NPSD Data Spotlight

Falls: Associated Factors and Clinical Outcomes

Agency for Healthcare Research and Quality

Patient Safety Listed PSO Organization

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Falls: Associated Factors and Clinical Outcomes

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INTRODUCTION

Each year, somewhere between 700,000 and 1,000,000 people in the United States fall in the hospital.[1] A patient fall is defined as sudden, unintended, uncontrolled, downward displacement of a patient's body to the ground or other object (e.g., onto a bed, chair, or bedside mat). These falls result in significant physical and economic burdens to patients (e.g., injuries, increased healthcare spending), as well as to medical organizations (increased lengths of stay, care costs, and litigation).[2] Further, as of 2008, the Centers for Medicare & Medicaid Services (CMS) stopped reimbursing hospitals for fall-related injuries.[3]

Highlights

- Across most years, the relative percentage of falls was highest among *Aged adults (85 years or older),* but rates of injury were highest among patients under 18.
- Across all age groups, rates of injury were higher in male patients. However, adult female patients had higher rates of fractures.
    - Rates of fracture in female patients 65 and older were nearly twice as high as those in male patients of the same age group.
- Falls occur in patients without documented risk factors, ranging from:
    - Half of falls among patients under 18
    - 1 in 10 falls among patients 85 and older

Newer evidence on fall prevention is based on elderly patients in residential facilities, which has often been generalized to the hospital environment --- despite key differences between the two settings and their patients.[2] From a setting perspective, hospital stays are often shorter and the diverse organizational structures of hospitals impose unique challenges to prevention research, compared to residential facilities. [2] From a patient perspective, hospital patients must also navigate an unfamiliar environment, on top of a myriad of acute and chronic conditions which limit judgement and mobility.[2] Further, falls in hospitals are not restricted to the elderly.

Given the significant financial impacts noted above and the fact that close to one-third of hospital falls can be prevented,[4] it is beneficial to examine the risk factors for severity of falls in order to improve fall prevention and intervention strategies in hospitals. Ageing is a well-known risk factor for falls and fall-related injury; however, evidence suggests that severity of falls and fall-related serious injury are much more complicated. Patient falls involve other intrinsic factors, such as patient gender, medical condition, mobility impairment, as well as extrinsic factors like environmental factors.[5] As such, this Spotlight seeks to examine patient falls recorded in the Network of Patient Safety Databases (NPSD) received through the end of 2021, specifically examining clinical outcomes and factors associated with falls by age and gender --- building upon previous analyses of the NPSD data.

The Agency for Healthcare Research and Quality (AHRQ) implements the NPSD for the United States Department of Health and Human Services (HHS) as mandated by the Patient Safety and

Quality Improvement Act of 2005 (PSQIA).[6] The NPSD data consists of non-identifiable[i] structured data elements and unstructured free text that describe the nature of patient safety events and concerns and their contributing factors. Findings presented in this Spotlight are based on aggregated NPSD data to maintain the anonymity of the patients involved as well as the contributing providers and Patient Safety Organizations (PSOs). The data used for this analysis include reports on patient safety concerns with initial report dates from April 24, 2008 through December 26, 2021.[ii]

LIMITATIONS

There are important caveats to consider in the interpretation of results from this and any analyses using NPSD data. Firstly, reporting of patient safety events from PSOs to the NPSD is voluntary as is the reporting to PSOs by providers. As such, the data are not a representative sample and cannot be used to calculate the actual incidence or prevalence of patient safety events. Secondly, patient safety event reports are submitted by providers to PSOs, then by PSOs to the PSO Privacy Protection Center (PSOPPC) for analysis in the NPSD. These submissions may originate from hospital-level incident or safety reports, and multiple staff with various levels of experience and different backgrounds may contribute information towards these submissions. Therefore, they are subject to variation in judgement as to what to report. Lastly, while the NPSD currently only contains data submitted in the Common Formats for Event Reporting-Hospitals (CFER-H), there may be a small proportion of data in the NPSD that is collected from non-Hospital settings, since some providers may have used the CFER-H to report data from other settings. However, despite these limitations, the wealth of standardized, structured data in the NPSD allows for trends and patterns in patient safety concerns to be identified across multiple hospitals, regions, and years --- providing a learning resource and insight on how to mitigate patient safety risks and reduce harm nationally.

[i] Patient Safety Organizations (PSOs) collect voluntary reports from healthcare providers and submit data to the PSO Privacy Protection Center (PSOPPC) using the Common Formats, an AHRQ-developed standardized reporting format using common language and definitions. The PSOPPC ensures the Common Formats data do not contain information that may identify the patients and providers before transmittal to the NPSD for analysis.

[ii] The initial report date represents the date a provider completed the Healthcare Event Reporting Form and entered the data into the provider system.

METHODOLOGY

Data used for the analyses presented below are based on data submitted in CFER-H V1.2 that were submitted to the PSOPPC through 2021 (2,288,210 records). The NPSD further excluded records where the nature of the patient safety event could not be attributed to the hospital, did not reach the patient, did not appear to involve incorrect actions, or were otherwise not part of the focus of the event-specific module;[iii] 1,637,560 records were included for analysis.

Of the 1,637,560 voluntarily reported events, 237,305 (14.5%) were falls. It should be noted that a single event record may have more than one type of event specified. A very small fraction (0.07%; 171 records) of the 237,305 fall records had another event type associated, mostly "Other" (137 records), followed by Device or Medical/Surgical Supply, including HIT (28 records), surgery (4), perinatal and/or surgery and perinatal (2). For this analysis, no distinction was made between records that only specified falls and records that identified both a fall and another type of event.

Using these 1,637,560 voluntarily reported events/concerns data, the annual trends in relative percentage of falls among all reports were examined by age and gender. From the 237,305 reported falls, data elements (DEs) for the following clinical outcomes and factors associated with falls were examined by patient age[iv] and gender:

- Presence of Physical Injury as a Result of Fall (DE201)
- Type of Injury as a Result of Fall (DE204)
- Patient Activity Prior to Fall (DE207)
- Risk Assessment Prior to Fall (DE210)
- Risk Factor(s) Prior to Fall (DE216)

Further, for the above analyses, the semi-structured free text associated with the Other: Please Specify categories for Type of Injury, Activity Prior to Fall, and Risk Factors Prior to Fall were categorized through the use of n-grams to provide an initial understanding of the most frequently used words.[7] From the top 50 n-grams, broader topics/themes were identified to regroup all free-text data and regular expressions were used to parse the text for themes and/or synonyms for the themes and label the text (e.g., different spellings and capitalizations of "walking" were labelled as "Ambulating"). Note that very small counts are not shown on the graphs that follow for brevity and/or potential risk of disclosure. For similar reasons, records with report dates through 2010 have been aggregated. Also, records that were missing age and/or gender information were excluded from applicable analyses.[v]

[iii] Details on the data validation rules and event definitions for the NPSD can be found in the 2022 NPSD Chartbook.
[iv] Note that patient age in this analysis spans the following age groups: Under 18 (<28 days-17 years), Adult (18-64 years), Mature Adult (65-74 years), Older adult (75-84 years), and Aged adult (85+ years). For statistical purposes and ease of visualization across age groups, reports across the Neonate (0-28 days) through Adolescent (13-17 years) age groups in CFER-H V1.2 were consolidated into a single category of Under 18.
[v] Full data validation and inclusion criteria for falls-specific analyses are detailed in the 2022 NPSD Falls Supplemental Analyses.

KEY FINDINGS

For brevity, key findings are highlighted in the body of this Spotlight. All other findings are detailed in Appendix A.

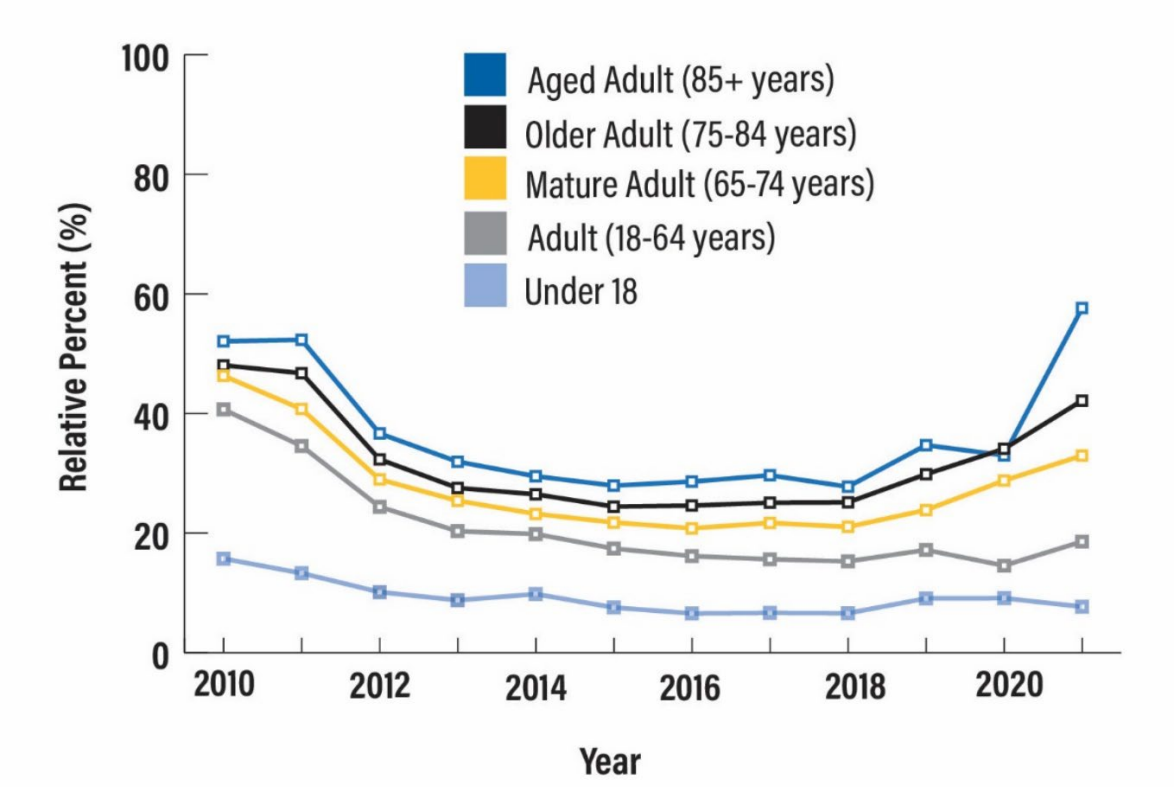
Annual Trends by Age

Figure 1 shows the relative percentage of falls compared to all other events by year for each age group. While the relative percentage of falls ranged from a modest 15-20% of patient safety events reported each year in the NPSD, there were some fluctuations from this overall pattern and notable differences between age groups (see Figure 1). From 2010-2018, the relative percentage of falls decreased, but then increased after 2018; this was seen both overall (see: Table A2) and across age groups. Across most years, the relative percentage of falls was highest among *Aged adults (85 years or older),* ranging from 27.8% (4,409 out of 14,772 events) in 2018 to 57.6% (960 out of 1,666 events) in 2021. Also, the increase in relative percentage of falls compared to other events was more apparent with increasing patient age. After 2018, the relative percentage of falls increased from:

- 6.6% to 7.7% (1.1% difference) among patients under 18 years of age;
- 15.3% to 18.6% (3.3% difference) among patients 18-64 years old;
- 21.0% to 33.0% (12.0% difference) among patients 65-74 years old;
- 25.1% to 42.2% (17.1% difference) among patients 75-84 years old;
- 27.8% to 57.6% (29.8% difference) among patients 85 and older

No major differences were noted across gender, nor across gender and age. More details on demographics can be found in Appendix A.

Figure 1 – Annual Trends in Relative Percentage of Reported Falls Compared to All Other Events by Age Groups[vi]



Examining Injury Resulting from Falls

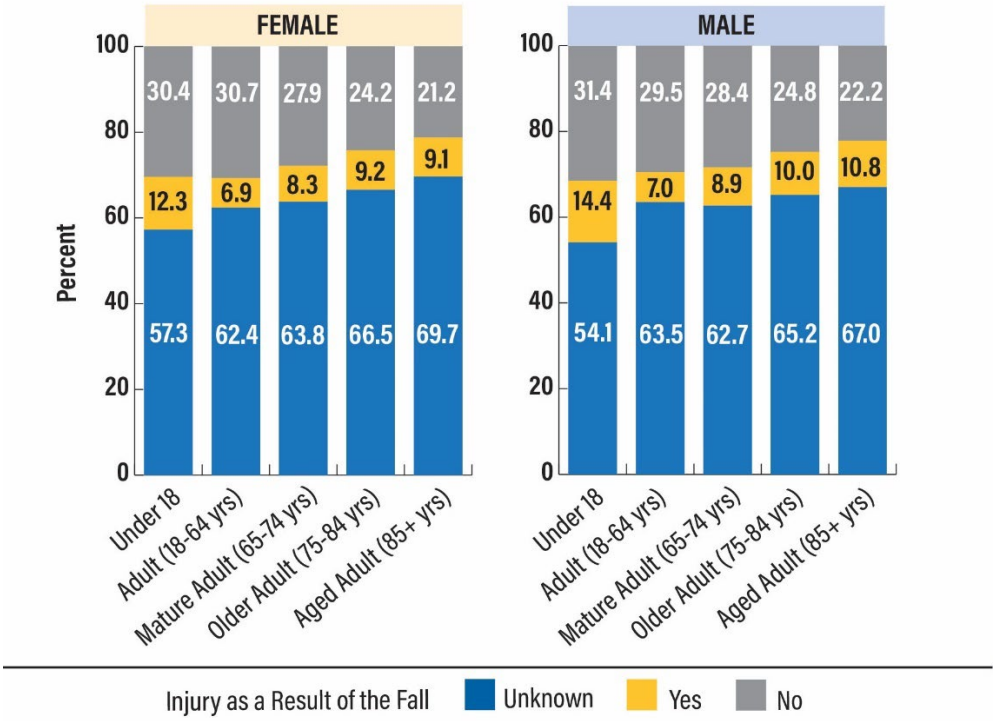
As observed in the 2022 NPSD Supplemental Fall Analyses, the majority of falls did not result in injury. Despite making up the smallest proportion of patients among all fall event records, patients under 18 had the highest rate of falls with injury.[6] Building on those observations, among female patients, 8.1% of falls resulted in injury (8,810 out of 109,097 falls). Rates of injury were similar for male patients (9,360 out of 108,809 falls; 8.6%).

Presence of Injury by Gender and Age

Figure 2 shows the presence of injury for female and male patients, respectively. Across all age groups, rates of injury were higher in male patients compared to female patients. Rates of injury were highest among patients under 18 with 12.3% of falls among female patients resulting in injury (427 of 3,475 falls) and 14.4% of falls among male patients resulting in injury (520/3,605).

[vi] For brevity and to mitigate potential risk of disclosure, records with report dates through 2010 have been aggregated.

Figure 2 - Presence of Injury by Age and Gender

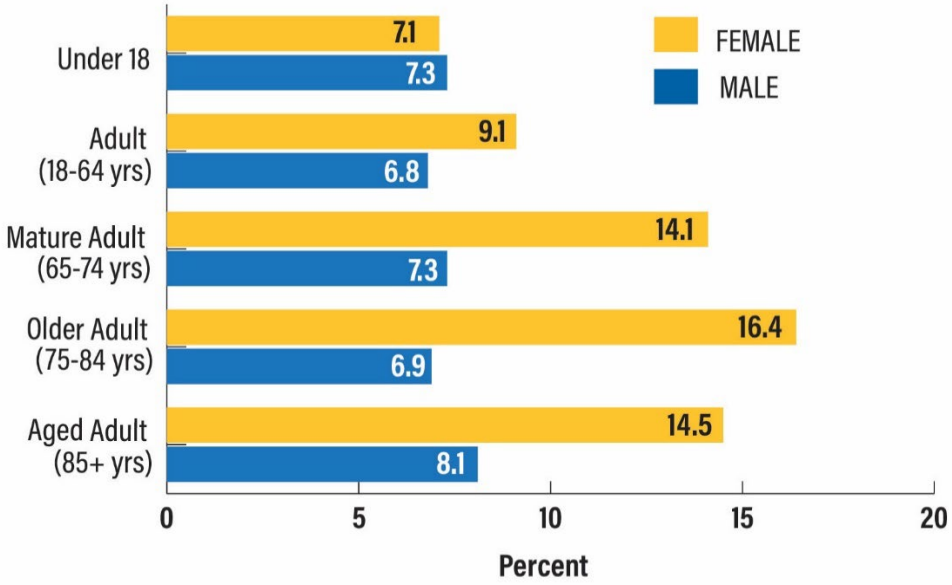


Fractures by Gender and Age

Figure 3 shows the distribution of fractures reported as a result of falls by age among female and male patients where differences were most striking. Among adult female patients (aged 18 years or older), rates of *Fractures* were consistently higher than observed in male patients of the same age. The difference is most apparent among adults aged 65 years and older (*Mature, Older, and Aged adults)* where the rates of fracture for female patients was nearly double that of male patients of the same age.

A complete examination of all injury types by age and gender can be found in Appendix A.

Figure 3 – Fractures as a Result of Falls by Age and Gender



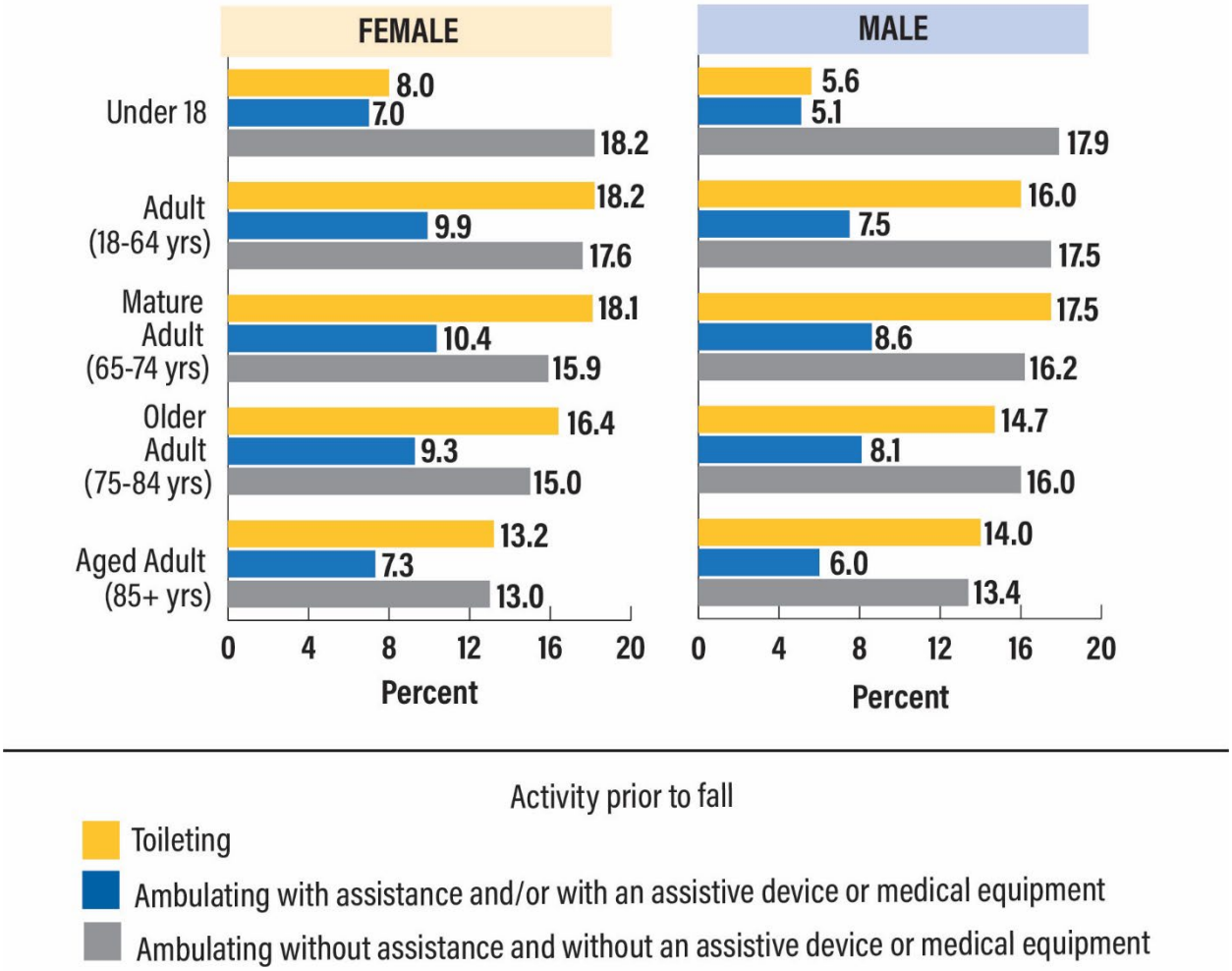
Circumstances Preceding the Fall

Activity Prior to Fall

Figure 4 shows *Commonly specified activities prior to fall* by age for female and male patients, respectively. Consistent with the previous 2022 NPSD Supplemental Fall Analyses, *Ambulating without assistive device, Toileting,* and *Ambulating with assistive device* were the most frequently specified activities across both genders and all ages. Across all age groups, *Ambulating with assistance* was reported more commonly among female patients than in their male counterparts. Across most age groups except *Aged adults (85 years and older)*, *Toileting* was the most commonly reported activity preceding the fall among female patients.

Further examination of all patient activities prior to fall by age and gender can be found in Appendix A.

Figure 4 – Commonly Specified Patient Activities Prior to Fall by Age and Gender

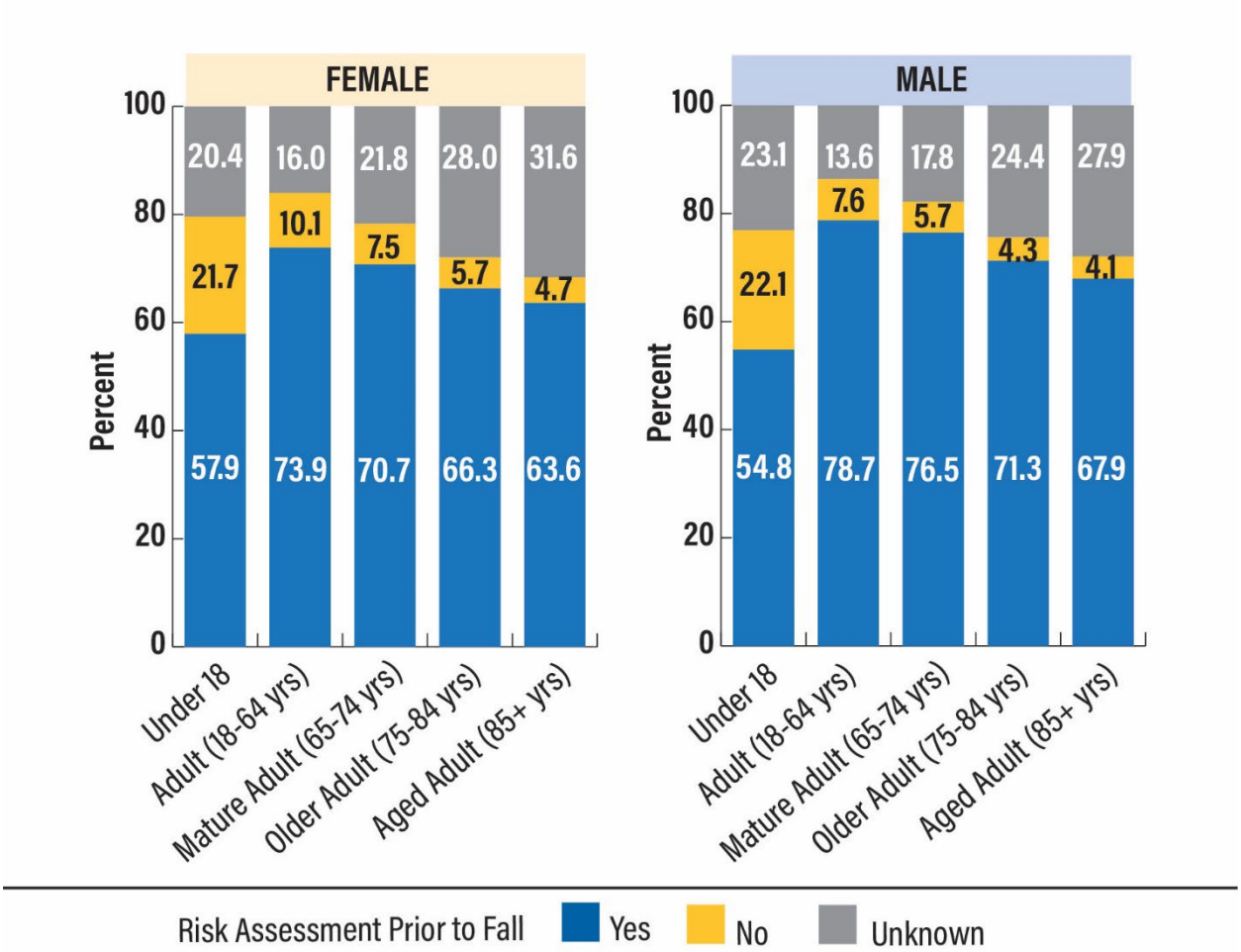


Risk Assessment Prior to Fall

Figure 5 shows whether a *Risk assessment was performed prior to fall* by age for female and male patients, respectively. Rates of risk assessment performance were similar for both genders across age groups, with rates being lowest for patients *Under 18 years old* (1,000 / 34,864; 57.9% for female patients and 1,051 / 36,337; 54.8% for male patients) compared to ~70% for all adults aged 18 or older. Notably, the rate of falls where documentation of a fall risk assessment was *Unknown* increased steadily across age groups for all adults starting from 16.0% and 13.6% for females and males aged 18-64, respectively, increasing to 21.8% (2,124 / 9,760) of female patients and 17.8% (1,858 / 10,421) male patients among *Mature adults aged 65-74 years.* This rate further increases to 28.0% (2,437 / 8,715) of female and 24.4% (2,224 / 9,110) of male

patients among *Older adults (75-84 years)* and reaches nearly 1 in 3 patients over 85 (2,027 / 6,405; 31.6% for female patients and 1,403 / 5,020; 27.9% for male patients).

Figure 5 – Risk Assessment Prior to Fall by Age and Gender



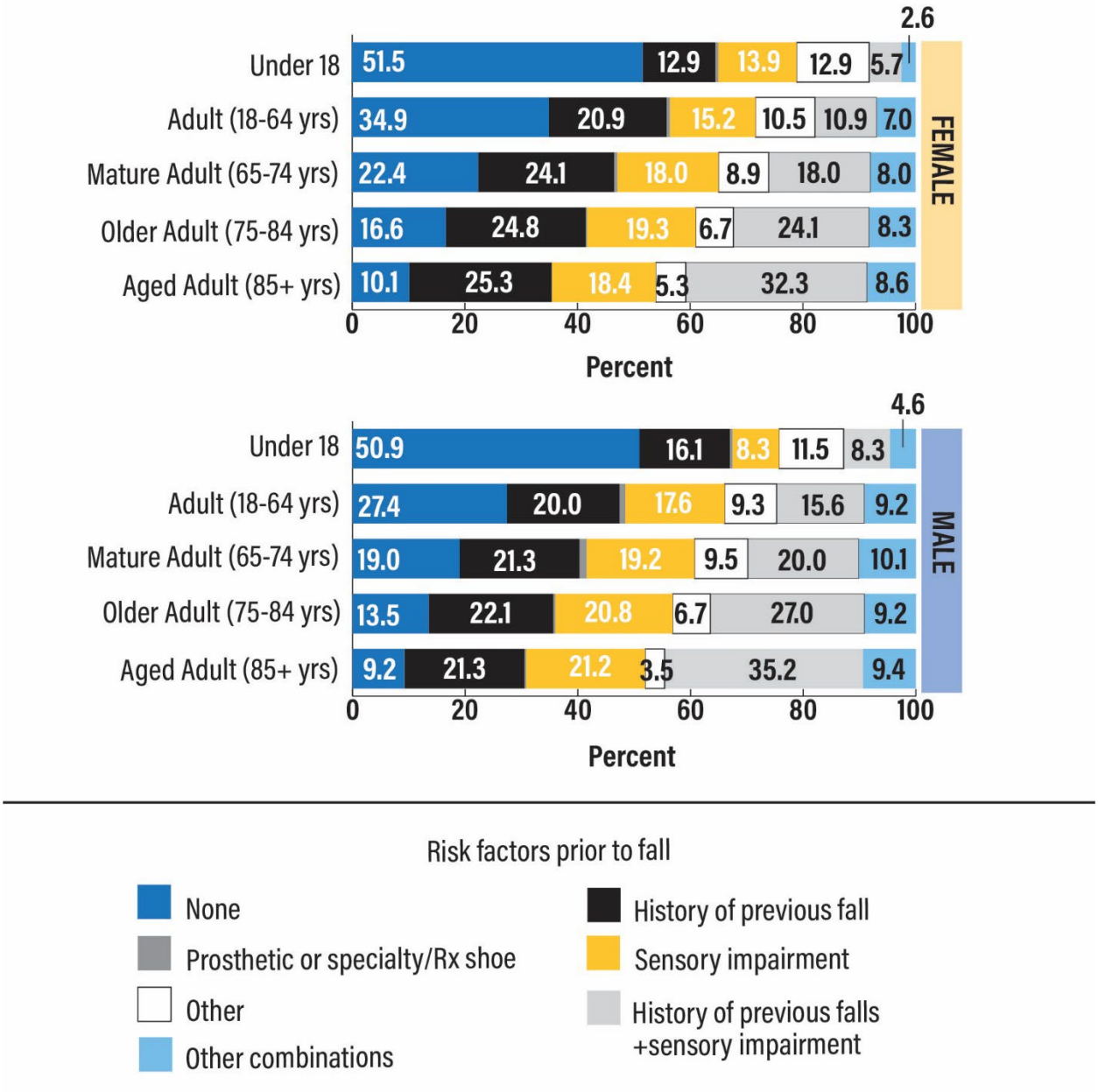
Risk Factor(s) Prior to Fall

Figure 6 shows the presence of *Risk factor(s) prior to fall* by age for female and male patients, respectively. Among adults of both genders, *History of previous fall* and *Sensory impairment* were the most independently reported risk factors. Notably, half of all falls among all patients under 18 occurred in patients with no known risk of falling. Across both genders and age groups, *History of previous fall* and *Sensory impairment* was by far the most reported combination of risk factors.

Other risk factors were associated with16.1% (3,493 / 21,712) of falls with valid information on patient risk factors. Of these combined 3,493 *Other risk factor* records, 690 (19.8%) had any

associated free text descriptions included. Adults aged 18-64 had the largest amount of text descriptions included (21.7 %; 354 / 1,632 records). Text was provided for 20.9% of Female patients (366 / 1,753 records) compared to 18.6% of Male patients (324 / 1,739 records). *Mobility issues, Change in mental status (including confusion), and Medications* were frequently cited among *Other risk factors,* accounting for 17.0% (117 / 690), 8.3% (57 / 690), and 6.4% (44 / 690) of records with free text associated. Combinations of these risk factors were indicated for 20.9% (144 / 690) of records.

Figure 6 – Risk Factors Prior to Fall by Age and Gender



CONCLUSIONS

The results contained in this report provide insight into the ability of the NPSD data to provide a broad-based examination of falls across multiple dimensions. While the relative percentage of falls ranges at a modest 15-20% of patient safety events reported each year in the NPSD, falls have accounted for over 30% of patient safety events reported among Older adults (75-84 years old) and Aged adults (85 years and older), which is consistent with other research.[5]

While male patients overall had higher rates of injury as a result of a fall, among all adult patients, female patient had fractures at consistently higher rates than observed in male patients --- particularly among adults aged 65 years and older where the rates of fracture for female patients was nearly double those of male patients of the same age. On the other hand, Skin tear, avulsion, hematoma, or significant bruising were more frequently reported in males as were Lacerations requiring sutures --- especially in patients under 18 years old. Interestingly, despite differences in injury outcomes, the rates of underlying risk factors and actions prior to falls (risk assessment, patient activity prior to fall) are quite similar across genders and age groups. While a comparison of patients who fall and those who do not fall is not feasible from event reporting data within the NPSD,[vii] studies comparing subgroups are possible. For instance, future studies could consider matching patients with and without injury on selected demographic variables to compare similarities and differences on the risk factors found to be significant.

In addition to the above findings, this Spotlight also highlights the capacity of the unstructured free text data to provide some useful context to data captured in structured data elements. The rate of available text to examine "Other: Please specify" fields ranged from 10% (injury type) to 33.1% (activity prior to fall). The large amount of data corresponding to pre-existing structured data fields within the CFER-H (e.g., 12.3% of "Other" patient activities that involved ambulating) points to some potential data submission and mapping issues upstream of the NPSD. However, observations of "changing mental status" and "confusion" among the free text responses in "Other: Please specify" fields point to potential patient risk factors not previously captured by the CFER-H that may be worth exploring.

[vii] Unlike surveillance systems, data about the population at risk for a given event are not collected as part of the voluntary event reporting to the NPSD (i.e., the total population at risk for a fall). Additionally, the CFER-H Fall module is limited to incidents. Therefore, a valid comparison of preceding factors among patients who do and do not experience a fall is not feasible. However, standardization of event reports under the Common Formats does allow for valid comparisons of subgroups of patients with or without an outcome who experienced the same event (e.g., patients who fell and experience a fracture vs. those who do not).

APPENDIX A. ADDITIONAL FINDINGS

NPSD Demographics

Table A1 displays the distribution for age and gender data in the NPSD for all reported events and falls, respectively. Among the 1,637,560 voluntarily reported events/concerns, about a third of records were missing information on patient age and/or gender.

The majority of records in the NPSD and fall records specifically are of Adults aged 18-64. Overall, demographic data were more complete among reported falls in the NPSD --- only 4.2% of fall records had *Unknown* age, compared to 30.4% for all events in the NPSD) and only 8.2% of fall records were missing gender, compared to 33.4% of all events in the NPSD.

Table A1 – Demographics Across All Reported Events in the NPSD

	All Events (1,637,560)		Falls[viii] (237,305)	
	Frequency	**Percent**	**Frequency**	**Percent**
Age Group				
Under 18	98,983	6.0	7,503	3.2
Adult (18-64 years)	613,414	37.5	105,713	44.6
Mature adult (65-74 years)	195,170	11.9	45,685	19.3
Older adult (75-84 years)	145,248	8.9	40,355	17.0
Aged adult (85+ years)	87,679	5.4	28,195	11.9
Unknown	497,066	30.4	9,854	4.2
Gender				
Female	551,774	33.7	109,097	46.0
Male	538,617	32.9	108,809	45.9
Unknown	547,169	33.4	19,399	8.2

Annual Trends in Falls

Of the 1,637,560 voluntarily reported events/concerns, 237,305 (14.5%) were falls. Table A2 shows the percentage of falls relative to other events by year. Through 2017, the relative percentage of falls compared to other event types decreased from 22.1% (6,786 out 30,763 events) to 13.2% (42,875 out of 325,381). Then from 2018 to 2021, this increased from 13.3% (38,398 out of 289,053 events) to 22.2% (4,580 to 20,638 events). There were no major differences observed by gender.

[viii] Age group distribution for reported falls can also be found in the 2022 NPSD Chartbook.

Table A2 – Relative Percentage (%) of Fall Events Compared to All Other Events by Year[ix]

	2010	2011	2012	2013	2014	2015	2016	2017
Total events	30,763	42,698	53,173	68,910	84,460	143,827	242,434	325,381
Falls (%)	22.1	22.2	17.3	15.1	15.7	14.8	13.6	13.2

	2018	2019	2020	2021	All years
Total events	289,053	236,929	99,294	20,638	1,637,560
Falls (%)	13.3	14.5	14.0	22.2	14.5

Type of Injury by Gender and Age

Figure A1 shows the distribution of injury types reported as a result of falls by age among female and male patients, respectively.[x] Among adult female patients (aged 18 years or older), rates of *Fractures* were consistently higher than their male counterparts. Conversely, *Skin tear, avulsion, hematoma, or significant bruising* were more frequently reported in males as were *Lacerations requiring sutures* --- especially in patients under 18 years old (10/182 injuries; 5.5% among females vs. 23 / 206 injuries; 11.2%). Dislocations (42 / 6,343 injuries; 0.66% among female patients and 30 / 6,536 injuries; 0.46% among male patients) and Intracranial injuries (141 / 6,343 injuries; 2.2% among female patients and 154 / 6,536 injuries; 2.4% among male patients) were less frequently reported.

Other injury made up 47.3% (3,002 / 6,343) of injuries among female patients and 45.1% (2,947 / 6,536) of injuries among male patients.[xi] Across all 6,091 *Other* injury records, only 627 (10.3%) had any associated free text descriptions included.[xii] Inclusion of any text description of Other injuries were observed more frequently for patients Under 18 (14.9%, 36 records) and Aged adults (13.8%, 109 records). There were slightly more records with text included for female patients (11.3%, 340 records) than male patients (9.6%, 282 records).Within this free text, the most common injuries were minor abrasions (163 / 627; 26.0%) and pain, redness, or soreness (107 / 627; 17.1%). Minor injuries from the pre-existing injury types in CFER-H v1.2 made up over 20% of *Other* injuries. Laceration, Fracture, Skin tear, and Bruising were also specified in the Other injury text making up 8.5% (53 / 627), 3.0% (19 / 627), 4.2% (26 / 627), and 10.1% (63 / 627), respectively, of Other injuries that were reported. Multiple injuries made up a small share of *Other* injuries reported (46 / 627; 7.3%).

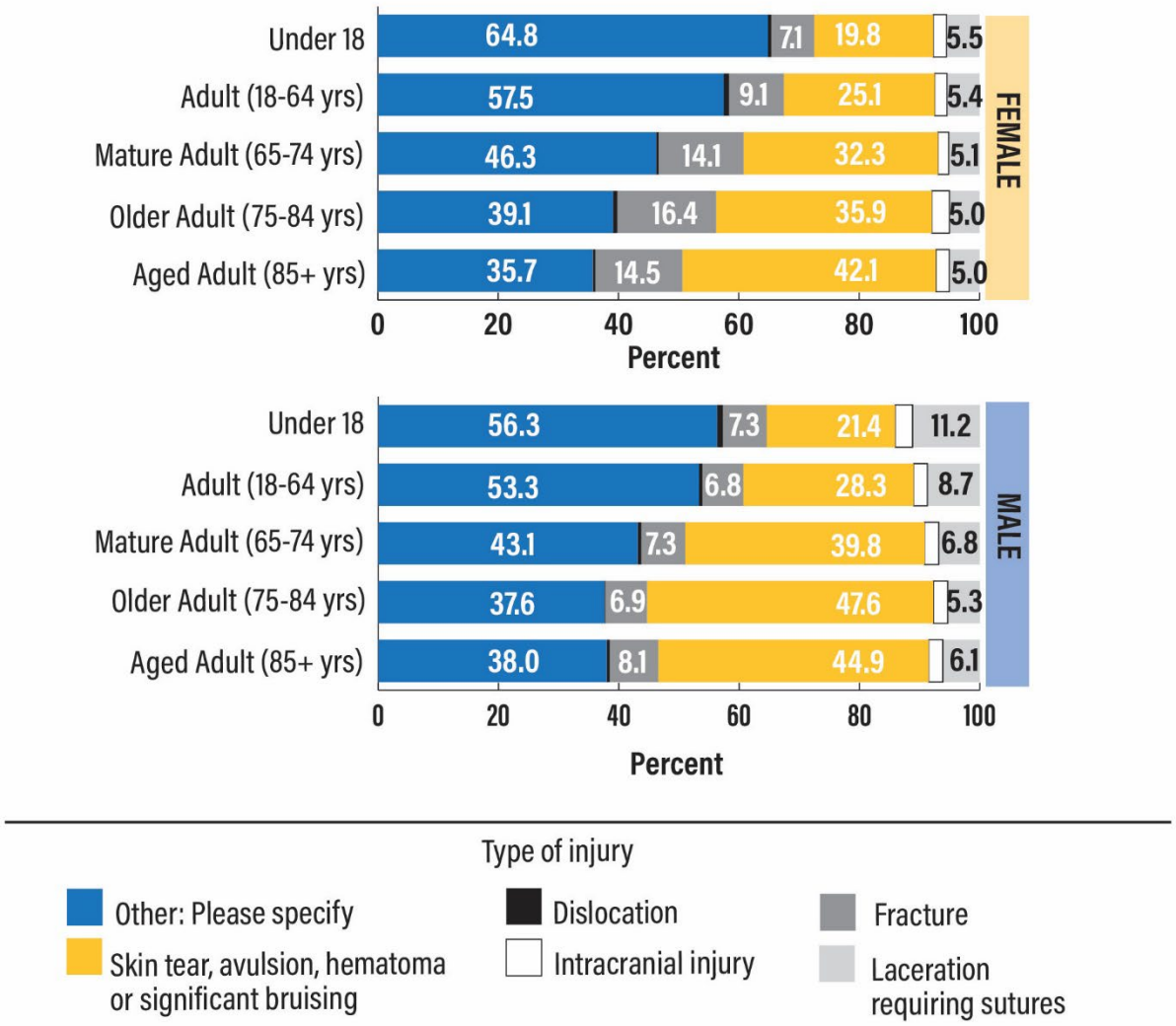
[ix] For brevity and to mitigate potential risk of disclosure, records with report dates through 2010 have been aggregated.

[x] Consistent with the 2022 NPSD Supplemental Fall Analyses, Skin tear, avulsion, hematoma, or significant bruising was the most commonly specified type of injury among both female and male patients across all ages.

[xi] Also consistent with the 2022 NPSD Supplemental Fall Analyses, Other injury was the most frequently reported injury overall.

[xii] This count includes records where patient gender was not indicated.

Figure A1 – Type of Injury as a Result of Falls by Age and Gender



Activity Prior to Fall

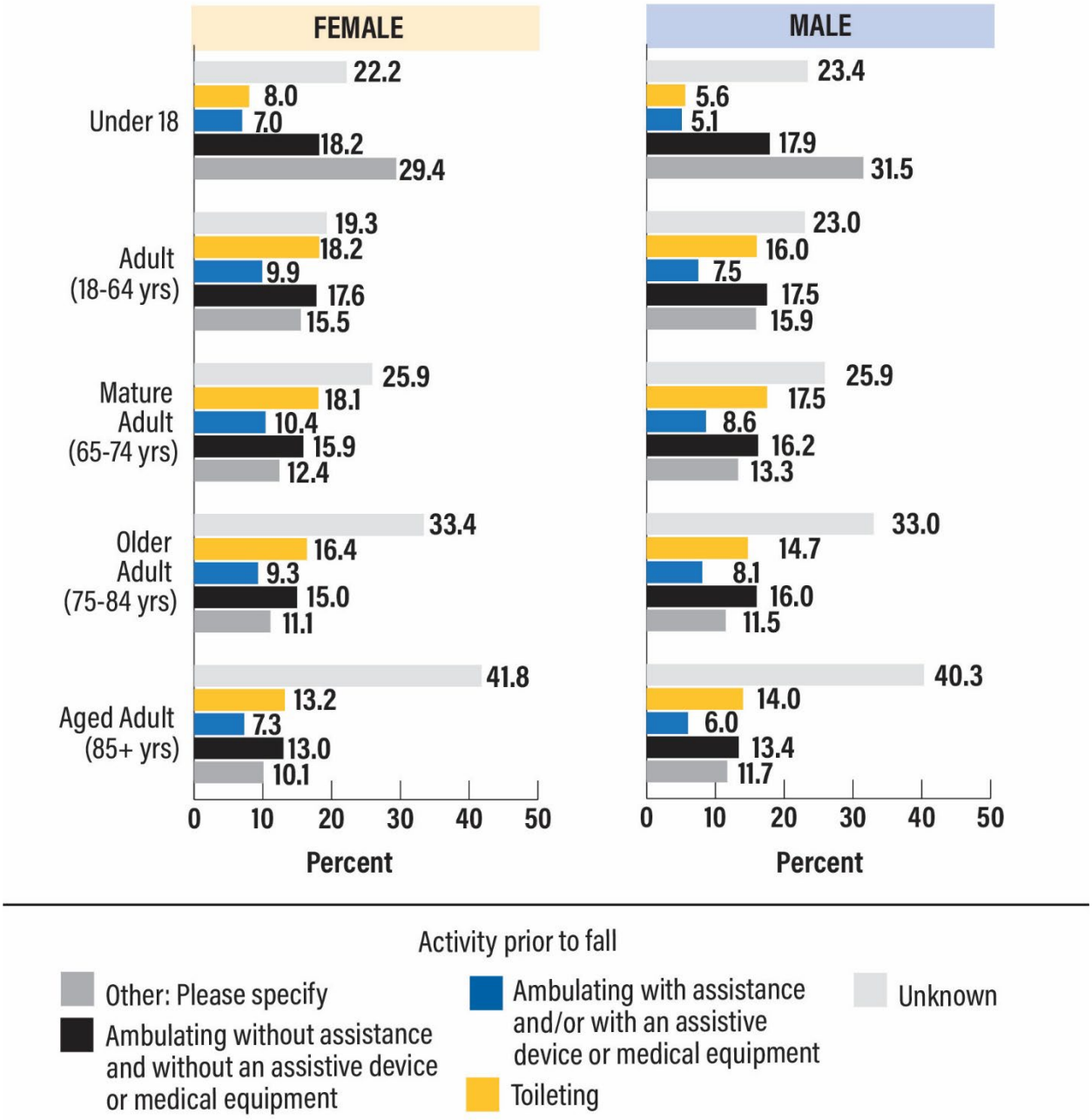
Figure A2 shows *Commonly reported activities prior to fall* by age for female and male patients, respectively. Consistent with the previous 2022 NPSD Supplemental Fall Analyses, *Ambulating without assistive device, Toileting,* and *Ambulating with assistive device* were the most frequently specified activities across both genders and all ages.

Reports where the activity prior to the fall were *Unknown* were the most frequent across both genders and all age groups --- particularly among *Aged adults (85 years and older)*. Activity prior to falls were unknown for 41.8% (2,428 / 5,814) of reported falls for female patients and 40.3% (1,919 / 4,760) of reported falls for male patients.

Other activity was the most frequently reported activity for both genders across all ages, especially among *Patients under 18 years old*. *Other* activity was associated with 29.4% (494 / 49,593) of falls with valid information on patient activity among female patients under 18 and with 31.5% (591 / 48,714) of falls with valid information on patient activity among male patients under 18 --- nearly double the rate observed among Adults (18-64 years) and triple the rate observed among Aged adults (85 years and older).

Of the 14,720 *Other* activity records across all age groups, 4,866 (33.1%) had any associated free text descriptions included. Text descriptions were more commonly provided for Older adults aged 75-84 (39.1 %; 790 / 2,022 records) and Adults aged 85 and over (43.0%, 495 / 1,151 records). Text was more commonly provided for Female patients (36.8%; 2,540 / 6,911 records) than Male patients (32.5%; 2,324 / 7,151 records). *Fainting or losing consciousness* (287 / 4,866; 5.9%) and *Falling out of a chair/bed while sitting/sleeping* (200 / 4,866; 4.1%) were commonly mentioned. As seen in the examination of the free text descriptions of injury above, the most commonly described Other activities overlapped with pre-existing activities in CFER-H v1.2: 40.3% (1,959 out of 4,866 records) indicated that the patient was “found on the floor”, but their prior activity was Unknown; 12.3% (600 out of 4,866 records) indicated that the patient was Ambulating or “walking”, “tripped”, or “slipped”; 4.5% (217 out of 4,866 records) indicated that the patient was either trying to Change position (“sit up”, “get up”) or Reach for an object “grab”, “reach for”, or “pick up”).

Figure A2 – Commonly Reported Activities Prior to Fall by Age and Gender



APPENDIX B. REFERENCES

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