Does motivation matter? A systematic review and meta-analysis of outcomes following intentional foreign object ingestion.
Preliminary Data Extraction and Methodology Review.

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0.1 Methods

0.1.1 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 search for any further relevant articles. The keywords and MeSH terms used can be found in Appendix .1.

0.1.2 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)

0.1.3 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.

0.1.4 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.
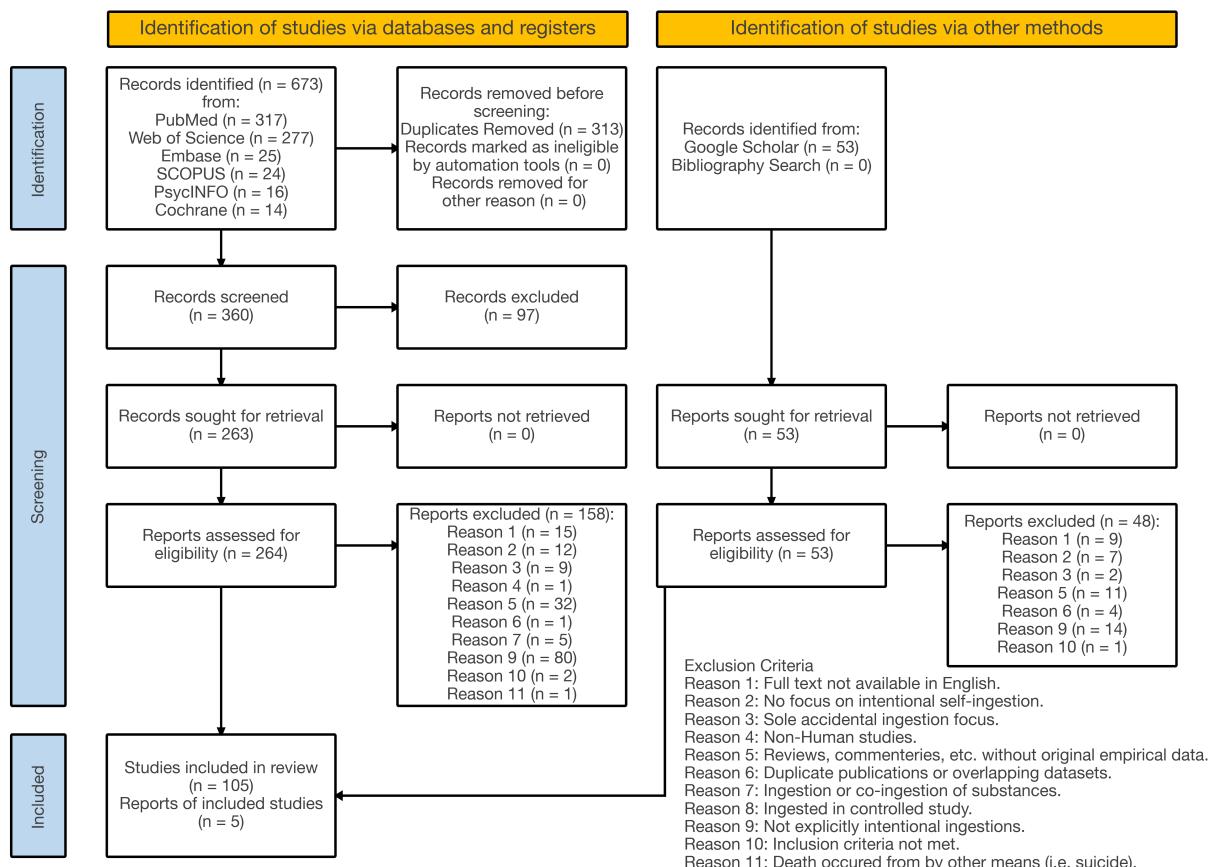

Figure 1: PRISMA 2020 flow diagram outlining the identification, screening, and inclusion of studies [1].

All identified articles were collated using Python (Pandas) [**ThePandasDevelopmentTeam˙2020a**]. 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).

0.1.5   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). This included any clinical diagnosis such as depression, anxiety disorders, psychotic disorders, personality disorders, or neurodevelopmental disorders. 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 [2]. 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: 1. Severe learning disabilities (e.g. profound intellectual disability, global developmental delay), and/or 2. 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 - 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.

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 (5cm) (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 - 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 – 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 - 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.

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 – 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.

0.2 Sources

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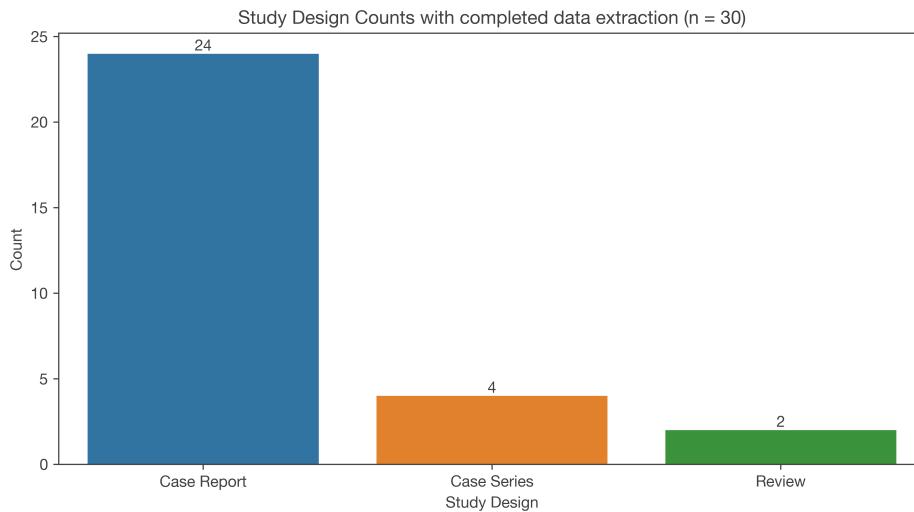
Figure 2: Bar plot showing the distribution of study design characteristics where data has been extracted.

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.

0.2.2 Sample Publication/Case Years
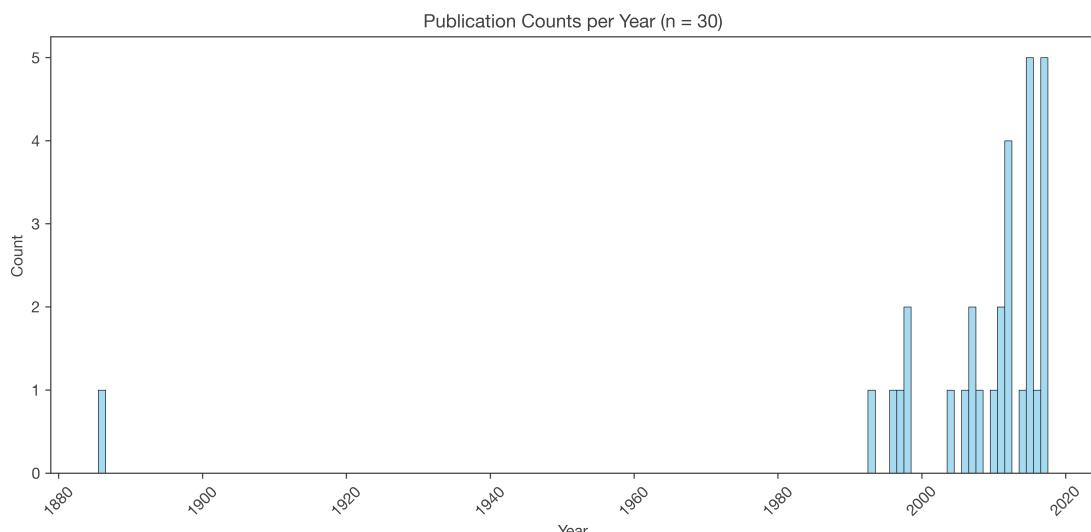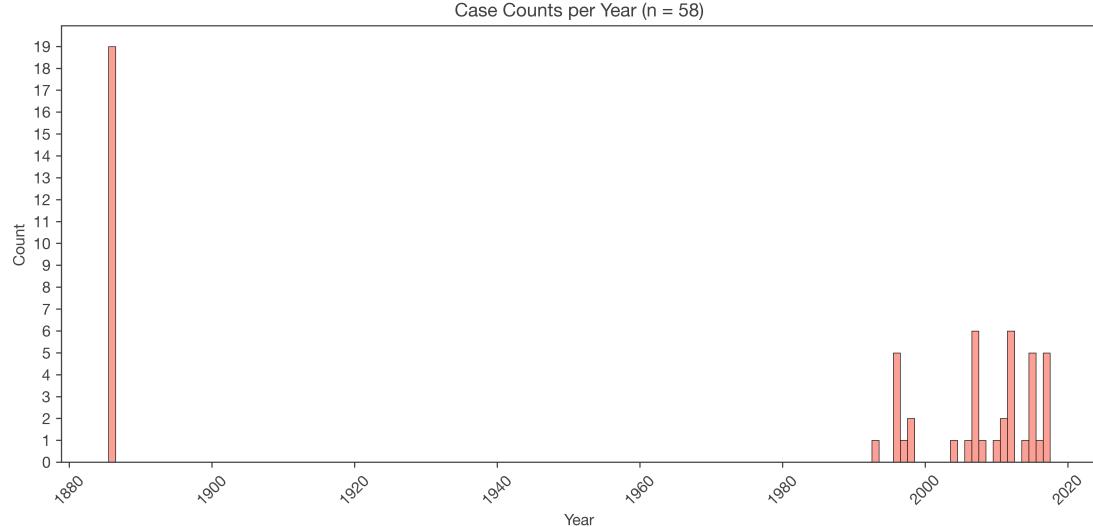
Figure 3: Histogram showing the distribution of publication dates of papers data collected from.

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.

0.3   Results

0.3.1   Age and Gender

Table 1: Summary statistics for age in years.

Statistic	Age (Years)
Count	47.0
Mean	30.2
Std	12.2
Min	12.0
25%	20.5
50%	28.0
75%	36.5
Max	62.0
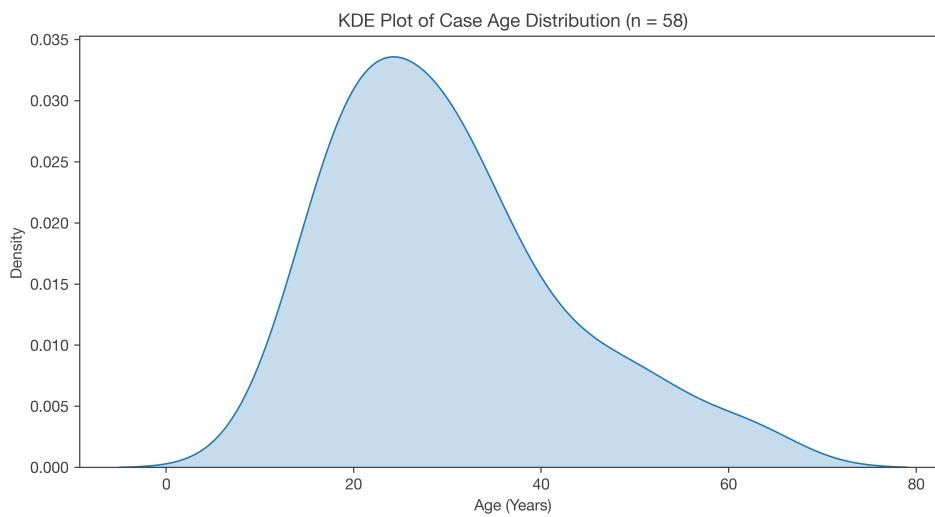
Figure 5: Kernel density estimate (KDE) plot showing the distribution of age among included cases.

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

Gender	Count (N)	Percentage (%)
Male	34	58.6
Female	19	32.8
Unknown	5	8.6

0.3.2 Subgroup Data

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

	Count (1s)	Valid N	Percentage (%)
Psych Hx	23	58	39.7
Is Prisoner	12	58	20.7
Previous Ingestions	11	58	19.0
Is Psych Inpat	4	58	6.9
Severe Disability Hx	3	58	5.2
Is Displaced Person	2	58	3.4
Under Influence Alcohol	2	58	3.4

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

|	Count (1s)	Valid N	Percentage (%)
Motivation Unknown	20	58	34.5
Motivation Other	20	58	34.5
Motivation Intent To Harm	19	58	32.8
Motivation Psychiatric	18	58	31.0
Motivation Protest	8	58	13.8
Motivation Other Long	0	39	0.0

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

	Count (1s)	Valid N	Percentage (%)
Object Long	26	58	44.8
Object Sharp	24	58	41.4
Object Multiple	23	58	39.7
Object Long Sharp	10	58	17.2
Object Magnet	3	58	5.2
Object Button Battery	0	58	0.0
Object Other Long	0	58	0.0

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

|	Count (1s)	Valid N	Percentage (%)
Outcome Surgery	42	58	72.4
Outcome Injury Needing Intervention	31	58	53.4
Outcome Perforation	21	58	36.2
Outcome Endoscopy	15	57	26.3
Outcome Other	13	58	22.4
Outcome Death	5	58	8.6
Outcome Obstruction	5	58	8.6

0.3.3   Correlations
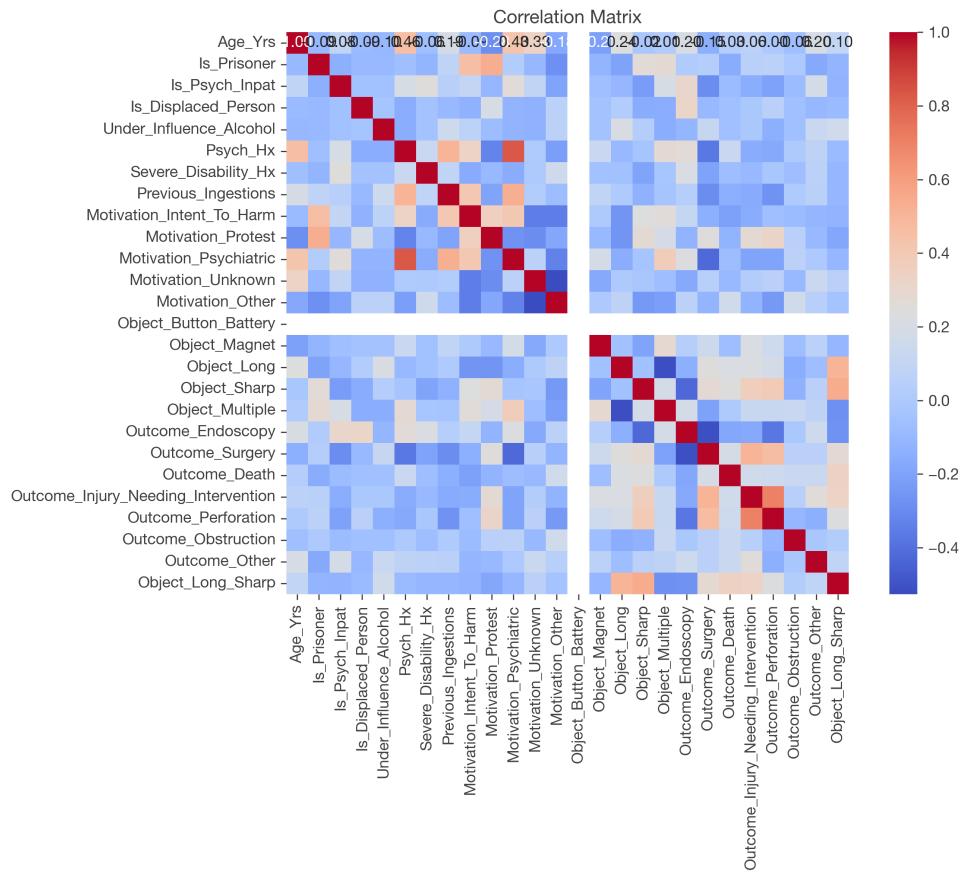
Figure 6: Correlation matrix showing correlation between variables.

Table 7: Top 30 strongest pairwise Pearson correlations between variables

Variable A	Variable B	Correlation
Psych Hx	Motivation Psychiatric	0.828000
Outcome Injury Needing Intervention	Outcome Perforation	0.703000
Object Sharp	Object Long Sharp	0.543000
Is Prisoner	Motivation Protest	0.536000
Previous Ingestions	Motivation Psychiatric	0.531000
Motivation Unknown	Motivation Other	-0.526000
Object Long	Object Multiple	-0.518000
Outcome Endoscopy	Outcome Surgery	-0.513000
Psych Hx	Previous Ingestions	0.507000
Outcome Surgery	Outcome Injury Needing Intervention	0.507000
Object Long	Object Long Sharp	0.506000
Outcome Surgery	Outcome Perforation	0.465000
Is Prisoner	Motivation Intent To Harm	0.460000
Age Yrs	Psych Hx	0.459000
Object Sharp	Outcome Endoscopy	-0.429000
Age Yrs	Motivation Psychiatric	0.427000
Motivation Psychiatric	Outcome Surgery	-0.420000
Previous Ingestions	Motivation Intent To Harm	0.412000
Motivation Intent To Harm	Motivation Psychiatric	0.405000
Object Sharp	Outcome Perforation	0.387000
Outcome Endoscopy	Outcome Perforation	-0.374000
Motivation Psychiatric	Object Multiple	0.370000
Psych Hx	Outcome Surgery	-0.367000
Object Sharp	Outcome Injury Needing Intervention	0.363000
Motivation Intent To Harm	Motivation Protest	0.360000
Motivation Intent To Harm	Motivation Unknown	-0.352000
Outcome Death	Object Long Sharp	0.348000
Psych Hx	Motivation Intent To Harm	0.335000
Outcome Injury Needing Intervention	Object Long Sharp	0.334000
Age Yrs	Motivation Unknown	0.334000

Bibliography

[1] Matthew J Page et al. "The PRISMA 2020 Statement: An Updated Guideline for Reporting Systematic Reviews". In: *BMJ* (Mar. 2021), n71. ISSN: 1756-1833. DOI: 10.1136/bmj.n71. (Visited on 12/10/2024).

[2] Francis Mading Deng, UN Representative of the Secretary-General on Internally Displaced Persons, and UN Office for the Coordination of Humanitarian Affairs. *Guiding Principles on Internal Displacement*. Tech. rep. UN Doc E/CN.4/1998/53/Add.2. United Nations Commission on Human Rights, Feb. 1998. (Visited on 03/31/2025).

.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 8: 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 9: 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*)	[mh foreign bodies]
Intentional Ingestion / Self-harm	intent* deliberate* purpose* (self NEXT injur*) (self NEXT harm*)	[mh self-injurious behavior]
Ingestion Behavior	ingest* swallow*	–
Interventions	surg* endoscop* EGD Esophagogastroduodenoscopy Oesophagogastroduodenoscopy manag*	[mh endoscopy] [mh surgical procedures, operative] [mh conservative treatment] [mh drug therapy]

Table 10: 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	ALL=
Intentional Ingestion / Self-harm	intent* deliberate* purpose* self-injur* selfharm* self-harm* swallowing	ALL=
Ingestion Behavior	ingest* swallow* endoscopy surgery conservative treatment drug therapy	ALL=
Interventions	surg* endoscop* EGD Esophagogastroduodenoscopy Oesophagogastroduodenoscopy manag*	ALL=

Table 11: 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*	ALL()
Intentional Ingestion / Self-harm	intent* deliberate* purpose* self PRE/0 injur* self PRE/0 harm*	ALL()
Ingestion Behavior	ingest* swallow*	ALL()
Interventions	endoscopy surgery 'conservative' 'treatment' 'drug' 'therapy' surg* endoscop* egd esophagogastroduodenoscopy oesophagogastroduodenoscopy manag*	ALL()

Table 12: 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*	–
Intentional Ingestion / Self-harm	automutilation intent* deliberate* purpose* self injur* self harm*	DE "Nonsuicidal Self-Injury"
Ingestion Behavior	ingest* swallow*	DE "Ingestion"
Interventions	endoscop* conservative treatment drug therapy surg* egd esophagogastroduodenoscopy oesophagogastroduodenoscopy manag*	DE "Surgery"

Table 13: 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*"	–
Intentional Ingestion / Self-harm	"intent*" "deliberate*" "purpose*" "self-injur*" "selfharm*" "self-harm*"	–
Ingestion Behavior	"ingest*" "swallow*"	–

Table 14: Concepts with associated keywords used in Google Scholar search strategy.

"foreign obj*"
"foreign bod*"
"intent*"
"deliberate*"
"purpose*"
"self-injur*"
"selfharm*"