

## Executive Summary - Final Submission - Jim King – JimKing100

### Key Findings

My analysis of the medical narratives on older adult falls provides the following key findings on the causes and precipitating events for falls:

Type of Falls – The type of falls can be broken down to slips (15%), trips (16%) and other falls (67%). For slips, baths/showers play a prominent role. For trips, walking/hiking is the top cause with rugs/carpets also playing a prominent role. For all other falls, nursing homes are the top cause factor.

Serious Falls – Fainting is the top cause for serious falls.

Falls by Sex – Males experience more falls due to fainting than females. Also, drugs and alcohol are involved in more male falls.

Falls by Age – The involvement of nursing homes in falls increases significantly once people reach their 80's. Interestingly, alcohol plays a prominent role in falls in the 60's but drops significantly once people reach their 70's.

Falls by Race – Fainting plays a more prominent role in non-white races while nursing homes play a more prominent role in whites.

Falls by Year – The causes of falls are fairly consistent over time with a bump in drug involvement in 2020 and 2021.

### Summary of Approach

I use a custom Named Entity Recognition (NER) model to identify cause and precipitating event keywords in the narrative section of the primary data. I use the spaCy package to build the custom model. The custom keywords are organized into four major categories:

- 1) Method of Fall – Fall, Trip, Slip
- 2) Care Facility – Whether a care facility was involved.
- 3) Medical Event – Whether a medical event was involved.
- 4) Activity – Whether a particular activity was involved.

There are several reasons for selecting this approach:

- 1) A review of the narrative data indicates that most of the narrative is detailed in the other features (e.g. the body part, disposition, fire involvement, alcohol involvement, drug involvement and products involved). So, very few words remain and often those remaining words refer to the cause or precipitating event. The key is to identify the “cause” keywords and the NER model is an excellent method.
- 2) A standard or generic NER provided by a package such as spaCy does not contain the specific medical terms and other terms typically used in the narrative. In addition, the medical terms used must be very specific, so a NER pre-trained on medical terms would be problematic. For example, many of the medical terms in the narrative refer to the result of the fall (e.g. a broken arm) when we are concerned with medical events that precede the fall (e.g. fainting). Thus, a custom model will provide the best results for this specific use case.
- 3) Once the NER model is trained and run on the narrative, it can provide several benefits. The results can be used to categorize and detail the causes and precipitating events. The model can also be used to highlight the cause factors in the text providing more real-time feedback to those entering and using the data. Ultimately, the insights provided by the model can help make decisions on how to prevent falls.

## Visualizations

### Falls by Type – All Falls, Slips, Trips, Other Falls, Serious Falls

The type of falls can be broken down to slips (15%), trips (16%) and other falls (67%). For slips, baths/showers play a prominent role. For trips, walking/hiking is the top cause with rugs/carpets also playing a prominent role. For all other falls, nursing homes are the top cause factor. Fainting is the top cause for serious falls.

	ALL CAUSES	A PCT	SLIP CAUSES	S PCT	TRIP CAUSES	T PCT	FALL CAUSES	F PCT	SERIOUS CAUSES	R PCT
0	Activity - Walking/Hiking	8	Activity - Walking/Hiking	8	Activity - Walking/Hiking	14	Facility - Nursing Home	9	Medical Event - Fainting	10
1	Activity - Getting Up/Out	7	Activity - Getting Up/Out	8	Activity - Getting Up/Out	4	Medical Event - Fainting	8	Activity - Getting Up/Out	9
2	Facility - Nursing Home	7	Facility - Nursing Home	5	Products - Stairs	4	Activity - Getting Up/Out	8	Activity - Walking/Hiking	7
3	Medical Event - Fainting	6	Alcohol/Drug - Drug	4	Alcohol/Drug - Drug	3	Activity - Walking/Hiking	7	Facility - Nursing Home	7
4	Medical Event - Lost Balance	5	Products - Baths/Showers	4	Products - Rugs/Carpets	3	Medical Event - Lost Balance	6	Alcohol/Drug - Drug	5
5	Alcohol/Drug - Drug	4	Products - Stairs	3	Activity - Carrying/Bending	2	Products - Beds	5	Medical Event - Lost Balance	4
6	Products - Stairs	4	Products - Beds	3	Facility - Nursing Home	2	Alcohol/Drug - Drug	3	Products - Beds	4
7	Products - Beds	4	Medical Event - Fainting	2	Products - Beds	1	Products - Stairs	3	Products - Stairs	3
8	Alcohol/Drug - Alcohol	2	Medical Event - Lost Balance	1	Alcohol/Drug - Alcohol	1	Alcohol/Drug - Alcohol	2	Products - Baths/Showers	2
9	Activity - Carrying/Bending	2	Alcohol/Drug - Alcohol	1	Products - Chairs	1	Activity - Carrying/Bending	2	Alcohol/Drug - Alcohol	2

### Falls by Sex – Male, Female

Males experience more falls due to fainting than females. Also, drugs and alcohol are involved in more male falls.

	MALE CAUSES	M PCT	FEMALE CAUSES	F PCT
0	Activity - Walking/Hiking	8	Activity - Walking/Hiking	9
1	Medical Event - Fainting	7	Activity - Getting Up/Out	7
2	Activity - Getting Up/Out	7	Facility - Nursing Home	7
3	Facility - Nursing Home	7	Medical Event - Lost Balance	5
4	Alcohol/Drug - Drug	5	Medical Event - Fainting	5
5	Products - Beds	4	Products - Beds	4
6	Medical Event - Lost Balance	4	Alcohol/Drug - Drug	3
7	Products - Stairs	4	Products - Stairs	3
8	Alcohol/Drug - Alcohol	3	Activity - Carrying/Bending	2
9	Activity - Carrying/Bending	2	Products - Baths/Showers	2

### Falls by Age – Age 60-69, Age 70-79, Age 80-89, Age 90+

The involvement of nursing homes in falls increases significantly once people reach their 80's. Interestingly, alcohol plays a prominent role in falls in the 60's but drops significantly once people reach their 70's.

	AGE 60-69 CAUSES	60s PCT	AGE 70-79 CAUSES	70s PCT	AGE 80-89 CAUSES	80s PCT	AGE 90+ CAUSES	90s PCT
0	Activity - Walking/Hiking	9	Activity - Walking/Hiking	9	Facility - Nursing Home	9	Facility - Nursing Home	17
1	Medical Event - Fainting	7	Activity - Getting Up/Out	7	Activity - Walking/Hiking	8	Activity - Getting Up/Out	9
2	Alcohol/Drug - Alcohol	5	Medical Event - Fainting	6	Activity - Getting Up/Out	8	Activity - Walking/Hiking	6
3	Activity - Getting Up/Out	5	Medical Event - Lost Balance	4	Medical Event - Fainting	6	Medical Event - Lost Balance	6
4	Products - Stairs	5	Facility - Nursing Home	4	Medical Event - Lost Balance	5	Products - Beds	6
5	Alcohol/Drug - Drug	3	Products - Stairs	4	Products - Beds	4	Alcohol/Drug - Drug	4
6	Medical Event - Lost Balance	3	Products - Beds	4	Alcohol/Drug - Drug	4	Medical Event - Fainting	3
7	Products - Beds	3	Alcohol/Drug - Drug	3	Products - Stairs	3	Products - Chairs	2
8	Activity - Carrying/Bending	2	Alcohol/Drug - Alcohol	2	Activity - Carrying/Bending	2	Products - Baths/Showers	2
9	Activity - Playing/Working	2	Activity - Carrying/Bending	2	Products - Chairs	2	Facility - Other Facility	2

### Falls by Race – White, Black, Hispanic, Asian

Fainting plays a more prominent role in non-white races while nursing homes play a more prominent role in whites.

	WHITE CAUSES	W PCT	BLACK CAUSES	B PCT	HISPANIC CAUSES	H PCT	ASIAN CAUSES	A PCT
0	Activity - Walking/Hiking	8	Activity - Walking/Hiking	8	Activity - Walking/Hiking	9	Activity - Walking/Hiking	8
1	Activity - Getting Up/Out	7	Medical Event - Fainting	8	Activity - Getting Up/Out	7	Medical Event - Fainting	6
2	Facility - Nursing Home	6	Activity - Getting Up/Out	7	Medical Event - Fainting	6	Activity - Getting Up/Out	5
3	Medical Event - Lost Balance	5	Products - Beds	6	Medical Event - Lost Balance	5	Products - Stairs	5
4	Medical Event - Fainting	5	Facility - Nursing Home	5	Alcohol/Drug - Drug	4	Products - Beds	4
5	Alcohol/Drug - Drug	4	Products - Stairs	5	Products - Stairs	4	Products - Baths/Showers	3
6	Products - Stairs	4	Medical Event - Lost Balance	3	Products - Beds	4	Alcohol/Drug - Drug	3
7	Products - Beds	4	Alcohol/Drug - Alcohol	3	Facility - Nursing Home	3	Medical Event - Lost Balance	3
8	Alcohol/Drug - Alcohol	2	Products - Baths/Showers	3	Products - Baths/Showers	3	Facility - Nursing Home	3
9	Activity - Carrying/Bending	2	Alcohol/Drug - Drug	2	Alcohol/Drug - Alcohol	2	Products - Chairs	2

### Falls by Year – 2019, 2020, 2021, 2022

The causes of falls are fairly consistent over time with a bump in drug involvement in 2020 and 2021.

	2019 CAUSES	2019 PCT	2020 CAUSES	2020 PCT	2021 CAUSES	2021 PCT	2022 CAUSES	2022 PCT
0	Activity - Walking/Hiking	8	Activity - Walking/Hiking	8	Activity - Walking/Hiking	8	Activity - Walking/Hiking	8
1	Activity - Getting Up/Out	7	Activity - Getting Up/Out	7	Activity - Getting Up/Out	8	Activity - Getting Up/Out	7
2	Facility - Nursing Home	7	Facility - Nursing Home	7	Facility - Nursing Home	8	Facility - Nursing Home	7
3	Medical Event - Fainting	5	Medical Event - Fainting	6	Medical Event - Fainting	6	Medical Event - Fainting	6
4	Medical Event - Lost Balance	4	Alcohol/Drug - Drug	4	Medical Event - Lost Balance	5	Medical Event - Lost Balance	5
5	Products - Stairs	4	Medical Event - Lost Balance	4	Alcohol/Drug - Drug	4	Products - Stairs	4
6	Products - Beds	4	Products - Beds	4	Products - Beds	4	Products - Beds	4
7	Alcohol/Drug - Drug	3	Products - Stairs	3	Products - Stairs	3	Alcohol/Drug - Drug	3
8	Activity - Carrying/Bending	2	Activity - Carrying/Bending	2	Alcohol/Drug - Alcohol	2	Alcohol/Drug - Alcohol	2
9	Products - Baths/Showers	2	Products - Baths/Showers	2	Activity - Carrying/Bending	2	Activity - Carrying/Bending	2