

Exploring Infant Fall Events Using Online Parenting Discussion Forums

Nipuna Cooray (✉ ncooray@georgeinstitute.org.au)

The George Institute for Global Health <https://orcid.org/0000-0003-1816-1454>

Si Sun

University of New South Wales Faculty of Medicine

Susan Adams

Sydney Children's Hospital Randwick

Lisa Keay

University of New South Wales Faculty of Science

Natasha Nassar

The University of Sydney

Julie Brown

The George Institute for Global Health

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Abstract

Background: Falls are the most common mechanism of hospitalised injury in children under 12 months and commonly result in traumatic brain injuries. Epidemiological studies exploring infant falls demonstrate the burden but lack the contextual information vital to the development of preventive interventions. The objective of this study was to examine contextual information for falls involving children under 12 months.

Methods: Online parenting forums provide an unobtrusive rich data source for collecting detailed information about fall events. Relevant discussions related to fall incidents were identified and downloaded using site-specific google search queries and a programming script. A qualitative descriptive approach was used to analyse the incidents and categorise contextual information into 'pre-cursor events' and 'influencing factors' for infant falls.

Results: 461 infant fall incidents were identified. Common fall mechanisms included: falls from furniture; falls when being carried or supported by someone; falls from baby products and falls on the same level. Across the spectrum of fall mechanisms, common precursor events were: infant rolling off; being alone on furniture; product misuse; caretaker falling asleep while holding the infant; and caretaker tripping/slipping while carrying the infant. Common influencing factors included: infant's rapid motor development; lapses in caretaker attention; and trip hazards.

Conclusions: The findings define targets for intervention to prevent infant falls and suggest the most viable intervention approach may be to target parental behaviour change. Online forums have provided rich information critical for preventive interventions aimed at changing behaviour.

Introduction

Injury is a widespread and longstanding public health problem (1). Globally, injury is a leading cause of child death and hospitalization.(2) In Australia, children ≤ 1 year have the highest death rates due to injury among all children and an injury hospitalisation rate of 799/100,000.(3) Falls are the most common injury mechanism for this age group accounting for almost 50% of all injury hospitalisations.(3) The head is the most commonly injured body region(4) and often leads to Traumatic Brain Injuries (TBI). (5) Similar incidence and injury patterns occur in North America and Europe.(6–8) TBI in early childhood is associated with negative behavioural and cognitive outcomes.(9) While a number of interventions are effective in minimising fall risk in older children (10, 11) there is a paucity of evidence for effective countermeasures for falls in children ≤ 1 year.

Epidemiologic studies examining infant falls usually rely on administrative data or medical records.(4, 12, 13) These provide detail on burden and demographic risk factors but generally have limited or incomplete contextual information. This is a barrier for effective intervention development.(14)

The best source of detailed contextual information about infant falls is from someone who witnessed the fall. However, one-on-one discussion and large sample sizes can be time and resource intensive. In other areas, the Internet and social media have been successfully used to collect data from people participating in online forum discussions.(15) These also provide naturalistic data as discussions occur without researcher involvement.(16)

We aim to use online parenting discussion forums to unobtrusively and cost-effectively access contextual information about infant falls to identify specific modifiable factors to prevent infant falls.

Method

This was an infodemiological study(17, 18) using online forum data following a qualitative descriptive approach(19) with the objective of providing comprehensive summaries of infant fall events. (20) The data source was social media forums within an online parenting website. This website was established in 1999 and is owned and operated by a large Australian media company. The website provides parenting information in the form of media articles and forums across a broad range of non-injury/prevention related child care topics. After obtaining approval from the website owner, and ethics approval from the Human Research Ethics Committee (HC180295), site specific google search queries were chosen to identify URLs potentially containing discussions related to infant falls. These were ; 'baby fall', 'baby falling', 'baby fell', 'baby dropped' and 'baby hurt'. This approach allowed us to search all forums on this website without placing too much burden on the website. A researcher manually screened the resulting URL list and compiled a list of possible URLs containing infant fall discussions. The discussions from the selected list of web pages were downloaded using a program script written in Python, and any potentially identifiable data were removed. The search was completed on 22nd of June, 2019 and included discussion threads ranging from 22nd November,2003 to 05th June 2016.

De-identified data were coded using QSR Nvivo12 software to identify relevant incidents. Relevant incidents were those relating to falls or near falls involving children ≤ 1 year, with age identified from wording in the post; specifically mentioned age as ≤ 1 year, or posting was from a forum specific to children aged 0–6 months or 6–12 months, or fall incident was mentioned in response to other incidents describing infant falls where age 0–12 months was mentioned, or words “newborn, tiny baby”.

Analysis

Fall mechanisms were categorised, described and mapped to ICD-10-AM codes (Table 1). Two researchers (NC and SS) independently coded the data using fall mechanism categories (Table 1) and any differences were discussed until agreement was reached.

Table 1
Fall mechanism categories derived from ICD-10-AM codes

Fall mechanism category	Detailed fall mechanism	ICD-10-AM codes	ICD-10-AM code description
Fall from household furniture	Fall from bed	W06	Fall from bed
	Fall from chair/couch/sofa	W07	Fall from chair
	Fall from change table	W08	Fall from other furniture
	Fall from table	W08	Fall from other furniture
Fall from baby products	Fall from baby capsules	W08	Fall from other furniture
	Fall from bassinet/cot	W08	Fall from other furniture
	Fall from bouncer	W08	Fall from other furniture
	Fall from child car restraints	W08	Fall from other furniture
	Fall from high chair/baby chair	W08	Fall from other furniture
	Fall from portable baby bed	W08	Fall from other furniture
	Fall from pram/stroller	W08	Fall from other furniture
Fall while being carried or supported by someone	Fall while being carried or supported by mother	W04	Fall while being carried or supported by other persons
	Fall when carried or supported by an unidentifiable parent	W04	Fall while being carried or supported by other persons
	Fall when carried or supported by an adult caretaker (other than parents)	W04	Fall while being carried or supported by other persons
	Fall when carried or supported by an older child	W04	Fall while being carried or supported by other persons
Fall on the same level	Fall while infant standing	W01	Fall on same level from slipping, tripping and stumbling
	Fall while infant sitting	W18	Other fall on the same level
	Fall while infant crawling	W18	Other fall on the same level
	Other fall on the same level due to collision	W03	Other fall on same level due to collision with, or pushing by, another person
Fall related to stairs	Fall on and from stairs and steps	W10	Fall on and from stairs and steps

Fall mechanism category	Detailed fall mechanism	ICD-10-AM codes	ICD-10-AM code description
Fall between levels	Fall from, out of or through building or structure	W13	Fall from, out of or through building or structure
	Fall from cliff	W15	Fall from cliff
	Other fall from one level to another	W17	Other fall from one level to another
Other fall mechanisms	Fall from mats or playmats	W08	Fall from other furniture
	Fall involving play equipment	W09	Fall involving playground equipment
	Fall from shopping cart	W08	Fall from other furniture

Coding of contextual information followed an inductive open coding approach. Emerging codes were then classified as ‘precursor events’ or ‘influencing factors’.

In recognition that fall circumstances are often multilayered we separated likely causative factors leading to the fall into a ‘precursor event’ and other ‘influencing factor’. A ‘precursor event’ was defined as the event/state immediately before the fall according to the literal meaning in the discussion. An ‘influencing factor’ was defined as a factor that impacted the ‘precursor event’ and therefore the occurrence of the fall.

One researcher (NC) compiled a list of factors categorised as a ‘precursor event’ or ‘influencing factor’ and a second (SS) independently re-coded the data using this list, adding new factors as necessary. The two researchers (NC and SS) compared analyses and differences were discussed until agreement was reached. To address potential coder biases and pre-conceptions, coding for each fall mechanism by each researcher was undertaken separately and consensus was reached before moving onto coding for the next mechanism.

NC (a PhD student) and SS (an undergraduate medical student) were supervised by senior co-authors experienced in injury and qualitative research methods.

Results

Figure 1 summarises the data capture process. Overall, 461 infant fall incidents were identified. The most common fall mechanisms were a fall from household furniture (270, 58.6%), followed by falls when being carried or supported by someone (92, 20%) and falls from baby products (55, 11.9%). Other mechanisms were a fall on the same level (28, 6.1%), fall on/from stairs (6, 1.3%), falls from playmats (4, 0.9%), playground equipment (3, 0.7%) and shopping carts (3, 0.7%).

Falls from household furniture

Detailed mechanisms for these falls included; falls from beds (146, 54.1%), falls from change tables (64, 23.7%), falls from chairs/couches/sofas (53, 19.6%) and falls from tables (6, 2.2%).

The most commonly mentioned precursor event for falls from household furniture, was the infant rolling off the furniture. This was mentioned 71 times within the 270 (26.3%) incidents related to furniture falls.

"Yesterday, my little girl (6 months) rolled off the bed. She hit her head ... and screamed..."

The next most common precursor event involved the infant being left alone on furniture. This was mentioned in 36 of the 270 (13.3%) incidents.

"I left her in the middle of my queen bed while I did some vacuuming. As I got closer to my bedroom ... I could hear her screaming like she had never screamed before. I ran into the room and she was on the floor!..."

The caretaker falling asleep with the baby was another common precursor event, identified 18 times (6.7%).

"... I was breastfeeding him in bed and fell asleep with him on the outside. I woke up when I heard a thud and DS cry."

It was clear from some discussions that the precursor event of falling asleep was often unintentional (10, 55.6%), while in others (6, 33.3%) it was intentional or intention was unclear (2, 11.1%).

For falls from change tables, a common precursor event was the caretaker reaching for something while nappy changing, identified 11 times within the 64 change table related incidents (17.2%).

"I was changing him on the change table and all I did was slip one hand down to put the dirty nappy in the nappy bag and ds launched himself off the table and landed on the floor..."

Unexpected or rapid changes in motor development was the most common influencing factor for furniture falls. This was identified 29 (10.7%) times.

"...when he had started to move - I underestimated how quick he was. I used to put him on our bed every morning while I got dressed. One day I turned my back for a second and in that time he pulled himself to the edge then did a somersault off the bed!"

Lapses in caretaker attention was the next most common influencing factor for this fall mechanism. This was identified 20 times (7.4%).

"... honestly it can happen in the blink of an eye. Similar to your DH I looked away from the table, and over he went. It was so quick"

Falls when carried or supported by someone

This was the second most common fall mechanism in the discussions (n=92). These commonly occurred when the child was carried or supported by the mother (39, 42.4%), or an unidentified parent (28, 30.4%); when the child was carried or supported by an adult caretaker other than a parent (19, 20.7%); and less commonly, when carried or supported by an older child (6, 6.5%).

The most common precursor for these falls was the caretaker tripping/slipping (29 of 92 incidents, 31.5%) and this often occurred on steps or stairs (18/29 incidents, 62.1%). Other environmental hazards within the home included slippery floors (2/29, 6.9%) and tripping hazards on the floor (2/29, 6.9%).

"I dropped my ds he was about 10 months triped up the back step he screamed has a giant bump ... "

Another common precursor event for these falls was the person falling asleep while holding the infant (mentioned 15 times/ 92 incidents, 16.3%) and often involved the child's mother falling asleep while feeding (12/15 incidents, 80.0%).

"...I was totally sleep deprived. Sat down on the couch to nurse her, dozed off with her snuggled low in my arms (basically in my lap) our dog barked and I startled awake - DD rolled down my legs and into the coffee table."

A tired caretaker is also a likely influencing factor; however, this was only overtly discussed a few times (2/15). Other commonly discussed influencing factors were inadequate holding of the child (13 times/92 incidents, 14.1%) and sudden unexpected movements of the child (9/92 incidents, 9.8%).

"A friend was holding my 6 month old he had his arm tucked behind his legs holding him up right and wasn't supporting his back when my LO flung back ..."

Fall from baby products

The most common products involved in falls were strollers/prams (21, 38.2%); bouncers (10, 18.2%); high-chairs/baby chairs (9, 16.4%); and bassinets/cots (9, 16.4%). Less commonly involved were baby carriers/capsules (3, 5.5%); child car restraints (2, 3.6%); and portable baby beds (1, 1.8%).

Improper use was the most common precursor event for these falls. Non-use or misuse of safety straps was common for many baby products (particularly for strollers/prams, baby bouncers, high chair/baby chair, child car restraints, baby capsules/carriers). This was identified 30 times (55%, 15 not using safety strap and 15 cases of apparent improper use of straps)

"Mother of the Year here took a few months to really internalise the 'strap them in' message and DD1 bounced herself face first out of the bouncer at about three months old"

Some other critical misuses identified were: cot base in high position (5, 9.1%), unbalancing the stroller (3, 5.5%), not using strollers' brakes (2, 3.6%) and carrying the infant while in bouncer/portable baby bed (2, 3.6%). Falls from cots were influenced by rapid motor development.

"...like he was balancing on the cot railing with his feet off the mattress suspended in mid air by piece of wood- ... "

Falls on the same level

Four different types of falls on the same level were mentioned. Most common was a fall while the infant was standing (20, 71.4%). Falls while the infant was sitting, falls while the infant was crawling and other falls due to being pushed by another person each had <five identified incidents.

The common influencing factor for this fall mechanism was the child's under-developed motor skills (13, 46.4%).

"...Now that both are easily pulling themselves up against furniture to stand, they are doing it every chance they get. The only problem is once they get up they don't know how to get down or lose concentration, let go and fall...a lot of the time hitting their heads on the tiles."

Fall on or from stairs

Falls on or from stairs were relatively uncommon (5 incidents). Two influencing factors for these were lapses in caretaker attention (3, 60%) and unexpected/rapid infant motor development (2, 40%).

"DS1 fell down the stairs - all 8 of them - when he was 4 months. He was lying at one end of the room, well away from the stairs. I put a book on the shelf and when I turned back he'd rolled across the room and I was just in time to see him disappear, screaming, down the stair well"

Other fall mechanisms

Other mechanisms identified from the discussions included falls from playground equipment or playmats and falls from shopping carts (10 incidents). Precursor events relating to falls from shopping carts was non-use of straps (3, 30%).

"...didn't bother to buckle him in. I was squatting down looking at something when I heard a horrible splat sound, he had fallen face first onto the cement floor ..."

There were no detailed discussions to identify causal factors for falls from playground equipment and playmats. Also, there were no discussions of falls between levels e.g. from windows

Table 2 summarises pre cursor events and influencing factors for different fall mechanisms.

Table 2
Pre cursor events and influencing factors for fall mechanisms

Fall mechanism	Precursor events	Influencing factors
Fall from furniture	<ul style="list-style-type: none"> • Infant rolling off • Infant being left alone on furniture • Caretaker falling asleep with the infant • Reaching for something while nappy changing 	<ul style="list-style-type: none"> • Unexpected or rapid changes in infant motor development • Lapse in caretaker attention
Fall when carried or supported by someone	<ul style="list-style-type: none"> • Caretaker tripping or slipping • Caretaker falling asleep while holding the infant 	<ul style="list-style-type: none"> • Inadequate holding of the child • Sudden unexpected movement of the infant
Fall from baby products	<ul style="list-style-type: none"> • Non-use or misuse of safety straps • Other product misuses 	
Fall on the same level		<ul style="list-style-type: none"> • Infant's under developed motor skills
Fall on or from stairs		<ul style="list-style-type: none"> • Lapse in caretaker attention • Unexpected or rapid changes in infant motor development

Discussion

Using a novel qualitative infodemiological approach, we identified contexts requiring intervention to prevent the majority of falls in children ≤ 1 year. These are leaving children alone on furniture; misuse of change tables and baby products such as strollers, baby carriers and baby chairs; slips and trips and falling asleep while holding an infant. Furthermore, the richness of our dataset allowed us to link specific influencing factors to specific precursor events for these fall types to identify modifiable factors to prevent the fall. These include awareness of unexpected or rapid changes in infant motor development; lapses in caretaker attention; importance of adequately holding the infant; and reducing hazards in the home environment.

Our findings align well with previously reported studies using administrative datasets and medical record reviews.(4, 7, 21, 22) While some factors we have identified have been noted previously,(8, 23–25) this is the first to provide this level of detail and identify targets for intervention across the spectrum of fall mechanisms among infants of this age.

Contextual information like that identified in this work also provides evidence for and adds to studies that have previously suggested using age appropriate injury prevention education for caregivers and home safety assessment programs.(7, 23) However currently there is no evidence for any effective interventions specifically targeting falls in this age group.(26) Given the magnitude and potential impact of this problem(5, 8) there is an urgent need to fill this gap and identify effective targeted interventions. The outcomes of this current work identify modifiable factors to be targeted in these interventions.

While our findings demonstrate that no single intervention would prevent all falls, there is a common need for parent/caretaker behavioural change across many of the fall mechanisms. It therefore appears that a behaviour change or active approach rather than purely structural change (passive approach)(27) may be effective to prevent infant falls. For example, having the safety harness in a change table is structural whereas the parent using it appropriately is behavioural. But behaviour change is complex and educational interventions alone usually do not enact behaviours.(28) Behaviour change interventions are more likely to be successful when based on behaviour theory.(29) One challenge to developing effective behaviour change interventions is that they require detailed understanding of the problem and target behaviours.(30) This study fills this gap.

In this study we did not attempt to examine data by age of infant but it is clear from our earlier work(4) that risk of fall by different mechanisms changes as children move through development stages in the first year of life. Different behaviour change intervention is likely needed at different times through this year and this needs to align with the infant's developmental stage.(6) For example it is possible the risk of a mother falling asleep while feeding is higher in early infancy and the risk of rolling off the bed is higher when the infant is gaining motor skills. Intervening at a single time point may also not be as effective as a targeted strategy to deliver behavioural change interventions at different time points over time.

Falls among infants on the same level were discussed relatively less commonly by parents in the forums than other falls, yet it is likely that these occur very commonly. As noted by Adolph and Berger (31) falling is a common by-product of children learning to walk with children at this stage of development falling within the vicinity of 17 times an hour and 100 times a day. As we previously observed (4) these types of falls very rarely occur among infants hospitalised from a fall (< 2% of all patients) and therefore this lack of severity might underpin the lack of discussion in the forums. As these falls occur while children are developing an important motor skill, it would not be appropriate to try to prevent the activities leading to these. Instead, injury risk might best be reduced by attention to the environment in which children are placed during this stage of development.

Another aspect warranting further environmental examination is the adequacy of both design and instructions of common baby products used by parents of infants. Improper use was the most common pre-cursor event for falls involving child products. In other areas, e.g. child car seats, it is becoming increasingly clear that correct use requires attention to how usage information is communicated, and the inherent design of the product in addition to the general behaviour of the user.(32) Extension of this approach to all baby products may be useful.

Limitations

As this is a qualitative study based on ad hoc reporting of fall types, the frequency of different fall types reported might not reflect true frequencies. However common fall mechanisms aligned with other epidemiological and medical record reviews.(4, 7, 22) Data used were from a convenience sample of online forum discussion participants and sample characteristics are unknown. Therefore, this may introduce some unknown bias and findings may not be generalizable to the whole population. Another limitation was use of a single search engine and different search engines may provide different results sets. Also, this kind of study collects data from a static point in time and precludes active engagement with caregivers and ability to clarify or to get additional details from parents compared to other qualitative approaches. However, the unobtrusive nature of this data collection method may be a strength as it provides data extracted from naturalistic parental discussion.

Conclusion

This study used infant fall incidents from online parenting forums to identify precursor events and influencing factors leading to different fall types among infants ≤ 1 year. This information is paramount to development of preventive interventions, particularly given the findings suggest interventions need to target parental behaviour.

Declarations

Ethics approval and consent to participate

Ethics approval from the Human Research Ethics Committee (HC180295), consent to participate was not applicable since the data was from a public online forum.

Consent for publication

Each of the authors confirms that this manuscript has not been previously published and is not currently under consideration by any other journal. Additionally, all of the authors have approved the contents of this paper and have agreed to the BMC Public Health Journal policies.

Availability of data and materials

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy and ethical restrictions.

Competing interests

The named authors have no conflict of interest, financial or otherwise.

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Authors' contributions

Nipuna Cooray conceptualized and designed the study, did the site-specific searches, developed the web scripting script, downloaded and cleaned the data, carried out the analysis, drafted the initial manuscript, reviewed and revised the manuscript.

Si Sun analysed the data, drafted the initial manuscript, reviewed and revised the manuscript.

Susan Adams, Lisa Keay and Natasha Nassar conceptualized and designed the study, coordinated and supervised data collection, and critically reviewed the manuscript for important intellectual content. Julie Brown conceptualized and designed the study, coordinated and supervised data collection and data analysis, drafted the initial manuscript, reviewed and revised the manuscript and critically reviewed the manuscript for important intellectual content. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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Figures

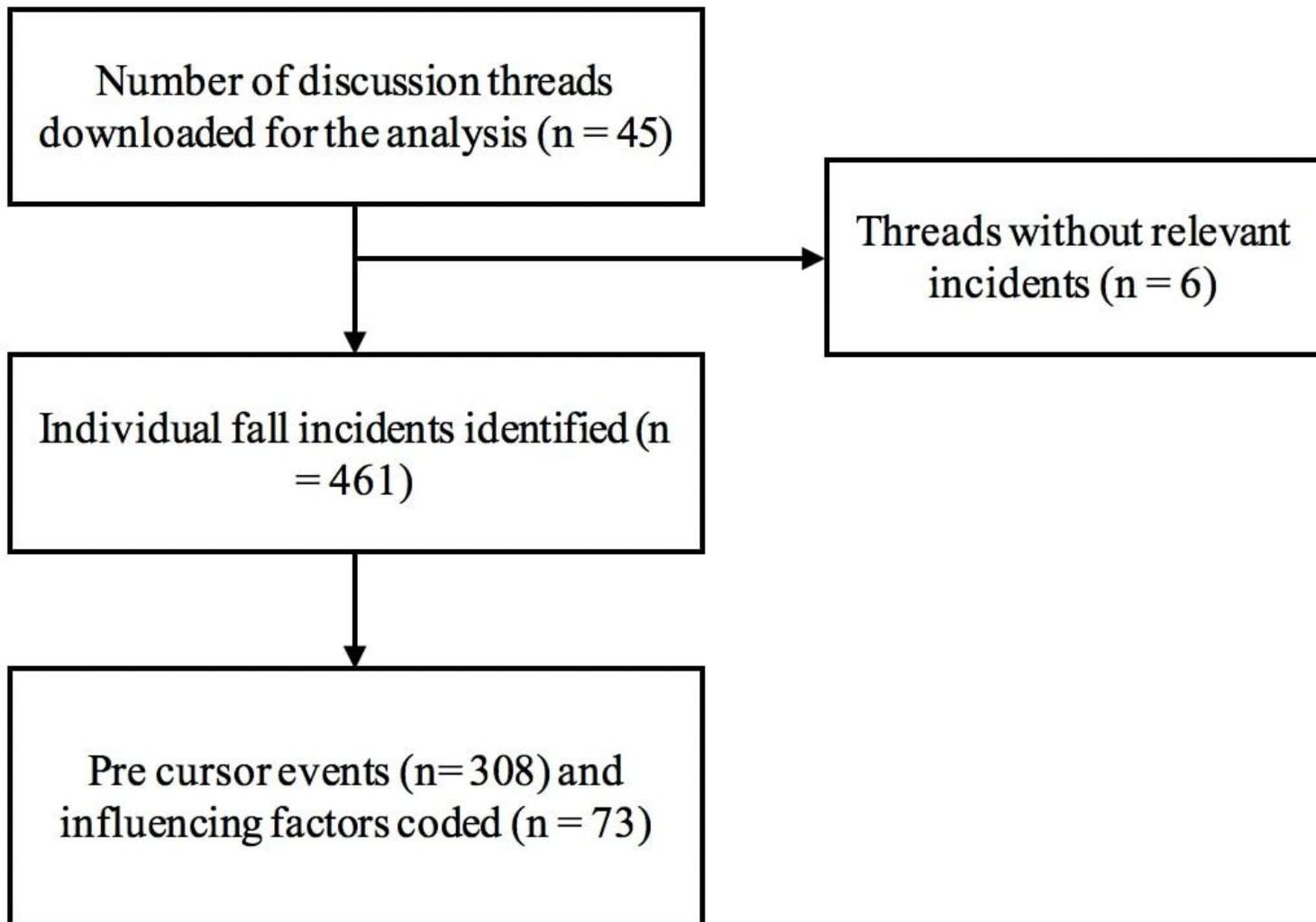


Figure 1

Outcome of the data capturing process

Supplementary Files

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