

Does motivation matter? A systematic review and meta-analysis of outcomes following intentional foreign object ingestion.

Jack Galbraith-Edge
Queen Mary, University of London
London, United Kingdom
ha201591@qmul.ac.uk

Mark Stanton
Critical Care Paramedic
Johannesburg, South Africa
trauma.1@mweb.co.za

Giles Cattermole
Queen Mary, University of London
London, United Kingdom
g.cattermole@qmul.ac.uk

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0.1 Introduction

0.2 Methods

0.2.1 Search Strategy

Relevant articles were identified through a systematic search of PubMed, Web of Science, Embase, Scopus, PsycINFO, CENTRAL and Google Scholar on 15th January 2025, with the assistance of a librarian.

The search was conducted using keywords and MeSH terms based on the concepts underpinning this review. The bibliography of each included article was searched for any further relevant articles. The keywords and MeSH terms used can be found in Appendix .1.

0.2.2 Eligibility Criteria

We included original studies involving humans of any age group who had intentionally ingested a foreign object through the oral cavity (mouth). Studies were excluded if the ingestion was not explicitly documented as intentional or if empirical data on individual intentional ingestions were unavailable.

Motivations or reasons for ingestion considered included protest, suicidal intent, self-harm, psychiatric conditions, and other documented motivations. Intervention details assessed included the number of ingestions and the management strategies employed (conservative, endoscopic, surgical). Object characteristics evaluated encompassed the ingestion of multiple, blunt, sharp-pointed, long (> 5 cm), and short (< 5 cm)

0.2.3 Outcomes of Interest

The primary outcomes of interest were rates of intervention: endoscopic intervention (defined as undergoing a minimally invasive procedure involving insertion of an endoscope to visually examine internal organs or tissues), surgical intervention (defined as any operative procedure involving an incision to retrieve ingested foreign objects or manage resulting complications), and conservative management (defined as cases not undergoing endoscopic or surgical intervention). Secondary outcomes included complication and mortality rates.

0.2.4 Study Selection

The study selection process is illustrated in Figure 1.

PRISMA 2020 flow diagram for new systematic reviews which included searches of databases, registers and other sources.

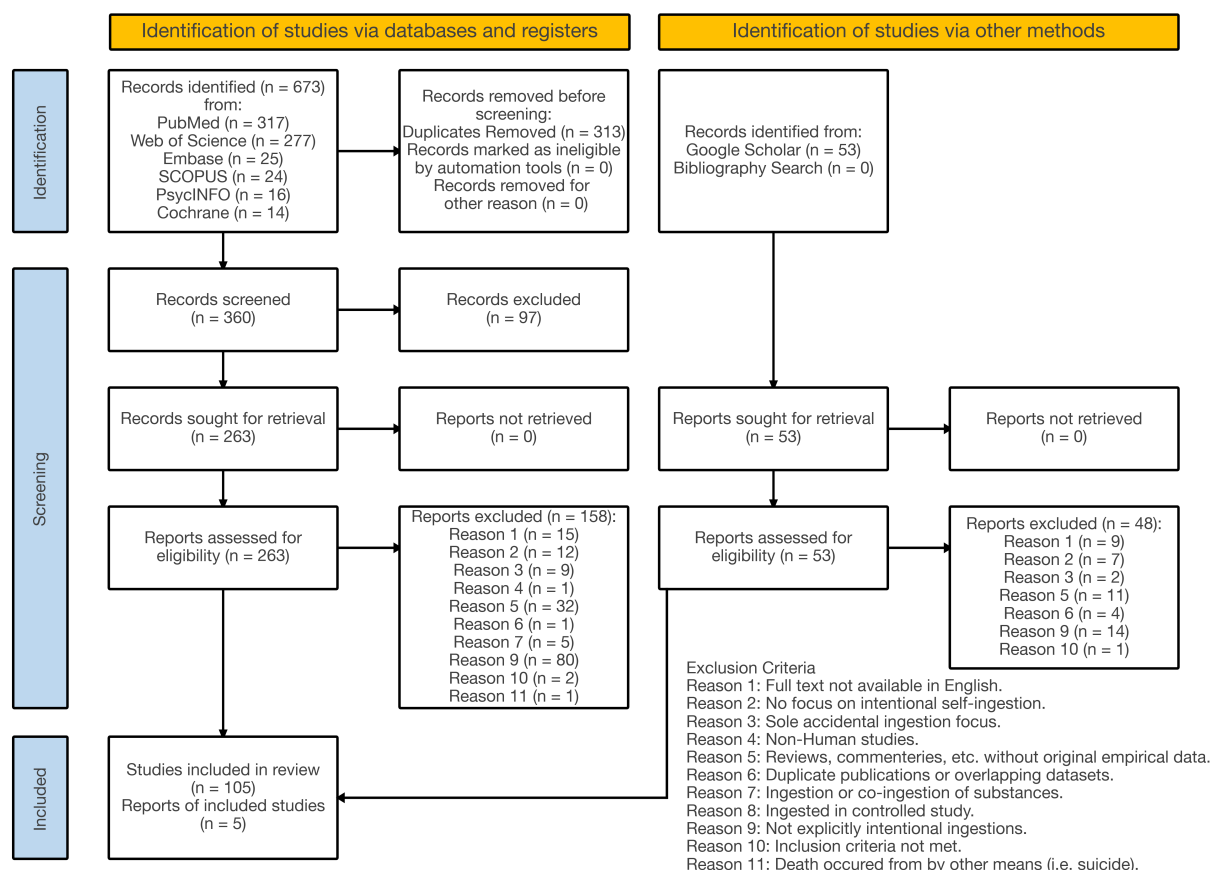


Figure 1: PRISMA 2020 flow diagram outlining the identification, screening, and inclusion of studies [1].

All identified articles were collated using Python (Pandas) [2]. Duplicate articles were identified and removed based on non-unique combinations of author, title, and DOI.

Following duplicate removal, all remaining articles underwent title and abstract screening conducted by the first author (JGE). To ensure consistency, a randomly selected 10% sample of these articles underwent independent screening by a second author (MS). Any discrepancies identified between these two reviewers were resolved by a third reviewer (GC).

Articles included after title and abstract screening proceeded to full-text review, which was initially performed by JGE. Again, a random 10% sample of these full-text articles underwent independent assessment by MS. Discrepancies between JGE and MS at the full-text screening stage were similarly resolved by a third review from GC.

Inter-reviewer agreement at each screening stage was calculated using Python (Pandas for data management and Sci-kit Learn for statistical analysis) [scikit-learn]. MS reviewed 50 papers during title and abstract screening. Fair agreement was reached with a Cohen's Kappa value of 0.381. 16 disagreements were reviewed by GC. In full text review, MS reviewed 31 papers. Almost perfect agreement was reached, with a Cohen's Kappa value of 0.832.

0.2.5 Data Collection Process

Demographic Variables

Prisoner Status (*Is_Prisoner*)

Individuals were classified as *Is_Prisoner* = "Y" if they were documented as being in prison, held in police custody, or otherwise detained at the time of the encounter. This included immigration detention and other forms of custodial supervision. Where there was no indication of detention status, *Is_Prisoner* was marked as negative (N), or "UK" if unknown.

Psychiatric History (*Psych_Hx*)

Psychiatric history was classified as positive (*Psych_Hx* = "Y") if the individual had a documented diagnosis of a mental disorder as defined by the *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition (DSM-5) [3]. This included any clinical diagnosis such as depression, anxiety disorders, psychotic disorders, personality disorders, or neurodevelopmental disorders. Substance-related and addictive disorders, including alcohol misuse disorders, were also

encompassed within this category. Where no such diagnosis was recorded, *Psych_Hx* was marked as negative (N), or “UK” if data were unavailable.

Displacement Status (*Is_Displaced_Person*)

Individuals were classified as *Is_Displaced_Person* = “Y” if they met the definition of displaced persons as outlined by the International Organisation for Migration (IOM). This includes individuals who have been forced or obliged to flee or leave their homes or places of habitual residence, particularly as a result of or in order to avoid the effects of armed conflict, situations of generalized violence, violations of human rights, or natural or human-made disasters [4]. Where no such displacement status was recorded, *Is_Displaced_Person* was marked as negative (N), or “UK” if unknown.

Alcohol Influence (*Under_Influence_Alcohol*)

The variable *Under_Influence_Alcohol* was marked as “Y” if there was documented evidence, clinical suspicion, or patient self-report indicating that the individual was under the influence of alcohol at the time of presentation. This included signs such as slurred speech, impaired coordination, smell of alcohol, or confirmed positive alcohol tests where available. The presence of alcohol use was considered relevant due to its potential influence on clinical presentation, risk behaviours, decision-making capacity, and healthcare outcomes. Where no such indication was present, the variable was marked as ‘N’ or “UK” if unknown.

Psychiatric Inpatients (*Is_Psych_Inpat*)

Individuals were classified as psychiatric inpatients if they were admitted to a psychiatric facility, psychiatric ward, or designated mental health unit at the time of data collection or during the relevant clinical encounter. This included both voluntary and involuntary admissions. Classification was based on documentation in medical records or transfer/referral notes. Identifying psychiatric inpatients allowed for analysis of patterns and outcomes specific to individuals receiving inpatient mental health care.

Severe Disability History (*Severe_Disability_Hx*)

The variable *Severe_Disability_Hx* was marked as “Y” if the individual had a documented history of significant cognitive or functional impairment consistent with severe disability. This was limited to individuals with:

- Severe learning disabilities (e.g. profound intellectual disability, global developmental delay), and/or
- Impairments of consciousness (e.g. persistent vegetative state, minimally conscious state, or severe acquired brain injury with loss of awareness).

This classification excluded milder forms of disability or functional limitation. The variable was marked as “N”, or “UK” where no such history was documented.

History of Previous Ingestions (*Previous_Ingestions*)

The variable *Previous_Ingestions* was marked as “Y” if there was documented evidence that the individual had a prior episode of foreign body ingestion before the current presentation. This included both intentional and unintentional ingestions, regardless of the time elapsed since the previous event. Documentation could include clinical notes, referral information, or electronic health records. The variable was marked as “N” where it was explicitly stated that this was the first ingestion, or marked “UK” if prior history was unknown.

Motivation Variables

Motivation - Intent to Harm (*Motivation_Intent_To_Harm*)

The variable *Motivation_Intent_To_Harm* was marked as “Y” if there was documented evidence that the ingestion was carried out with the intent to cause self-harm, self-injury, or suicide. This included explicit statements by the individual, clinical impressions recorded by healthcare professionals, or circumstances strongly suggesting deliberate self-injurious behaviour. Ingestions motivated by other factors (e.g. attention-seeking, protest, escape, or psychosis without suicidal intent) were not included in this category. The variable was marked as ‘N’ where motivation was determined to be non-harm-related or marked “UK” if intent could not be clearly established.

Motivation - Protest (*Motivation_Protest*)

The variable *Motivation_Protest* was marked as “Y” if there was documented evidence that the ingestion was carried out as a form of protest, demonstration, or to express objection or dissatisfaction, including cases involving manipulation or attempts to secure betterment of conditions. This included ingestions in response to perceived injustice, detention conditions, delays in asylum processes, or efforts to influence external decision-making. Classification was based on explicit statements by the individual or clinical documentation suggesting protest-related intent. The variable was marked as “N” where protest was not identified as a motivation, or marked “UK” if intent was unclear.

Motivation - Psychiatric (*Motivation_Psychiatric*)

The variable *Motivation_Psychiatric* was marked as “Y” if the ingestion was considered to be primarily driven by an underlying psychiatric condition. This included cases where ingestion occurred in the context of psychosis, impulsivity related to personality disorder, intellectual disability, severe emotional dysregulation, or other recognised mental health diagnoses. Classification was based on clinical documentation indicating a psychiatric motive or context, even if the individual did not explicitly state intent. The variable was marked as “N” where no psychiatric motivation was identified, or marked “UK” if unclear.

Motivation – Psychosocial (*Motivation_Psychosocial*)

The variable *Motivation_Psychosocial* was developed to classify cases in which ingestion appeared to be motivated by social, emotional, or interpersonal factors—distinct from psychiatric illness, medical indications, or criminal intent. Prior to the introduction of this category, ‘Motivation Other’ accounted for 34.5% of cases, making it the joint most frequently recorded motivation.

Psychosocial motivations are understood as behaviours shaped by the interaction between psychological states and social environments. These include influences such as interpersonal relationships, cultural norms, identity, and social roles. In the literature, psychosocial factors are defined as “the interrelation of social factors and individual thought and behaviour” [5].

This classification emerged following a manual review of the *Motivation_Other_Long* field in the dataset. Relevant entries were first identified using basic keyword filtering in Python, and then refined through manual reading and interpretation of the free-text responses in the Excel spreadsheet.

Examples of motivations reclassified under this category include:

- Imitative or performance behaviours, such as jugglers, sword swallows, or individuals imitating these acts.
- Statements such as “cleaning oesophagus with a wire,” interpreted as symbolic or performative acts.
- Ingestions intended to provoke a reaction, such as “in front of husband for shock value” or “to impress friends.”
- Ingestions related to body image or weight concerns, e.g., “for dietary purposes” or “to induce weight loss.”
- Ingestions carried out “by a refugee for safe keeping,” indicating a socially-motivated protective act.

This reclassification enabled a more nuanced understanding of ingestion behaviours that fall outside conventional psychiatric, medical, or criminal frameworks, yet reflect significant psychosocial drivers.

Motivation - Unknown (*Motivation_Unknown*)

The variable *Motivation_Unknown* was marked as “Y” when no clear motivation for the ingestion could be identified from available documentation. This included cases where the individual did not disclose a reason, was unable to communicate, or where clinical notes did not specify a suspected or confirmed motive. The variable was marked as “N” when a specific motivation was documented, or marked “UK” if documentation was incomplete or ambiguous.

Motivation Count (*Motivation_Count*)

This variable was computed using Python. Motivation-related variables marked as “Y” were converted to binary values (1), while “N” and “UK” were treated as 0. The sum of these values across all motivation columns was used to calculate a total Motivation Count for each individual. This measure was used to explore potential associations between the number of identified motivations and clinical outcomes.

Object Variables

Object - Button Batteries (*Object_Button_Battery*)

This variable was marked as “Y” if the ingested object was identified as a button battery. Classification was based on clinical documentation, radiological findings, or patient report. The variable was marked as “N” when a button battery was not ingested, or marked “UK” if object type was not recorded.

Object - Magnets (*Object_Magnet*)

This variable was marked as “Y” if the ingested object was a magnet or included magnets. Special consideration was given to cases involving multiple magnets due to elevated clinical risk. Classification was based on clinical records, imaging, or patient report. The variable was marked as “N” if no magnets were ingested, or marked “UK” if unknown.

Object - Long (> 5 cm) (*Object_Long*)

This variable was marked as “Y” if the ingested object exceeded 5 cm in length, consistent with standard clinical thresholds for increased risk of obstruction or complications. Length was determined based on documentation, radiology, or object description. The variable was marked as “N” for shorter objects, or marked “UK” if object dimensions were not available.

Object – Long and Sharp (*Object_Long_Sharp*)

The variable *Object_Long_Sharp* was marked as “Y” if both *Object_Long* and *Object_Sharp* were marked as “Y”, indicating that the ingested object was both longer than 5 cm and sharp or pointed. This classification was generated programmatically in Python by identifying cases where both conditions were true. The variable was marked as “N” if either *Object_Long* or *Object_Sharp* was “N”, and marked as “UK” if either contributing variable was “UK”.

Object - Short (< 5 cm) (*Object_Short*)

The variable *Object_Short* was created to classify ingested objects that were less than 5 cm in length. This threshold aligns with clinical guidelines indicating that objects shorter than 5 cm are generally considered lower risk for gastrointestinal obstruction or complication, particularly in adults.

The classification was derived programmatically using Python and the Pandas library. A value of “Y” was assigned if the corresponding *Object_Long* variable was marked as “N”, indicating the object was not considered long.

Objects with unknown dimensions were retained as “UK” in the *Object_Long* variable and not reassigned in this field, thus preserving uncertainty in classification.

Object – Short Sharp (< 5 cm and Sharp) (*Object_Short_Sharp*)

The variable *Object_Short_Sharp* was created to identify cases in which the ingested object was both less than 5 cm in length and sharp. This classification was developed based on the recognition that small sharp objects—although not exceeding the standard 5 cm threshold for increased obstruction risk—may still present significant clinical hazards, such as mucosal injury or perforation.

To derive this variable, a two-step classification was applied using Python and the Pandas library [2].

Then, *Object_Short_Sharp* was assigned a value of “Y” if both *Object_Short* and *Object_Sharp* were marked “Y”. The variable was marked “N” otherwise, and “UK” if either component variable was unknown.

This classification allows for targeted analysis of cases involving small but potentially dangerous objects, which may warrant different management strategies than either blunt or long foreign bodies.

Object - Sharp (*Object_Sharp*)

This variable was marked as “Y” if the ingested object was described as sharp, pointed, or capable of causing mucosal injury or perforation. Examples included razor blades, nails, glass, and needles. Classification was based on object description or radiological appearance. The variable was marked as “N” if no sharp object was ingested, or marked “UK” if object type was unclear.

Object - Multiple (*Object_Multiple*)

This variable was marked as “Y” if the individual ingested more than one object during the same episode. This included ingestion of identical or different objects. Classification was based on clinical notes, imaging, or patient report. The variable was marked as “N” for single-object ingestion, or marked “UK” if number of objects was not specified.

Object - Diameter (> 2,5 cm) (*Object_Diameter_Large*)

This variable was marked as “Y” if the individual ingested an object with a diameter > 2,5 cm. The variable was marked as “N” for objects with a diameter < 2,5 cm, or marked “UK” if the diameter was not specified and could not be calculated.

Object - Free Text (*Object_Other_Long*)

Additional information on objects ingested was recorded as free text in the *Object_Other_Long* column. This can be interrogated at a later date.

Outcome Variables

Outcome - Endoscopy (*Outcome_Endoscopy*)

The variable *Outcome_Endoscopy* was marked as “Y” if the individual underwent endoscopic intervention during the clinical episode. Endoscopy was defined as a “minimally invasive medical procedure involving the insertion of a flexible tube equipped with a light and camera (an endoscope) into the body to visually examine internal organs or tissues”. This included both diagnostic and therapeutic endoscopic procedures related to the ingestion. The variable was marked as “N” if no endoscopy was performed, or “UK” if this information was unavailable.

Outcome – Surgery (*Outcome_Surgery*)

The variable *Outcome_Surgery* was marked as “Y” if the individual required surgical intervention as a result of the ingestion. Surgery was defined as any operative procedure performed under general or regional anaesthesia in a theatre setting, intended to retrieve the ingested object or to treat complications arising from the ingestion (e.g., perforation, obstruction, haemorrhage). The variable was marked as “N” if no surgery was performed, or marked “UK” if not documented.

Outcome – Endoscopy and Surgery (*Outcome_Endoscopy_Surgery*)

The variable *Outcome_Endoscopy_Surgery* was marked as “Y” if both *Outcome_Endoscopy* and *Outcome_Surgery* were recorded as “Y” for a given individual, indicating that the patient underwent both endoscopic and surgical interventions during the clinical episode. This composite variable was computed using Python and reflects the occurrence of both procedures, regardless of their order or whether one was diagnostic and the other therapeutic. The variable was marked as “N” if one or neither procedure was performed, and “UK” if data were insufficient to determine this.

Outcome – Conservative (*Outcome_Conservative*)

The variable *Outcome_Conservative* was created to identify cases managed without procedural intervention. A value of “Y” was assigned if the individual did not undergo either surgery or endoscopy during the clinical episode. Conversely, a value of “N” was assigned if either surgical or endoscopic intervention was documented.

This variable was derived programmatically using Python and the Pandas library [2]. The following logic was applied: if both *Outcome_Surgery* and *Outcome_Endoscopy* were not equal to “Y”, the case was considered to have been managed conservatively.

This allowed for consistent identification of conservative management across the dataset, based on the absence of documented procedural intervention.

Outcome – Death (*Outcome_Death*)

The variable *Outcome_Death* was marked as “Y” if the ingestion was temporally or causally associated with death due to direct medical complications (e.g., perforation, sepsis, aspiration). Deaths attributable solely to comorbid psychiatric conditions or suicide, where the ingestion was not directly responsible, were excluded. The variable was marked as “N” if the individual survived, or marked “UK” if outcome was unknown.

Outcome – Perforation (*Outcome_Perforation*)

The variable *Outcome_Perforation* was marked as “Y” if there was clinical or radiological evidence of gastrointestinal or airway perforation resulting from the ingestion. This included any confirmed full-thickness breach of the gastrointestinal tract, oesophagus, or other affected structures. The variable was marked as “N” if perforation was ruled out or absent, or marked “UK” if unknown.

Outcome – Obstruction (*Outcome_Obstruction*)

The variable *Outcome_Obstruction* was marked as “Y” if the ingestion led to a confirmed or clinically suspected obstruction of the gastrointestinal tract. Diagnosis was based on clinical assessment, imaging, or procedural findings. The variable was marked as “N” if no obstruction occurred, or marked “UK” if not documented.

Outcome – Injury Requiring Intervention (*Outcome_Injury_Needing_Intervention*)

The variable *Outcome_Injury_Needing_Intervention* was marked as “Y” if there was clinical evidence that the ingestion caused an internal injury significant enough to require medical or procedural intervention, and this injury contributed to the clinical decision to proceed with endoscopy or surgery. This classification was used to support assessment of whether invasive intervention was necessary, rather than to catalogue all injuries. The variable was marked as “N” if no such injury was identified, or marked “UK” if data were unavailable.

Outcome – Other (*Outcome_Other*)

The variable *Outcome_Other* was marked as “Y” if the ingestion led to a clinically significant outcome not covered by the other defined outcome variables. Examples included aspiration pneumonitis, sepsis without perforation, prolonged hospitalisation due to psychiatric sequelae, or other medical complications directly linked to the ingestion. The variable was marked as “N” if no such outcome occurred, or marked “UK” if data were insufficient. Free text outcomes were then recorded in *Outcome_Other_Long* to elaborate on other outcomes.

0.3 Sources

0.3.1 Sample Study Designs

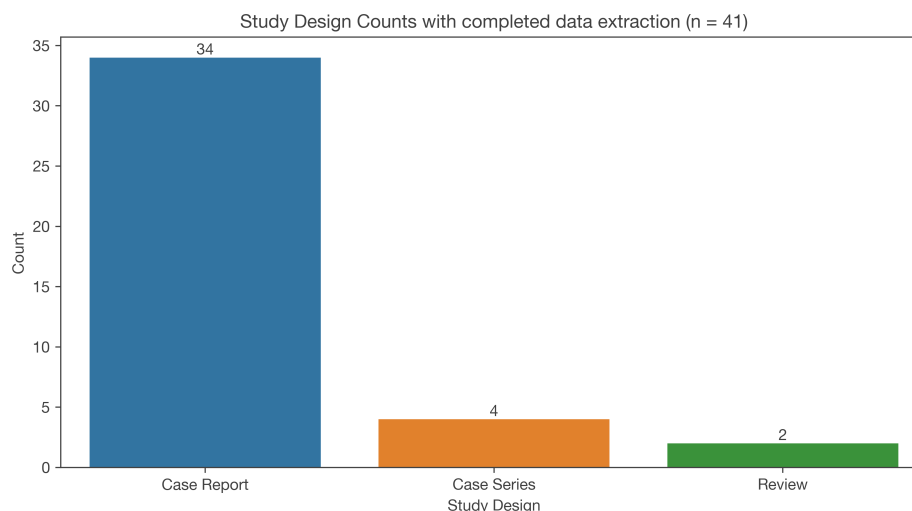


Figure 2: Bar plot showing the distribution of study design characteristics where data has been extracted.

Figure 2 shows that the majority of papers included in this 30-paper sample are case reports. This is likely because extracting granular data from larger case series and retrospective cohort studies is more challenging.

To address this, aggregate data will first be generated from the included case reports and case series before attempting data extraction from larger studies with differing designs. This approach aims to reduce data heterogeneity and enable the aggregate data from larger studies to be more easily analysed alongside the data from case series.

Furthermore, the more detailed data available in case reports and case series is generally preferred over the broader aggregate data from large studies. In some cases, larger studies may include the same case reports or series already included in the review. These larger studies may therefore meet exclusion criteria and be removed before final data extraction begins.

0.3.2 Sample Publication/Case Years

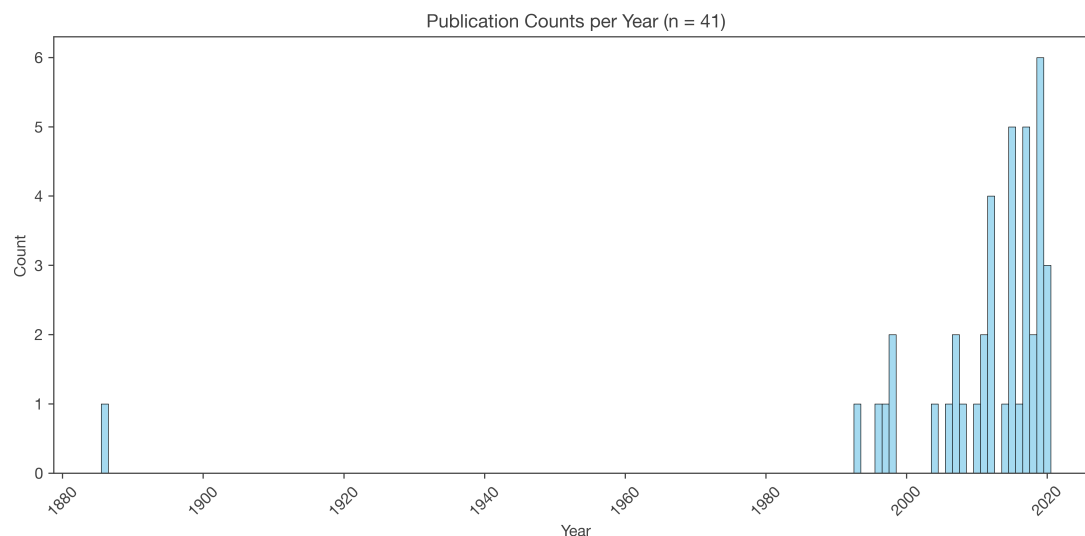


Figure 3: Histogram showing the distribution of publication dates of papers data collected from.

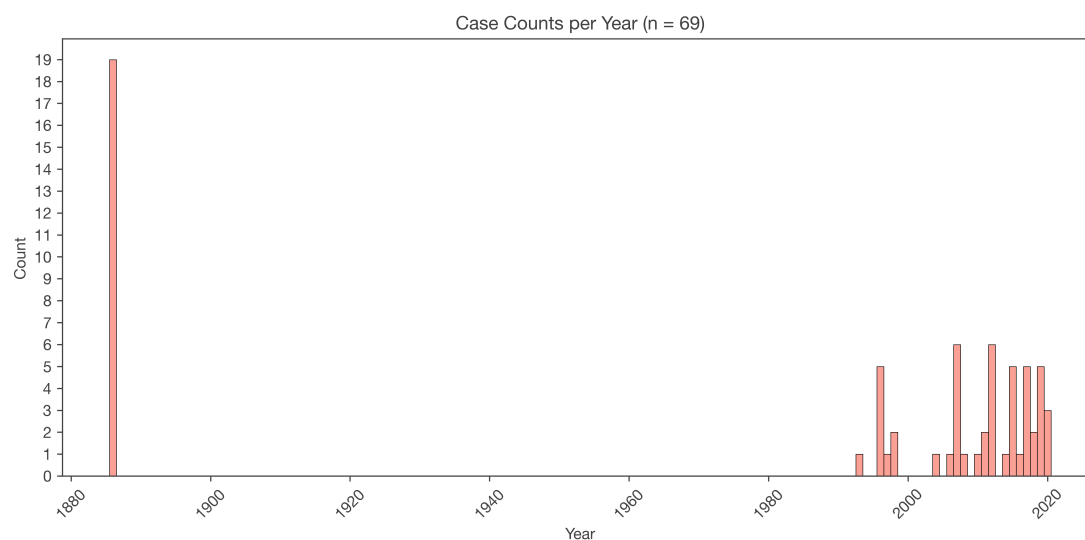


Figure 4: Histogram showing the distribution of case dates.

Figures 3 and 4 show that, while most papers with extractable data were published after 1990, there is one large historical case series from before 1900. This single study may skew the surgical intervention and mortality rates for the overall population.

0.4 Results

0.4.1 Age and Gender

Table 1: Summary statistics for age in years.

Statistic	Age (Years)
Count	58.0
Mean	31.0
Std	12.1
Min	9.0
25%	22.0
50%	29.0
75%	38.8
Max	62.0

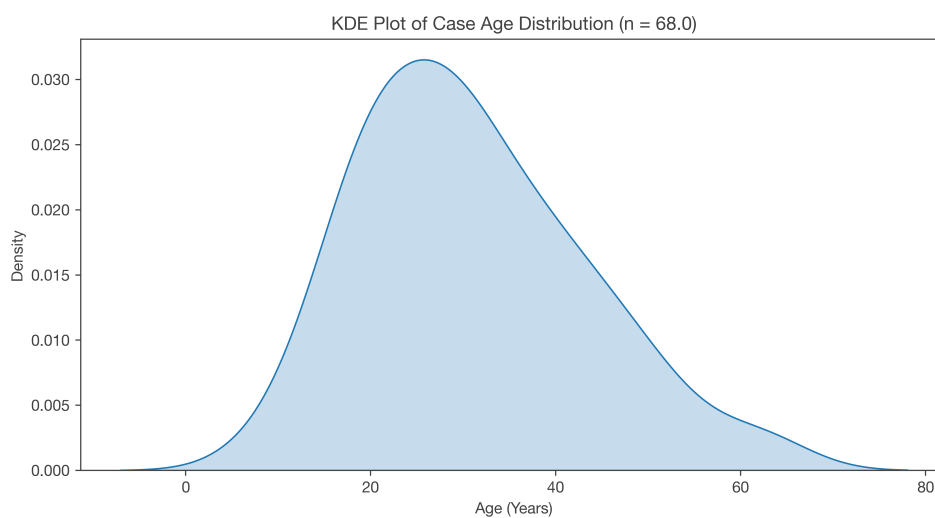


Figure 5: Kernel density estimate (KDE) plot showing the distribution of age among included cases.

Table 2: Counts and percentages of 1s in Gender Column (sorted descending)

Gender	Count (N)	Percentage (%)
Male	43	62.3
Female	21	30.4
Unknown	5	7.2

0.4.2 Subgroup Data

Table 3: Counts and percentages of 1s for population summary (sorted descending by percentage).

	Count (1s)	Valid N	Percentage (%)
Psych Hx	30	69	43.5
Previous Ingestions	16	69	23.2
Is Prisoner	14	69	20.3
Is Psych Inpat	4	69	5.8
Under Influence Alcohol	4	69	5.8
Severe Disability Hx	3	69	4.3
Is Displaced Person	2	69	2.9

Table 4: Counts and percentages of 1s for motivation summary (sorted descending by percentage).

	Count (1s)	Valid N	Percentage (%)
Motivation Psychiatric	23	69	33.3
Motivation Unknown	23	69	33.3
Motivation Intent To Harm	20	69	29.0
Motivation Psychosocial	15	69	21.7
Motivation Other	9	69	13.0
Motivation Protest	8	69	11.6
Motivation Other Psych Hx	6	69	8.7
Motivation Other Severe Disability Hx	2	69	2.9

Table 5: Counts and percentages of 1s for object summary (sorted descending by percentage).

	Count (1s)	Valid N	Percentage (%)
Object Diameter Large	54	69	78.3
Object Long	33	69	47.8
Object Short	33	69	47.8
Object Sharp	31	69	44.9
Object Multiple	30	69	43.5
Object Short Sharp	18	69	26.1
Object Long Sharp	12	69	17.4
Object Magnet	4	69	5.8
Object Button Battery	0	69	0.0

Table 6: Counts and percentages of 1s for outcome summary (sorted descending by percentage).

	Count (1s)	Valid N	Percentage (%)
Outcome Surgery	48	69	69.6
Outcome Injury Needing Intervention	38	69	55.1
Outcome Perforation	25	69	36.2
Outcome Endoscopy	20	68	29.4
Outcome Other	17	69	24.6
Outcome Obstruction	7	69	10.1
Outcome Conservative	6	69	8.7
Outcome Death	5	69	7.2
Outcome Endoscopy Surgery	5	69	7.2

From Table 3, we observe that 39.7% of the population had a psychiatric history, 20.7% were prisoners, and 19.0% had a history of previous ingestions. Smaller proportions were psychiatric inpatients (6.9%), had a history of severe disability (5.2%), were displaced persons (3.4%), or were under the influence of alcohol (3.4%) at the time of presentation.

From Table 4, the most frequently recorded motivations were unknown (34.5%), intent to harm (32.8%), and psychiatric reasons (31.0%). Psychosocial motivations accounted for 20.7% of cases, followed by protest-related ingestion (13.8%), and motivations classified as 'other' (12.1%). Additional subcategories included 'Other Psych Hx' (6.9%).

From Table 5, the most commonly ingested object types were long objects (50%), sharp objects (41.4%), and multiple objects (39.7%). Less frequently, ingestions involved long sharp objects (17.2%), magnets (5.2%), while no cases involved button batteries (0.0%).

From Table 6, surgical intervention was the most common outcome (72.4%), followed by injuries requiring intervention (53.4%) and perforation (36.2%). Endoscopy was performed in 26.3% of cases. Other outcomes included miscellaneous findings (22.4%), conservative management (10.3%), death (8.6%), and obstruction (8.6%).

Table 7: List of comments made during data extraction in Motivation_Other_Long where Motivation_Other marked 'Y'.

Patient ID	Free Text Motivation
3-012	Delirium Tremens
3-014	Cleaning Oesophagus with sponge on wire
113-001	"Reported that thermometer ingestion and suicide attempts were her best chance to obtain narcotic medications. History of narcotic use since teens, multiple admissions and surgeries related to similar behavior."
168-001	"Foreign body ingested in police custody to conceal object, likely related to narcotics smuggling. Lighter was double-wrapped in cellophane and retained for 17 months without prior symptoms."
217-001	Smuggling
238-001	"A 29-year-old mentally retarded female patient was admitted to the emergency service with a two-day history of abdominal pain, nausea, vomiting, and failure to eliminate feces or pass gas. Patient history revealed that the patient had undergone two surgeries due to repeated foreign body ingestion within the last 6 months."
260-001	"history of cerebral palsy and self-destructive behaviour"
328-001	"PICA", "anxiety and an empty prescription for alprazolam as the primary trigger leading to the ingestions.", "past psychiatric history included major depressive disorder, generalized anxiety disorder, posttraumatic stress disorder, borderline personality disorder, and pica with a history of more than twenty admissions for ingestion behaviors often requiring endoscopic retrieval"
349-001	"adjustment disorder who developed a gastrocolic fistula following the deliberate ingestion of multiple magnets.", "Although she acknowledged this was a wrong and harmful act, she refused to explain her action."

Table 8: List of comments made during data extraction where Outcome_Other marked 'Y'.

Patient ID	Free Text
3-008	"stomach and abdominal surfaces everywhere adherent".
3-009	"Fifteen months later an abscess appeared in the right hypochondrium. Two months later a large amount of pus was discharged through the mouth. One month later opening of the abscess outwardly. After repeated closing and breaking out of the wound, the sharp end of the fork appeared. For eleven months the condition continued the same, without the fork protruding any farther. Then for the first time the opening of the abscess was enlarged, and the fork removed. Convulsions followed, with trifling haemorrhage. For thirty hours' food was discharged through the wound. Fifteen days later it was healed."
3-012	"small fluctuating spot with a fistula, secreting fetid pus, in which the metallic body could be felt.", "caries of the sternum and ribs. Autopsy showed complete adhesion of the stomach wound with the abdominal parietes."
39-001	"Fluroscopy"
61-001	Interintestinal adhesions
85-001	"lodged near the ileocecal valve and an inflammatory mass had formed around the intraluminal coin, causing a 10 x 0.7 cm fibrous tumor to completely obstruct the small bowel"
99-001	"Subsequent post-mortem confirmed a mediastinal abscess and aortoesophageal fistula but no significant clot in the gastrointestinal tract"
113-001	"Thermometer in Mediastinum"
148-001	"a median sternotomy was performed and pericardiotomy evacuated 150 ml of blood. A needle found embedded within the left ventricle was surgically removed", "in the small bowel, with no peritonism clinically. An exploratory laparotomy was performed six days post-sternotomy and the needle, which was embedded within the pylorus removed through an enterotomy. No diaphragmatic or hollow viscous injuries were noted intraoperatively. The patient recovered uneventfully."
168-001	"presence of an ulcer in the angular part of the stomach (Forrest III) as well as a large foreign body wrapped in dark-colored cellophane in the middle of the stomach."
214-001	Severe antral erosion is observed, likely related to pressure effect of the magnet clump, but there was no sign of perforation
261-001	"complicated by respiratory failure requiring continued ventilator support for 6 days. A postoperative contrast esophagram showed contrast extravasation at the esophagotomy site. It was managed with antibiotics and continued chest tube drainage. Seven days after the operation, CT of the chest showed fluid and gas collections in the paraesophageal and right lower hemithorax that were not being drained by the chest tubes. Thoracentesis confirmed empyema with pleural fluid growing Actinomyces meyeri and Streptococcus mitis. Antibiotics were switched to piperacillin-tazobactam and fluconazole and given for 14 days.", "and delirium, which were treated with antipsychotics. A follow-up chest x-ray 25 days after the operation showed resolution of empyema. A repeat esophagram at 29 days showed no leak. The patient was discharged to a nursing home 53 days after admission"
273-001	"pneumoperitoneum and free intra-abdominal fluid"
300-001	"early mucosal appendicitis"
322-001	"gastro-oesophagoscopy showed oedema and a haematoma of the left piriform sinus. The oesophagus showed no signs of perforation. Due to the presence of laryngeal oedema and haematoma the patient was left intubated and admitted to the intensive care unit.", "Two days later, a follow-up CT scan still showed a small foreign body at the posterior wall of hypopharynx (Figure 3). A second endoscopic procedure was required to remove it", "After removal, the oedema reduced and the patient could be extubated safely and was transferred"
327-001	"perforated sigmoid colon secondary to a linear metallic foreign body or 2 adjacent foreign bodies with surrounding inflammatory changes and a 3.5-cm abscess", "transrectal 10F pigtail drain placed by interventional radiology to drain the pelvic abscess. Under general anesthesia and fluoroscopy support, flexible sigmoidoscopy was performed."
349-001	"gastrocolic fistula"

We can expand on the 'Outcome_Other' by examining the comments made during Data Extraction. This is shown in Table 8.

0.4.3 Correlations

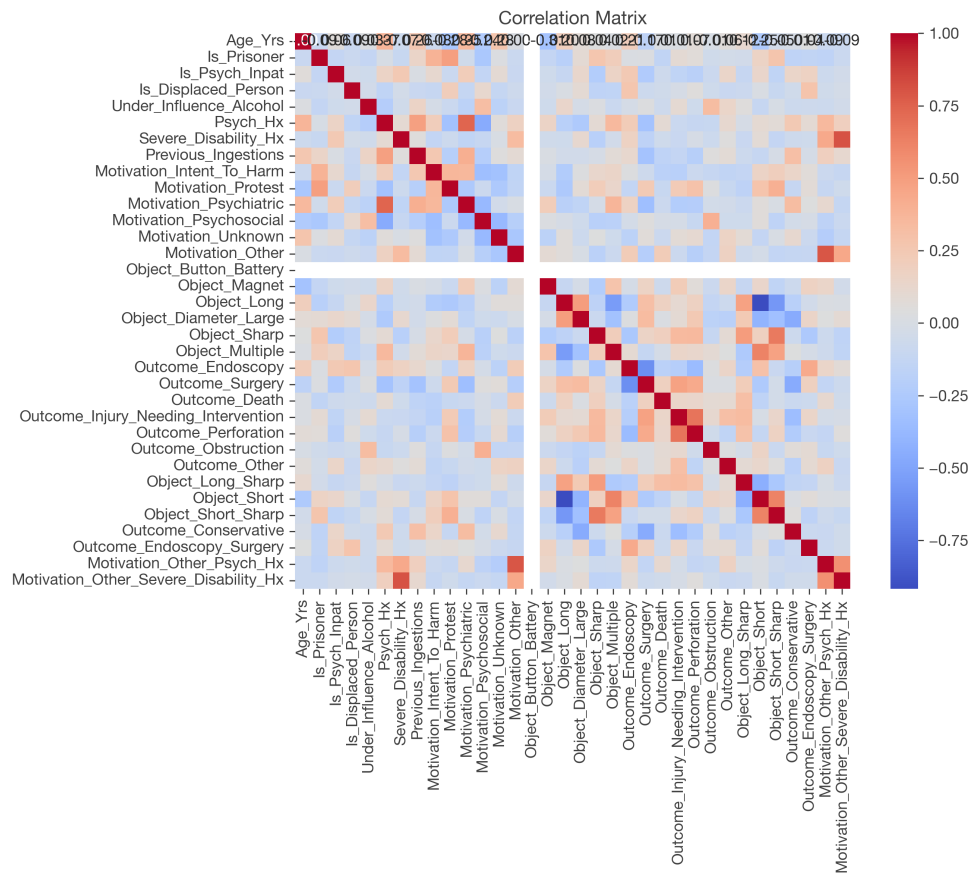


Figure 6: Correlation matrix showing correlation between variables.

Table 9: Top 30 strongest pairwise Pearson correlations between variables

Variable A	Variable B	Correlation
Object Long	Object Short	-0.917000
Severe Disability Hx	Motivation Other Severe Disability Hx	0.810000
Motivation Other	Motivation Other Psych Hx	0.797000
Psych Hx	Motivation Psychiatric	0.744000
Outcome Injury Needing Intervention	Outcome Perforation	0.681000
Object Sharp	Object Short Sharp	0.658000
Object Multiple	Object Short	0.623000
Object Short	Object Short Sharp	0.621000
Outcome Endoscopy	Outcome Surgery	-0.616000
Object Long	Object Short Sharp	-0.569000
Motivation Other Psych Hx	Motivation Other Severe Disability Hx	0.560000
Object Long	Object Multiple	-0.547000
Object Sharp	Object Long Sharp	0.508000
Object Long	Object Diameter Large	0.505000
Is Prisoner	Motivation Protest	0.493000
Psych Hx	Previous Ingestions	0.488000
Object Long	Object Long Sharp	0.479000
Outcome Surgery	Outcome Injury Needing Intervention	0.479000
Object Multiple	Object Short Sharp	0.478000
Outcome Surgery	Outcome Conservative	-0.467000
Psych Hx	Motivation Psychosocial	-0.462000
Object Diameter Large	Outcome Conservative	-0.461000
Motivation Other	Motivation Other Severe Disability Hx	0.446000
Object Long Sharp	Object Short	-0.439000
Severe Disability Hx	Motivation Other Psych Hx	0.439000
Outcome Endoscopy	Outcome Endoscopy Surgery	0.436000
Outcome Surgery	Outcome Perforation	0.433000
Previous Ingestions	Motivation Psychiatric	0.413000
Object Diameter Large	Object Short	-0.410000
Motivation Psychosocial	Outcome Obstruction	0.405000

Interpretation

From Table 9 several strong correlations were observed between key variables:

- **Psychiatric history** showed a strong positive correlation with **psychiatric motivation** ($r = 0.83$), as expected.
- **Injury requiring intervention** was strongly associated with **perforation** ($r = 0.70$), aligning with clinical severity.
- **Being a prisoner** was notably linked to **protest-related motivation** ($r = 0.54$).
- **Surgical intervention** correlated positively with both **injury needing intervention** ($r = 0.51$) and **perforation** ($r = 0.47$), while showing negative associations with **conservative management** ($r = -0.55$) and **psychiatric motivation** ($r = -0.42$).
- **Endoscopy** was negatively associated with both **sharp object ingestion** ($r = -0.43$) and **perforation** ($r = -0.37$).
- **Conservative management** negatively correlated with **injury needing intervention** ($r = -0.36$) but showed a positive association with **previous ingestions** ($r = 0.41$).
- **Psychiatric motivation** also correlated positively with **multiple object ingestion** ($r = 0.37$), possibly reflecting impulsivity or complexity in intent.

0.4.4 Aggregate Data

These columns represent aggregate data computed using Python and the **pandas** library. They summarise key demographic, clinical, motivational, object-related, and outcome variables—such as age ranges, gender distribution, psychiatric history, ingestion motivations, and clinical outcomes like endoscopy or surgery rates. Each variable is captured in terms of both absolute case counts (e.g., *Psych_Hx_Cases*) and proportions relative to the total number of cases (e.g., *Psych_Hx_Rate*).

This structure enables case data from individual reports and small case series to be standardised into a common format. As described earlier in the report, this method of generating aggregate-level data is designed to support the

integration of studies with differing data structures, particularly larger studies where individual-level data may not be available. By reducing heterogeneity in data format and content, these aggregated variables facilitate comparative analysis across diverse sources, strengthening the overall synthesis in case series and systematic reviews.

Columns are listed below and can be generated computationally where individual case data is available. The Python-based workflow allows for flexible and scalable creation of additional **_Cases** and **_Rate** columns for any new variables of interest, enabling consistent integration of diverse data sources into a unified structure.

List of Aggregate Data Columns (Excluding _Long Fields)

- Total_Cases
- Age_Low
- Age_High
- Age_Mean
- Age_Median
- Gender_Male_Cases
- Gender_Male_Rate
- Gender_Female_Cases
- Gender_Female_Rate
- Gender_Unknown_Cases
- Gender_Unknown_Rate
- Is_Prisoner_Cases
- Is_Prisoner_Rate
- Is_Psych_Inpat_Cases
- Is_Psych_Inpat_Rate
- Is_Displaced_Person_Cases
- Is_Displaced_Person_Rate
- Under_Influence_Alcohol_Cases
- Under_Influence_Alcohol_Rate
- Psych_Hx_Cases
- Psych_Hx_Rate
- Severe_Disability_Hx_Cases
- Severe_Disability_Hx_Rate
- Previous_Ingestions_Cases
- Previous_Ingestions_Rate
- Motivation_Intent_To_Harm_Cases
- Motivation_Intent_To_Harm_Rate
- Motivation_Protest_Cases
- Motivation_Protest_Rate
- Motivation_Psychiatric_Cases
- Motivation_Psychiatric_Rate
- Motivation_Psychosocial_Cases
- Motivation_Psychosocial_Rate
- Motivation_Unknown_Cases

- Motivation_Unknown_Rate
- Motivation_Other_Cases
- Motivation_Other_Rate
- Motivation_Other_Psych_Hx_Cases
- Motivation_Other_Psych_Hx_Rate
- Motivation_Other_Severe_Disability_Hx_Cases
- Motivation_Other_Severe_Disability_Hx_Rate
- Object_Button_Battery_Cases
- Object_Button_Battery_Rate
- Object_Magnet_Cases
- Object_Magnet_Rate
- Object_Long_Cases
- Object_Long_Rate
- Object_Sharp_Cases
- Object_Sharp_Rate
- Object_Multiple_Cases
- Object_Multiple_Rate
- Object_Long_Sharp_Cases
- Object_Long_Sharp_Rate
- Object_Short_Cases
- Object_Short_Rate
- Object_Short_Sharp_Cases
- Object_Short_Sharp_Rate
- Outcome_Endoscopy_Cases
- Outcome_Endoscopy_Rate
- Outcome_Surgery_Cases
- Outcome_Surgery_Rate
- Outcome_Death_Cases
- Outcome_Death_Rate
- Outcome_Injury_Needing_Intervention_Cases
- Outcome_Injury_Needing_Intervention_Rate
- Outcome_Perforation_Cases
- Outcome_Perforation_Rate
- Outcome_Obstruction_Cases
- Outcome_Obstruction_Rate
- Outcome_Other_Cases
- Outcome_Other_Rate
- Outcome_Conservative_Cases
- Outcome_Conservative_Rate
- Outcome_Endoscopy_Surgery_Cases
- Outcome_Endoscopy_Surgery_Rate

0.5 Key Findings

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.1 Appendix A - Keywords and MeSH Terms

.1.1 PubMed

Concept	Keywords	MeSH Terms
Foreign Bodies	"foreign obj*" "foreign bod*"	Foreign Bodies [MeSH]
Intentional Ingestion / Self-harm	"intent*" "deliberate*" "purpose*" "self-injur*" "selfharm*" "self-harm*"	Self-Injurious Behavior [MeSH]
Ingestion Behavior	"ingest*" "swallow*"	–
Interventions	"surg*" "endoscop*" "EGD" "OGD" "Esophagogastroduodenoscopy" "Oesophagogastroduodenoscopy" "manag*"	Endoscopy [MeSH] Surgical Procedures, Operative [MeSH] Conservative Treatment [MeSH] Drug Therapy [MeSH]

Table 10: Concepts with associated keywords and MeSH terms used in PubMed search strategy.

.1.2 Embase

Concept	Keywords	EMTREE Terms
Foreign Bodies	"foreign obj*" "foreign bod*"	"foreign body"/exp
Intentional Ingestion / Self-harm	"intent*" "deliberate*" "purpose*" "self-injur*" "selfharm*" "self-harm*"	"automutilation"/exp
Ingestion Behavior	"ingest*" "swallow*"	"swallowing"/exp
Interventions	"surg*" "endoscop*" "EGD" "OGD" "Esophagogastroduodenoscopy" "Oesophagogastroduodenoscopy" "manag*"	"endoscopy"/exp "surgery"/exp "conservative treatment'/exp 'drug therapy"/exp

Table 11: Concepts with associated keywords and EMTREE terms used in Embase search strategy.

.1.3 Cochrane (CENTRAL)

Concept	Keywords	Cochrane MeSH Terms
Foreign Bodies	"foreign obj*" "foreign bod*" (foreign NEXT obj*) (foreign NEXT bod*) intent* deliberate*	[mh foreign bodies]
Intentional Ingestion / Self-harm	purpose* (self NEXT injur*) (self NEXT harm*)	[mh self-injurious behavior]
Ingestion Behavior	ingest* swallow* surg* endoscop*	—
Interventions	EGD Esophagogastroduodenoscopy Oesophagogastroduodenoscopy manag*	[mh endoscopy] [mh surgical procedures, operative] [mh conservative treatment] [mh drug therapy]

Table 12: Concepts with associated keywords and Cochrane MeSH terms used in CENTRAL search strategy.

.1.4 Web of Science

Concept	Keywords	Search Field
Foreign Bodies	foreign obj* foreign bod* automutilation intent* deliberate*	ALL=
Intentional Ingestion / Self-harm	purpose* self-injur* selfharm* self-harm*	ALL=
Ingestion Behavior	swallowing ingest* swallow* endoscopy surgery conservative treatment drug therapy	ALL=
Interventions	surg* endoscop* EGD Esophagogastroduodenoscopy Oesophagogastroduodenoscopy manag*	ALL=

Table 13: Concepts with associated keywords and Web of Science fields used in the search strategy.

.1.5 Scopus

Concept	Keywords	Search Field / Syntax
Foreign Bodies	foreign PRE/0 obj* foreign PRE/0 bod* intent* deliberate*	ALL()
Intentional Ingestion / Self-harm	purpose* self PRE/0 injur* self PRE/0 harm* ingest*	ALL()
Ingestion Behavior	swallow* endoscopy surgery 'conservative' 'treatment' 'drug' 'therapy'	ALL()
Interventions	surg* endoscop* egd esophagogastroduodenoscopy oesophagogastroduodenoscopy manag*	ALL()

Table 14: Concepts with associated keywords and Scopus syntax used in the search strategy.

.1.6 PsycINFO

Concept	Keywords	PsycINFO Descriptors
Foreign Bodies	foreign obj* foreign bod* automutilation intent*	—
Intentional Ingestion / Self-harm	deliberate* purpose* self injur* self harm*	DE "Nonsuicidal Self-Injury"
Ingestion Behavior	ingest* swallow* endoscop* conservative treatment drug therapy	DE "Ingestion"
Interventions	surg* egd esophagogastroduodenoscopy oesophagogastroduodenoscopy manag*	DE "Surgery"

Table 15: Concepts with associated keywords and controlled vocabulary (Descriptors) used in PsycINFO search strategy.

.1.7 Google Scholar

Concept	Keywords	Search Field
Foreign Bodies	"foreign obj*" "foreign bod*" "intent*" "deliberate*"	—
Intentional Ingestion / Self-harm	"purpose*" "self-injur*" "selfharm*" "self-harm*"	—
Ingestion Behavior	"ingest*" "swallow*"	—

Table 16: Concepts with associated keywords used in Google Scholar search strategy.