	100.0%

Indicators Calculated for 2022	Level I & II	Level III	Level IV	State	Goal
Minutes					
Indicator 1f - Physician Response Time Unknown	37.5%	10.7%	27.3%	24.2%	0.0%
Indicator 2 - Injury Time Blank	25.7%	18.9%	11.6%	18.5%	0.0%
Indicator 3 - Probability of Survival Calculated	84.6%	74.2%	73.5%	77.2%	100.0%
Indicator 4a - Deceased Trauma Patient Autopsied	39.1%	26.2%	33.1%	32.7%	NA
Indicator 4b - No Autopsy on Death with LOS Greater Than 72 Hours	85.7%	100.0%	94.1%	92.0%	NA
Indicator 5a - Blood ETOH Measured	43.7%	23.6%	19.0%	27.9%	NA
Indicator 5b - Blood ETOH Positive	32.0%	46.3%	47.8%	40.0%	NA
Indicator 5c – Drug Screen Completed	25.0%	9.7%	10.3%	14.4%	NA
Indicator 5d – Drug Screen Positive	2.2%	0.0%	1.4%	1.2%	NA
Indicator 6a - 1st Hospital Initial GCS Less Than 9 With No Head CT Before Transfer to Definitive Care	No Calc	49.0%	53.7%	49.1%	100.0%
Indicator 6b - 1st Hospital Initial GCS Less Than 9 And Arrived to Definitive Care Over 3 Hours from Injury	30.8%	15.7%	6.6%	25.9%	0.0%
Indicator 7 - Patients to Definitive Care Greater Than 3 Hours	47.6%	21.7%	20.4%	31.4%	0.0%
Indicator 8 - Survival Rate for All Traumas	95.4%	98.4%	98.4%	97.5%	NA
Indicator 8 - Survival Rate for Low Risk Traumas	98.4%	98.8%	98.8%	98.7%	NA
Indicator 8 - Survival Rate for Moderate Risk Traumas	90.8%	96.3%	97.3%	92.9%	NA
Indicator 8 - Survival Rate for High Risk Traumas	40.0%	48.5%	77.1%	46.0%	NA

Indicators Calculated for 2022	Level I & II	Level III	Level IV	State	Goal
Other Indicator 1 - Incidents Submitted Within 60 Days of Patient Discharge	37.6%	95.1%	79.5%	72.8%	80.0%
Other Indicator 2 - Incidents with Validity Score Greater Than 84	86.8%	99.1%	98.6%	95.1%	90.0%

Table 2: SEQIS indicator results by level and entire state with goals for reference

The indicator results are listed below for the hospital preparedness service areas as well, anonymized with letters. Cells with an NA value did not contain enough data to meet reporting requirements. The order of the columns below is different from previous years, and will be randomized each year. While this is the case, the analyst that produces these analyses is capable of tracing performance back to specific regions each year.

In previous reports, the eight service areas were presented as seven areas after combining two of the service areas. In this report, all eight service areas are displayed.

Indicators Calculated for 2022	A	B	C	D	E	F	G	H	Goal
Indicator 1a - Trauma Surgeon Responding Within 15 Minutes	93.5%	79.9%	92.4%	94.6%	89.9%	83.2%	88.2%	90.8%	80.0%
Indicator 1b - Trauma Surgeon Responding Within 30 Minutes	98.4%	91.3%	95.8%	97.6%	98.6%	98.5%	96.5%	93.6%	80.0%
Indicator 1c - Trauma Surgeon Response Time Unknown	10.1%	23.6%	14.7%	8.8%	9.1%	4.9%	4.9%	16.2%	0.0%
Indicator 1d - Physician Responding Within 5 Minutes	70.1%	61.3%	90.5%	78.4%	72.6%	49.8%	71.6%	81.3%	80.0%
Indicator 1e - Physician Responding Within 20 Minutes	95.7%	88.5%	95.1%	91.9%	94.4%	88.2%	95.5%	96.1%	100.0 %
Indicator 1f - Physician Response Time Unknown	7.9%	16.1%	8.7%	49.9%	6.5%	4.5%	20.4%	40.4%	0.0%
Indicator 2 - Injury Time Blank	8.9%	27.2%	18.6%	14.7%	15.2%	18.8%	20.8%	17.8%	0.0%
Indicator 3 - Probability of Survival Calculated	74.1%	80.1%	73.1%	81.1%	73.1%	74.5%	76.7%	73.4%	100.0 %
Indicator 4a - Deceased Trauma Patient Autopsied	35.3%	21.1%	33.3%	14.4%	17.2%	25.6%	22.6%	13.3%	NA
Indicator 4b - No Autopsy on Death with LOS Greater Than 72 Hours	NA	96.2%	NA	17.9%	100.0%	100.0%	40.7%	NA	NA

Indicators Calculated for 2022	A	B	C	D	E	F	G	H	Goal
Indicator 5a - Blood ETOH Measured	19.0%	21.3%	23.6%	32.5%	23.7%	23.1%	33.6%	24.2%	NA
Indicator 5b - Blood ETOH Positive	64.9%	45.6%	44.8%	42.6%	33.0%	40.9%	34.4%	41.1%	NA
Indicator 5c – Drug Screen Completed	24.8%	8.6%	8.2%	17.2%	14.7%	12.7%	17.3%	5.8%	NA
Indicator 5d – Drug Screen Positive	7.7%	0.3%	1.2%	0.1%	0.1%	0.4%	2.7%	1.1%	NA
Indicator 6a - 1st Hospital Initial GCS Less Than 9 With No Head CT Before Transfer to Definitive Care	22.2%	80.0%	35.7%	46.5%	NA	53.5%	32.0%	75.0%	100.0 %
Indicator 6b - 1st Hospital Initial GCS Less Than 9 And Arrived to Definitive Care Over 3 Hours from Injury	100.0%	5.6%	100.0%	44.9%	10.0%	10.2%	16.1%	20.0%	0.0%
Indicator 7 - Patients to Definitive Care Greater Than 3 Hours	18.2%	15.7%	12.6%	50.1%	23.3%	19.5%	33.0%	19.6%	0.0%
Indicator 8 - Survival Rate for All Traumas	97.7%	97.1%	98.5%	96.8%	97.4%	98.5%	97.0%	99.1%	NA
Indicator 8 - Survival Rate for Low Risk Traumas	98.6%	98.7%	99.4%	98.4%	98.7%	99.0%	98.6%	99.1%	NA
Indicator 8 - Survival Rate for Moderate Risk Traumas	90.9%	93.2%	100.0%	90.6%	100.0%	96.0%	92.6%	100.0%	NA
Indicator 8 - Survival Rate for High Risk Traumas	NA	53.8%	NA	44.9%	44.4%	69.0%	35.7%	NA	NA
Other Indicator 1 - Incidents Submitted Within 60 Days of Patient Discharge	73.6%	87.7%	94.3%	50.9%	97.2%	95.1%	61.3%	71.1%	80.0%
Other Indicator 2 - Incidents with Validity Score Greater Than 84	99.9%	99.7%	99.6%	90.5%	99.9%	99.9%	92.2%	95.2%	90.0%

Table 3: SEQIS indicator results by service area

Data Sources

Iowa Hospital Association Inpatient and Outpatient Data Registry: These are patients who were admitted to a given facility. The incidents used for analysis were the patients whose admitting or principal diagnosis was a trauma diagnosis code based on the state's trauma registry inclusion criteria.

Iowa Death Certificate Data: The Bureau of Health Statistics provides the trauma program with trauma-related death statistics, and the epidemiologist for the Bureau of Emergency Medical and Trauma Services has access to vital records as well. Final death certificate data is used in this report which may differ slightly with regard to the counts as the Bureau of Health Statistics maintains statistical files which are the death certificate data prior to being sent to and returned by the CDC. The use of the final death certificate data returned by the CDC may compare better with CDC statistics which are used in this report.

Centers for Disease Control and Prevention WONDER Data: The Centers for Disease Control and Prevention publishes and maintains the Wide-ranging ONline Data for Epidemiologic Research (WONDER) database. WONDER is an intuitive platform offering comprehensive access to the Centers for Disease Control and Prevention's (CDC) resources on a variety of vital statistics. This user-friendly system caters to public health professionals and the wider community, providing an extensive range of public health information. Through WONDER, users can access CDC programs' data, ensuring compliance with data release policies. The platform facilitates evidence-based assessments of public health initiatives and population health trends, incorporating CDC Scientific Data archives for in-depth research.

Iowa EMS Registry: This registry contains the EMS run reports for the state of Iowa in 2022. Data are pulled from our state registry at https://iowa.imagetrendelite.com/elite/organizationiowa/.

Iowa Trauma Registry: This is the trauma registry that hospitals are required to submit data to as defined by the inclusion criteria on page 10 of the Iowa Trauma Registry Data Dictionary. Note that some facilities track same-level falls resulting in isolated hip fractures, but these data are not required. The information is collected on https://iowa.imagetrendregistry.com/.

Appendix

APPENDIX 1: HOSPITAL SYSTEM INDICATORS

Details regarding the calculation of the performance indicators are described below.

- Indicator 1a – Trauma surgeon present in ED within 15 minutes of patient arrival
    - For level 1 trauma activations, how often did the first responding trauma surgeon arrive within 15 minutes of the arrival of the patient?
    - Trauma surgeons are defined as trauma team members who have "Surgery/Trauma" selected for the Trauma Team Member Service Type on the incident form.
    - The response time is calculated as the minutes from the ED/Acute Care Admission Time to the Trauma Team Member Arrived Time.
    - 15 minutes is the indicator for Level I and II facilities.
    - This indicator disregards incidents for which there was no calculable response time for a "Surgery/Trauma" trauma team member.
- Indicator 1b – Trauma surgeon present in ED within 30 minutes of patient arrival
    - Calculated the same as 1a, but 30 minutes is the indicator for Level III facilities.
- Indicator 1c – Trauma surgeon response time unknown
    - For level 1 trauma activations, how often are we unable to calculate the response time of the trauma surgeon?
    - If we are unable to calculate the response time, the incident is missing at least one of ED/Acute Care Admission Date/Time or Trauma Team Member Arrived Date/Time.
- Indicator 1d – 1st physician (Trauma surgeon or ED physician) present in ED within 5 minutes of patient arrival
    - For level 1 and 2 trauma activations, how often did the first responding physician arrive within 5 minutes of the arrival of the patient?
    - Physicians are defined as trauma team members who have "Surgery/Trauma," "Emergency Medicine," or "Surgery Senior Resident" selected for the Trauma Team Member Service Type on the incident form.
    - The response time is calculated as the minutes from the ED/Acute Care Admission Time to the Trauma Team Member Arrived Time.
    - 5 minutes is the indicator for Level I and II facilities.
    - This indicator disregards incidents for which there was no calculable response time for a "Surgery/Trauma" or "Emergency Medicine" trauma team member.
- Indicator 1e – 1st physician (Trauma surgeon or ED physician) present in ED within 20 minutes of patient arrival
    - Calculated the same as 1d, but 20 minutes is the indicator for Level III and IV facilities.

- Indicator 1f – Physician response time unknown
    - For level 1 and 2 trauma activations, how often are we unable to calculate the response time of the physician?
    - If we are unable to calculate the response time, the incident is missing at least one of ED/Acute Care Admission Date/Time or Trauma Team Member Arrived Date/Time.
- Indicator 2 – Missing injury time
    - Calculated as the number of incidents with a missing injury time divided by the total number of incidents for the period.
- Indicator 3 – Trauma patient had a Probability of Survival (Ps) score calculated
    - Calculated as the number of incidents with a valid Probability of Survival score divided by the total number of incidents for the period.
    - Probability of Survival is calculated using the following factors:
        - Injury Severity Score (ISS): Derived from the AIS codes associated with the diagnosis codes.
        - Revised Trauma Score (RTS): Derived from Glasgow Come Scale, systolic blood pressure, and respiratory rate.
        - Patient age.
        - Trauma type: Derived from the injury code (found on the Injury tab in ImageTrend) and its associated trauma type.
    - If any of those factors are missing, the Probability of Survival score will not be calculated.
    - Injuries with a trauma type of burn are excluded from this calculation.
- Indicator 4a – Deceased trauma patient was autopsied
    - Calculated as the number of incidents with a "Yes" value for Autopsy divided by the number of incidents with a value of "Deceased/Expired" for either ED/Acute Care Disposition or Hospital Discharge Disposition.
- Indicator 4b – No autopsy done on death with stay greater than 72 hours
    - Calculated as the number of deceased patients who were at the facility for over 72 hours and did not have an autopsy performed divided by all deceased patients who were at the facility for over 72 hours.
- Indicator 5a – Blood ETOH was measured
    - Calculated as the number of patients who had blood ETOH measured divided by all patients.
    - This does not exclude any patients, so pediatric patients are included.
- Indicator 5b – Blood ETOH was positive

  - Calculated as the number of patients who had a positive blood ETOH divided by the number of patients who had blood ETOH measured.
- Indicator 5c – Administration of a drug screen
  - Calculated as the number of incidents that involved a drug screen based on the field ED Acute Care Drug(s) suspected or confirmed by test / Drug Screen divided by the total number of incidents.
- Indicator 5d – Positive drug screen
  - Calculated as the number of incidents that involved one or more positive drug screens based on the same field as 5c, divided by the total number of incidents.
- Indicator 6a – 1st hospital initial GCS < 9 with no head CT done before transfer to definitive care
  - Calculated as the number of patients with a GCS less than 9 at the first hospital who did not have a head CT prior to transfer divided by the number of patients with a GCS less than 9 at the first hospital who were transferred.
- Indicator 6b – 1st hospital initial GCS < 9 arrived to definitive care > 3 hours in transferred patients
  - Calculated as the number of patients with a GCS less than 9 at the first hospital who arrived to definitive care over 3 hours from injury time divided by the number of patients with a GCS less than 9 who were transferred.
- Indicator 7 – Population that arrived to definitive care in > 3 hours from injury time
  - Calculated as the number of patients who took more than 3 hours to arrive at the definitive care facility from injury time divided by all patients.
  - Definitive care is determined the same as in 6a, i.e. patient is not transferred out.
- Indicator 8 – Survival rate by risk for death (high, moderate, and low) stratified by trauma hospital level
  - The definitions for risk levels are as follows (Abnormal Physiology thresholds also listed):
    - Abnormal Physiology
      - GCS 3-5
      - Respiration <5 or >30 respirations per minute
      - Systolic Blood Pressure <60 mm Hg
    - Risk Definitions
      - High
        - Probability of Survival <.2 OR
        - ISS >41 OR

        - ISS >24 if Abnormal Physiology
    - Moderate
        - Probability of Survival 0.2-0.5 OR
        - ISS 16-41
    - Low
        - Probability of Survival 0.5-1.0 OR
        - ISS <16 OR
        - Normal range physiology
- All survival rates are calculated as the number of patients who do not have an ED/Acute Care Disposition or Hospital Discharge Disposition of "Deceased/Expired" divided by all patients.

- Other Indicator 1 – Incident submitted within 60 days of patient discharge
    - Calculated as the number of incidents entered in the trauma registry within 60 days of patient discharge divided by the number of all incidents.
    - The data dictionary specifies that 80% of incidents should be entered within 60 days of patient discharge, and 100% of incidents should be entered within 120 days of patient discharge.
    - The patient discharge date is the later of ED/Acute Care Admission Date and Hospital Discharge Date.
- Other Indicator 2 – Incident has validity score of 85% or greater
    - Calculated as the number of incidents with a validity score of 85% or greater divided by all incidents.