

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

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I. ABSTRACT

Background

Intentional ingestion of foreign objects (IIFO) is a clinically distinct form of self-harm, yet its outcome profile and drivers of morbidity remain poorly defined. Whether patient motivation modifies clinical outcomes has never been systematically evaluated.

Objectives

To synthesise all available evidence on outcomes following intentional foreign-object ingestion, and to determine whether patient motivation, object characteristics, or demographic factors influence the need for intervention, risk of complications, or mortality.

Methods

A comprehensive search of PubMed, Embase, CENTRAL, Web of Science, Scopus, PsycINFO, and Google Scholar (1st January 1906–31st March 2025) identified studies reporting non-accidental ingestion of true foreign bodies in humans.

Human studies of any design, any age, reporting intentional ingestion of non-digestible foreign objects that reported outcomes of endoscopy, surgery, conservative management, complications and mortality were included. Accidental or substance ingestion, animal studies, non-English full texts, pre-1906 reports, and studies lacking motivation, object, or outcome data were excluded.

II. INTRODUCTION

A. Rationale

As of May 2024, over 100 million individuals were forcibly displaced worldwide [1]. Refugees and asylum seekers often endure extreme hardship—including violence, trauma, and detention—leading to elevated rates of mental health disorders [2–7]. Among the most alarming manifestations is self-harm, which is up to 216 times more common in offshore detention settings than in the general population [8–10]. Methods vary and include cutting, poisoning, hanging, self-immolation, and intentional ingestion of foreign objects (IIFO) [9, 11, 12].

IIFO—the non-accidental ingestion of non-nutritive items—is a serious clinical issue, with 10–20% of cases requiring endoscopy and up to 1% needing surgery [13–15]. In displaced populations, delayed access to care increases risks [16]. Rates of IIFO are

rising globally; in the U.S., cases doubled in 2017, and intentional ingestion is common in lower socioeconomic groups [17, 18]. While techniques for foreign body removal have advanced—from early gastrotomy to modern endoscopy—clinical outcomes depend on multiple factors including object characteristics, patient comorbidities, and timeliness of intervention [14, 19–25].

IIFO motivations vary widely. In detention, it may be a form of protest or communication [26]; in psychiatric contexts, it may stem from conditions like psychosis, personality disorders, pica, or malingering [27–33]. In borderline personality disorder, it may function as emotional regulation rather than a suicide attempt [27]. Rare cases of repeated IIFO have prompted palliative approaches to care [34].

Despite its growing prevalence, little research explores how these differing motivations affect clinical management and outcomes [35–37]. Understanding motivation is crucial, as it may influence decisions around intervention. For example, ingestion as protest may be less likely to involve high-risk behaviours, supporting conservative treatment [38, 39].

This review aims to examine how motivation shapes IIFO outcomes—specifically rates of endoscopic and surgical intervention, conservative management, complications, and mortality—to better guide care in vulnerable populations.

B. Objectives

The primary object of this systematic review was to quantify the rates of endoscopy, surgery, death, complication and conservative management following intentional ingestion of foreign objects in human populations. The review sought to examine how individual factors such as demographic/population characteristics, object characteristics and motivations for ingestion influence the likelihood of these outcomes.

This study was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [40]. Ethical approval was not required as all analysis was based on published data. Eligibility criteria were structured using the PICOS (Population, Intervention, Comparator, Outcome, Studies) framework.

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C. Eligibility Criteria

Category	Details
Population	Any human; any age group.
Interventions or exposures	Non-accidental ingestion of a true foreign body (non-nutritive items).
Comparators / Control group	Demographics: Gender, age, detained person, psychiatric inpatient, displaced person, under influence of alcohol, psychiatric history, severely disabled, previous ingestion. Motivation: Intent to harm, psychiatric, psychosocial, protest, other. Object characteristics: Button battery, magnet, long (>5 cm), large diameter (>2.5 cm), multiple, blunt objects, sharp-pointed objects.
Outcomes of interest	Endoscopic intervention, surgical intervention, conservative management, complication rates, mortality.
Setting	Any setting.
Study designs	Any design.

TABLE I: Inclusion criteria structured using the PICOS framework.

A full list of eligibility criteria is shown in Table ???. This is reproduced in a larger format for clarity in Appendix ???. A full list of exclusion criteria is available in Appendix ??? and in the PRISMA diagram shown in Figure ???.

D. Information Sources

Relevant articles were identified through a systematic search of PubMed, Web of Science, Embase, Scopus, PsycINFO, CENTRAL and Google Scholar during January 2025, with the assistance of a librarian. Included articles then had their bibliography’s searched by the primary author (JGE) on 14th May 2025 to identify any potential additional literature not uncovered in the primary search. The search was conducted using keywords and MeSH terms based on the concepts underpinning this review. The search queries, keywords and MeSH terms used can be found in Appendix ???.

All identified articles were collated and duplicate articles were identified and removed. Remaining articles underwent independent title and abstract screening conducted by the first author (JGE). 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). Inter-reviewer agreement was calculated using Cohen’s Kappa [41]. Remaining articles proceeded to full text review, where the same independent screening process was repeated on full text articles.

E. Data Extraction

Data were initially extracted by a single reviewer (JGE) into *Microsoft Excel* [42] and processed in *Python* [114] using *Pandas* [113]. This process is outlined in Appendix ???.

Data was first extracted from case reports. Predictors were grouped into four subgroups: gender; age group; demographic

characteristics, motivation; object characteristics. These are shortened hereafter to: gender, age group, demographic and motivation. Outcome data were extracted for rates of endoscopy, surgery, conservative management, mortality, and complications. All outcomes were binary and coded per event, rather than per individual. Predictor variables and outcome variables were not mutually exclusive, nor were outcomes. For example, patients, or ingestors – hereafter referred to as the latter – could have multiple outcomes (e.g. endoscopy and surgery) and multiple predictors from each group (e.g. intent-to-harm and other, and detained and displaced person).

After case report data extraction, data was collapsed and aggregated to form a “series”. This data was used as a template for case series data extraction to homogenise data and reduce heterogeneity.

Full definitions of all variables (predictors and outcomes) are provided in Appendix ???. The full dataset of extracted case-level and series-level data (including bias assessments), is available on Github.

F. Risk of Bias Assessment

Risk of bias was assessed manually for all included studies by a single reviewer (JGE), using the *Joanna Briggs Institute (JBI) Critical Appraisal Checklists for Case Reports and Case Series* [43]. Studies were first classified as either case reports or case series based on the level of granularity in the data. Each study was then evaluated using the corresponding JBI tool. A novel computational risk of bias filter was then applied in *Pandas* [113]. That process is outlined in Appendix ???.

G. Synthesis Methods

Associations between binary predictors and outcomes were assessed using univariate logistic regression, reporting odds ratios (ORs), 95% confidence intervals, and p-values. Where appropriate, chi-squared (χ^2) tests were also used to evaluate differences in outcome proportions between groups [41].

Multivariable logistic regression was not performed due to the limited sample size, high collinearity between predictors (e.g., overlapping motivations), and the exploratory nature of the analysis.

For series-level data, univariate meta-regression will be conducted to assess associations between binary series-level predictors and pooled outcome proportions, where sufficient data are available. Each predictor will be entered separately to account for incomplete reporting across studies and to avoid overfitting. Effect estimates will be reported as odds ratios (ORs) with 95% confidence intervals, using a random-effects model with restricted maximum likelihood (REML) estimation [44].

Due to the inclusion of primarily case reports and small case series, formal assessment of reporting bias (e.g., via funnel plots or statistical tests for asymmetry) was not feasible.

Confidence in the body of evidence was not formally graded but was considered low to very low due to reliance on uncontrolled observational designs, small sample sizes, and incomplete reporting.

III. RESULTS

A. Study Selection

A total of 808 records were identified through initial database searches: PubMed (317), Web of Science (277), Google Scholar

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

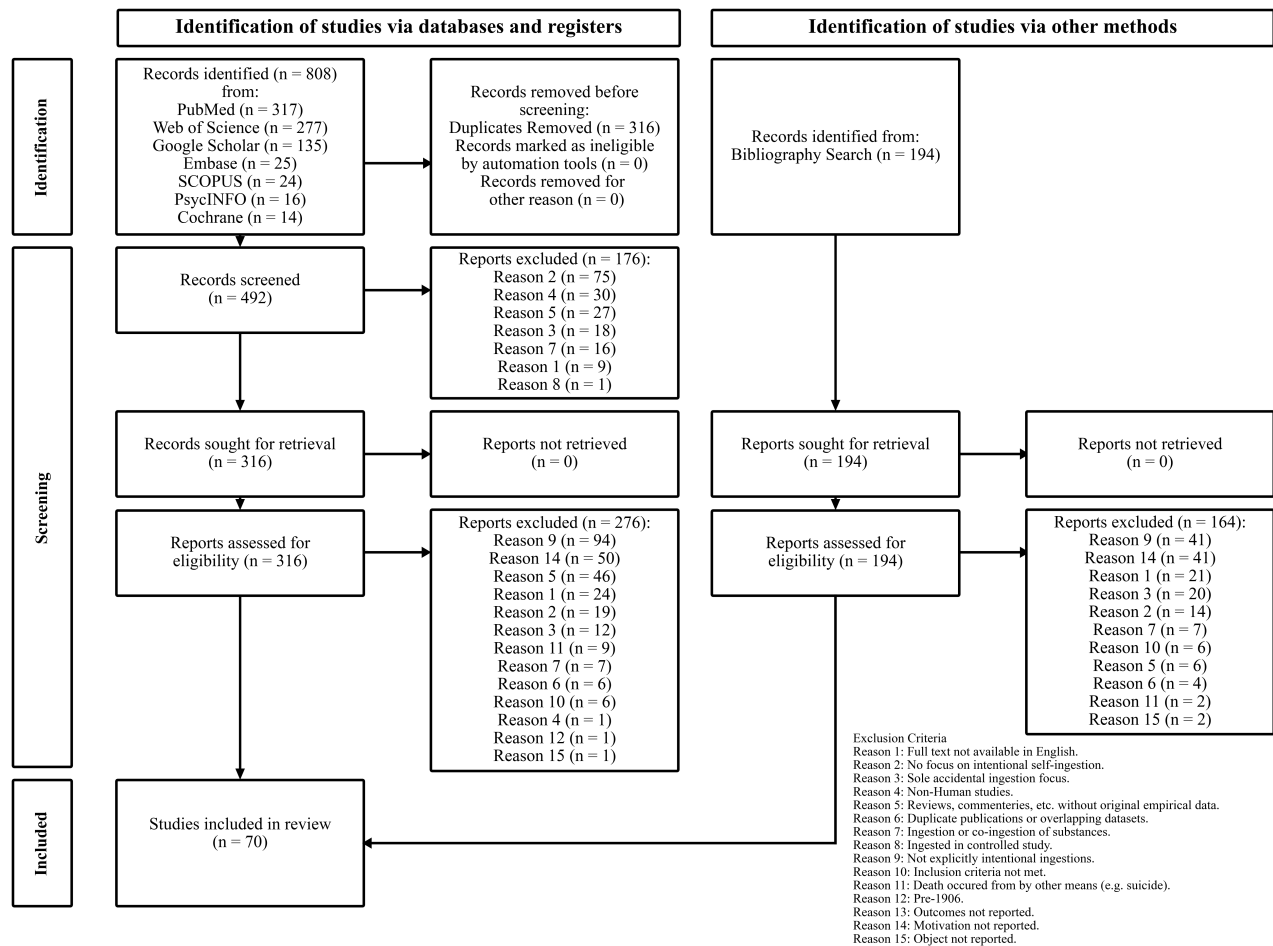


Fig. 1: PRISMA flow diagram summarising the study selection process.

(135), Embase (25), SCOPUS (24), PsycINFO (16), and Cochrane (14). 316 duplicates were identified and removed.

Title and abstract screening was undertaken, with JGE reviewing all 492 records. A random sample of 50 records was generated for independent screening MS. Cohen's Kappa was calculated for inter-reviewer agreement between JGE and MS, yielding a value of 0.38, indicating fair agreement. Where JGE and MS disagreed, 16 records were reviewed by GC. In total, 176 records were excluded, leaving 316 for full text review.

During full text review, JGE reviewed all 316 records. A random sample of 32 records was generated for independent review by MS. Inter-reviewer agreement was again calculated using Cohen's Kappa, yielding a value of 0.21, indicating fair agreement. Where JGE and MS disagreed, 5 records were reviewed by GC. In total, 276 records were excluded during full text review. 40 records were included and proceeded to bibliography search.

The bibliographies of the 40 included papers were searched by manually JGE. Relevant bibliography items were identified, collated, and evaluated against the eligibility criteria, yielding 194 results.

These 194 results were reviewed by JGE. 164 bibliography search records were excluded, leaving 30 for inclusion.

Therefore, a total of 70 records were included in this study and proceeded to bias assessment. This process is illustrated in

Figure ??.

B. Risk of Bias

Case Reports: 75 cases from 67 studies [33, 38, 45–109] were evaluated using the *JBIChecklist for Case Reports* [43]. 3 cases were excluded. Cases were excluded at this stage if they failed to describe the following domains: patient history and timeline (1 case) [82], current patient condition (2 cases) [82], interventions and treatments (1 case) [94], patient post-intervention condition (2 cases) [82], harms (2 cases) [82], and takeaway lessons (2 cases) [82]. The excluded cases came from the following studies: [82, 94]. Of the remaining 71 cases, all reported interventions and treatments (71 cases, 100%) [33, 38, 45–81, 83–93, 95–101, 103–109]. Most clearly described patient history and timeline (70 cases, 99%) [33, 38, 45–59, 61–81, 83–93, 95–101, 103–109], patient post-intervention condition (69 cases, 97%) [33, 38, 45–80, 83, 85–93, 95–101, 103–109], takeaway lessons (69 cases, 97%) [33, 38, 45–59, 61, 63–81, 83–93, 95–101, 103–109], patient demographic (68 cases, 96%) [38, 45–54, 56–81, 83–93, 95–101, 103, 104, 106–109], and current patient condition (68 cases, 96%) [33, 38, 45–65, 67–81, 83–93, 95–101, 103–109]. Reporting was also strong for harms (38 cases, 93%) [49, 50, 54–59, 61, 63, 67, 69, 70, 76, 77, 79, 80, 84, 85, 87–89, 96–101, 103–105, 107,

108], and diagnostic assessments (65 cases, 92%) [33, 38, 45–59, 61–65, 67–71, 73–81, 83–93, 95–101, 103–109].

Case Series: Separately, 3 studies [110–112] were evaluated using the *JBIChecklist for Case Series* [43]. Reporting quality was generally high across all JBI domains. All included case series fully reported clear inclusion criteria, standard condition measurements, valid patient identification methods, complete inclusion, clear demographic information, clear clinical information, clear outcome and follow-up, and appropriate statistical analysis [110–112]. However, fewer studies (2) reported consecutive inclusion, and clear site demographic information [110, 111].

C. Study Characteristics

1) Case Reports: A total of 71 cases were reported 33 countries [33, 38, 45–81, 83–93, 95–101, 103–109].

The top three countries represented were the United States of America ($n = 12$), India ($n = 7$), and the United Kingdom ($n = 7$). The median number of case reports per country was 1.0 (IQR = 1.0[range 1-12])

Cases were present from a wide age range (7 to 100 years) with a median age of 28 year [IQR = 18].

The majority of cases were reported in males (60% vs 39%), with 1 case of unknown gender.

Half of cases had a psychiatric history and over a quarter (26%) had ingested previously. 17% were detained, 6% were psychiatric inpatients, 10% had a severe disability and 3% ($65 = 2$) were displaced persons.

Psychiatric motivation was reported in nearly half of cases (48%), with intent-to-harm and psychosocial reported in 29% and 23% of cases respectively. Protest was reported in 11% of cases and other in 12%.

Most ingestions involved large (> 2.5cm) diameter (72%), sharp (62%) objects and multiple object ingestion (62%). Almost 50% of cases (48%) involved sharp and sharp (45%) object ingestion. Fewer ingestions involved magnets (12%) and button batteries (2%)

Complication rates were high (66%), as were rates of endoscopy and surgery (61% and 44% respectively). Cases were only managed conservatively 10% of the time. The mortality rate in case reports was 2.8%. Object

A table of case-level characteristics is shown in Table ehtab:case_summary

2) Case Series: 4 studies were case series, yielding 180 cases [110–112]. Case series were present from the United States of America [111], South Korea [112] and Tunisia [110].

Values reported herein are mean averages across all case series. Unreported variables are treated as 0.

All cases were male, aged 17–50 years and detained 33% had a psychiatric history (range 82-95%) - no psychiatric inpatients.

Demographic predictors were poorly recorded. Previous ingestion rates were only reported in one series at 11%. There was no severe disability (not reporting in two series). Data on displaced person and alcohol influence were not reported at all.

Motivations were predominantly protest (78%, range 16-97%); psychiatric in 13% (63.2% in one series, 0% in the other two); intent-to-harm in 7% (range 0-21%). There were no reports of other motivation or psychosocial motivation.

One series only report sharp object ingestion and no other object characteristics [111]. In the other two series, overall

ingestion involved a sharp object in most cases (76%, range 64-100%). Long objects were ingested 37% of cases (36

In terms of outcomes, complications were only reported in one series [112], data was absent from the other two. Endoscopy occurring in 52% (range 5-89%), although it was unreported in one series [111]. Surgery occurred following 17% of ingestions (range 12-26%), conservative management following 32% (0% in one case and above 70% in the other two).

A full list of grouped series-level characteristics and outcomes is available in Table ??.

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TABLE II: Case-level summary statistics.

Variable	Count	Percentage	References
<i>Age</i>			
Max	100		[83]
Mean	30		
Median	28		
IQR	18		
Min	7		[84, 89]
<i>Gender</i>			
Male	43	61%	[33, 45, 46, 48, 49, 51–53, 55, 56, 59, 60, 64, 67–70, 72, 74, 75, 79–81, 84–87, 91, 92, 95, 97–101, 103, 106, 109]
Female	27	38%	[38, 47, 50, 54, 57, 58, 61–63, 65, 66, 71, 73, 76–78, 83, 88–90, 93, 96, 104, 105, 107]
Unknown	1	1%	[108]
<i>Demographic</i>			
Psychiatric History	36	51%	[38, 47, 48, 50, 52–54, 60, 62, 65, 66, 68, 69, 72–76, 78–81, 84, 86, 87, 89, 90, 93, 96–98, 107–109]
Prior Ingestion	19	27%	[48, 52, 56, 58, 64, 66, 67, 72, 74, 75, 84, 93, 98, 100, 107–109]
Detained	12	17%	[33, 48, 51, 52, 85, 91, 97, 101]
Severe Disability	7	10%	[53, 78, 84, 89, 90, 107, 109]
Psychiatric Inpatient	4	6%	[66, 108, 109]
Alcohol	3	4%	[55, 64, 100]
Displaced Person	2	3%	[45, 70]
<i>Motivation</i>			
Psychiatric	34	48%	[38, 46, 48, 50, 52, 53, 57, 58, 65–68, 72–81, 83, 84, 87, 89, 93, 96–98, 106, 109]
Intent-to-Harm	21	30%	[33, 46–49, 60, 62–64, 69, 83, 85, 86, 93, 97, 98, 108]
Psychosocial	16	22%	[45, 55, 58, 61, 71, 73, 79, 83, 88, 91, 92, 95, 99, 100, 104, 105]
Other	9	13%	[50, 51, 67, 72, 90, 93, 101, 103, 107]
Protest	8	11%	[33, 59, 70, 85]
<i>Object</i>			
Large (>2.5cm) Diameter	51	72%	[33, 45–49, 51–53, 56, 57, 60–64, 66, 67, 70, 72, 74, 75, 77–81, 85–93, 96, 98, 100, 101, 105, 107–109]
Multiple	44	62%	[38, 50, 52–54, 58–61, 67–69, 71–77, 79–81, 83–89, 95–100, 103, 104, 106, 108, 109]
Sharp	34	48%	[33, 38, 47, 48, 52, 55, 57, 58, 60, 64–69, 72–75, 77, 79, 81, 85–87, 95, 106, 109]
Long (>5cm)	32	45%	[46, 47, 49, 51, 53, 57, 60, 62–64, 66, 67, 69, 70, 75, 77–79, 81, 86, 87, 89, 91, 93, 96, 100, 101, 106, 107, 109]
Magnet	9	13%	[50, 59, 61, 84, 88, 89, 98, 99, 104]
Button Battery	2	3%	[56, 59]
<i>Outcome</i>			
Complication	47	66%	
Surgery	43	61%	
Endoscopy	31	44%	
Conservative	7	10%	
Death	2	3%	

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TABLE III: Grouped aggregate series-level summary.

Variable	Pooled	Karp <i>et al.</i> (1991) [111]	Lee <i>et al.</i> (2007) [112]	Elghali <i>et al.</i> (2016) [110]
<i>Total Cases</i>	90	19	52	19
<i>Gender</i>				
Male	90 (100%)	19 (100%)	52 (100%)	19 (100%)
Female	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Unknown	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<i>Age</i>				
Min	17	17	25	19
Max	50	40	50	27
Median	35	—	35	—
Mean	24	24	—	24
<i>Demographic</i>				
Detained	90 (100%)	19 (100%)	52 (100%)	19 (100%)
Psychiatric History	30 (33%)	18 (95%)	9 (18%)	2 (12%)
Prior Ingestion	2 (2%)	—	—	2 (10%)
Psychiatric Inpatient	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Displaced Person	0 (0%)	—	—	—
Alcohol	0 (0%)	—	—	—
Severe Disability	0 (0%)	—	0 (0%)	—
<i>Motivation</i>				
Protest	70 (78%)	3 (16%)	50 (97%)	17 (90%)
Psychiatric	12 (13%)	12 (63%)	0 (0%)	0 (0%)
Intent-to-Harm	6 (7%)	4 (21%)	0 (0%)	2 (10%)
Psychosocial	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Other	0 (0%)	0 (0%)	0 (0%)	0 (0%)
<i>Object</i>				
Sharp	68	19	33	16
Long (>5cm)	32	—	32	0
Multiple	25	—	24	1
Button Battery	0	—	0	0
Magnet	0	—	0	0
Large (>2.5cm) Diameter	0	—	—	—
<i>Outcome</i>				
Endoscopy	47 (52%)	—	46 (88%)	1 (5%)
Conservative	29 (32%)	14 (74%)	0 (0%)	15 (79%)
Surgery	15 (17%)	5 (26%)	6 (12%)	4 (21%)
Complication	6 (7%)	—	6 (12%)	—
Death	1 (1%)	0 (0%)	0 (0%)	1 (5%)

Key: n (%).

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APPENDIX A SEARCH STRATEGY

1) Keywords and MeSH Term:

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

2) PubMed:

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

3) Embase:

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

4) *Cochrane (CENTRAL):*

Concept	Keywords	Search Field
Foreign Bodies	foreign obj* foreign bod* automutilation intent* deliberate*	ALL=
Intentional Ingestion / Self-harm	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 VII: Concepts with associated keywords and Web of Science fields used in the search strategy.

5) *Web of Science:*

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*	ALL()
Ingestion Behavior	ingest* swallow* endoscopy surgery 'conservative' 'treatment' 'drug' 'therapy'	ALL()
Interventions	surg* endoscop* egd esophagogastroduodenoscopy oesophagogastroduodenoscopy manag*	ALL()

TABLE VIII: Concepts with associated keywords and Scopus syntax used in the search strategy.

6) *Scopus*:

Concept	Keywords	PsycINFO Descriptors
Foreign Bodies	foreign obj* foreign bod* automutilation intent* deliberate*	–
Intentional Ingestion / Self-harm	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 IX: Concepts with associated keywords and controlled vocabulary (Descriptors) used in PsycINFO search strategy.

7) *PsycINFO*:

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

8) *Google Scholar*:

Database Searches

PubMed Query:

```
("Foreign Bodies"[MeSH] OR "foreign obj*" OR "foreign bod*")
AND
("Self-Injurious Behavior"[MeSH] OR "intent*" OR "deliberate*" OR "purpose*" OR "self-injur*" OR "selfharm*" OR
"self-harm*")
AND
("ingest*" OR "swallow*")
AND
("Endoscopy"[MeSH] OR "Surgical Procedures, Operative"[MeSH] OR "Conservative Treatment"[MeSH] OR "Drug
Therapy"[MeSH] OR "surg*" OR "endoscop*" OR "EGD" OR "OGD" OR "Esophagogastroduodenoscopy" OR "Oe-
sophagogastroduodenoscopy" OR "manag*")
```

Embase Query (All Fields):

```
('foreign body'/exp OR "foreign obj*" OR "foreign bod*")
AND
('automutilation'/exp OR "intent*" OR "deliberate*" OR "purpose*" OR "self-injur*" OR "selfharm*" OR "self-harm*")
AND
('swallowing'/exp OR "ingest*" OR "swallow*")
AND
('endoscopy'/exp OR 'surgery'/exp OR 'conservative treatment'/exp OR 'drug therapy'/exp OR "surg*" OR "endoscop*"
OR "EGD" OR "OGD" OR "Esophagogastroduodenoscopy" OR "Oesophagogastroduodenoscopy" OR "manag*")
```

CENTRAL (Cochrane) Query (All Fields):

```
([mh "foreign bodies"] OR ("foreign" NEXT "obj*") OR ("foreign" NEXT "bod*"))
AND
([mh "self-injurious behavior"] OR "intent*" OR "deliberate*" OR "purpose*" OR ("self" NEXT "injur*") OR ("self"
NEXT "harm*"))
AND
("ingest*" OR "swallow*")
AND
([mh "endoscopy"] OR [mh "surgical procedures, operative"] OR [mh "conservative treatment"] OR [mh "drug therapy"]
OR "surg*" OR "endoscop*" OR "EGD" OR "Esophagogastroduodenoscopy" OR "Oesophagogastroduodenoscopy" OR
"manag*")
```

Web of Science Query: **Link:** <https://www.webofscience.com/wos/woscc/summary/4da44d48-3e09-4a94-a3bd-ff8139e94859-01387ccd63/relevance/1>

```
ALL=("foreign obj*" OR "foreign bod*")
AND
ALL=("automutilation" OR "intent*" OR "deliberate*" OR "purpose*" OR "self-injur*" OR "selfharm*" OR "self-harm*")
AND
ALL=("swallowing" OR "ingest*" OR "swallow*")
AND
ALL=("endoscopy" OR "surgery" OR "conservative treatment" OR "drug therapy" OR "surg*" OR "endoscop*" OR "EGD"
OR "Esophagogastroduodenoscopy" OR "Oesophagogastroduodenoscopy" OR "manag*")
```

Scopus Query:

```
ALL ("foreign PRE/0 obj*" OR "foreign PRE/0 bod*")
AND
ALL ("intent*" OR "deliberate*" OR "purpose*" OR "self PRE/0 injur*" OR "self PRE/0 harm*")
AND
ALL ("ingest*" OR "swallow*")
AND
ALL ("endoscopy" OR "surgery" OR "conservative" OR "treatment" OR "drug" OR "therapy" OR "surg*" OR "endoscop*"
OR "EGD" OR "Esophagogastroduodenoscopy" OR "Oesophagogastroduodenoscopy" OR "manag*")
```

PsycINFO Query: **Link:** [https://search.ebscohost.com.ezproxy.library.qmul.ac.uk/login.aspx?direct=true&db=psyh&bquery=\(foreign+obj*+OR+foreign+bod*\)+AND+\(DE+%26quot%3bNonsuicidal+Self-Injury%26quot%3b+OR+automutilation+OR+intent*+OR+deliberate*+OR+purpose*+OR+self+injur*+OR+self+harm*\)+AND+\(DE+%26quot%3bIngestion%26quot%3b+OR+ingest*+OR+swallow*\)+AND+\(DE+%26quot%3bSurgery%26quot%3b+OR+endoscop*+OR+conservative+treatment+OR+drug+therapy+surg*+OR+endoscop*+OR+egd+OR+esophagogastroduodenoscopy+OR+oesophagogastroduodenoscopy+OR+manag*\)&type=0&searchMode=Standard&site=ehost-live](https://search.ebscohost.com.ezproxy.library.qmul.ac.uk/login.aspx?direct=true&db=psyh&bquery=(foreign+obj*+OR+foreign+bod*)+AND+(DE+%26quot%3bNonsuicidal+Self-Injury%26quot%3b+OR+automutilation+OR+intent*+OR+deliberate*+OR+purpose*+OR+self+injur*+OR+self+harm*)+AND+(DE+%26quot%3bIngestion%26quot%3b+OR+ingest*+OR+swallow*)+AND+(DE+%26quot%3bSurgery%26quot%3b+OR+endoscop*+OR+conservative+treatment+OR+drug+therapy+surg*+OR+endoscop*+OR+egd+OR+esophagogastroduodenoscopy+OR+oesophagogastroduodenoscopy+OR+manag*)&type=0&searchMode=Standard&site=ehost-live)

```
("foreign obj*" OR "foreign bod*")
AND
```

(DE “Nonsuicidal Self-Injury” OR “automutilation” OR “intent*” OR “deliberate*” OR “purpose*” OR “self injur*” OR “self harm”)

AND

(DE “Ingestion” OR “ingest*” OR “swallow”)

AND

(DE “Surgery” OR “endoscop*” OR “conservative treatment” OR “drug therapy” OR “surg*” OR “endoscop*” OR “EGD” OR “Esophagogastroduodenoscopy” OR “Oesophagogastroduodenoscopy” OR “manag”)

Grey Literature

Google Scholar:

(“foreign obj*” OR “foreign bod”)

AND

(“intent*” OR “deliberate*” OR “purpose*” OR “self-injur*” OR “selfharm*” OR “self-harm”)

AND

(“ingest*” OR “swallow”)

APPENDIX B

COMPUTATIONAL RISK OF BIAS ASSESSMENT

To reduce bias dilution of intentionality effect, a novel computation risk of bias assessment was undertaken, using a combination of human review followed by computational risk of bias assessment. First, the author (JGE) extracted data into Microsoft Excel [42]. Then, a computation risk of bias filter was applied to extracted case report and case series data. That process is outlined in this appendix.

Case Reports

For case reports, the JBI Checklist for Case Reports was used. This tool assesses eight domains of reporting quality, including whether patient demographics were clearly described, a timeline of clinical history was provided, the presenting condition and diagnostic assessment were outlined, and whether the intervention, post-intervention condition, and any adverse events were reported. The final domain evaluates whether the case provides meaningful takeaway lessons.

In addition to manual JBI appraisal, a logic-based validation filter was applied to all case reports using *Python Pandas* [113]. This secondary filter assessed whether key variables — specifically, outcomes, object characteristics, and motivation — were completely unreported. For each domain, a binary flag was generated:

- *Outcome_Unknown* was marked 1 if all outcome-related fields were either missing or marked as unknown.
- *Object_Unknown* was marked 1 if all object-related fields (excluding *Object_Other_Long*) were missing or unknown.
- *Motivation_Unknown* was predefined in the dataset and indicated absence of motivational information.

If any of these flags were triggered, the corresponding JBI item most affected by the missing domain was marked as not reported (e.g., *Post_Intervention_Condition_Described* or *History_Timeline* set to N). Finally, an *Overall_Appraisal* score of *Exclude* was assigned, indicating high risk of bias and exclusion from analysis. This ensured that only case reports with sufficient information to meaningfully contribute to the review question were retained.

Case Series

For case series, the JBI Checklist for Case Series was applied. The JBI Checklist for Case Series assesses 10 domains of methodological and reporting quality. These include whether the case series defined clear inclusion criteria, applied valid and consistent methods to identify the condition, and included participants consecutively and completely. The checklist also evaluates whether participant demographics and clinical information were clearly reported, whether outcomes or follow-up results were adequately described, and whether the study setting was detailed. Finally, it considers whether the statistical analysis used was appropriate for the data presented.

In addition to manual JBI appraisal, a logic-based exclusion filter was applied using *Python Pandas* [113]. This filter assessed whether key variables — specifically, motivation, object characteristics, and outcomes — were unreported for the entire study population. For each of these domains, a derived rate variable was calculated:

- *Outcome_Unknown_Rate* was marked as 1 if all outcome-related fields were missing or marked as unknown (i.e. the entire population had an unknown outcome).
- *Motivation_Unknown_Rate* indicated whether motivation was absent or only partially reported across cases within the study.
- *Object_Unknown_Rate* was derived if all object-related fields were missing or unknown.

If any of these indicators were flagged, the corresponding JBI checklist item (e.g., *Clear_Outcome_Followup_Reported*, *Clear_Demographic_Reporting*, or *Clear_Clinical_Info_Reporting*) was marked as N, and the study received an *Overall_Appraisal* of *Exclude*. This logic-based validation ensured that case series lacking essential variables could be systematically excluded from the final analysis, maintaining consistency with the review question and minimising risk of bias in the dataset.

APPENDIX C

DATA EXTRACTION

A. Process

Data were initially extracted by a single reviewer (JGE) into *Microsoft Excel* [42]. Variables for extraction were developed iteratively through engagement with the literature and analysis of consistent reporting patterns. A preliminary review of the first 30 case reports informed the development of additional data categories, which were subsequently applied to the remaining reports.

Following initial extraction, data were imported into *Python* [114] for further processing and analysis. The Python-based pipeline included data cleaning, validation, and transformation to ensure consistency across heterogeneous study formats. These structured data were then used to guide the extraction of aggregate data from case series. Studies were grouped for extraction based on their classification as case reports or case series. Where case series contained sufficiently granular data, cases were extracted individually and treated as case reports; otherwise, data were extracted at the aggregate level. Case grouping for analysis followed the criteria for inclusion as individual case reports or case series, as defined above. Relevant data from reviews and other literature types were recorded under the case report category.

B. Variables

C. Definitions

For the purposes of this study, “surgery” was defined as “any operative intervention performed in a sterile operating theatre under general or regional anaesthesia, involving incision or surgical access to body cavities (including laparotomy, laparoscopy, thoracotomy, or cervical exploration) for the purpose of removing an ingested object or managing complications of ingestion”. Procedures performed “solely via flexible or rigid endoscopy through natural orifices” were categorised as “endoscopy” and not considered surgical interventions.

APPENDIX D

SCREENING PROCESS

A total of 808 records were identified through initial database searches: PubMed (317), Web of Science (277), Google Scholar

(135), Embase (25), SCOPUS (24), PsycINFO (16), and Cochrane (14). 316 duplicates were identified and removed.

Title and abstract screening was undertaken, with JGE reviewing all 492 records. A random sample of 50 records was generated for independent screening MS. Cohen's Kappa was calculated for inter-reviewer agreement between JGE and MS, yielding a value of 0.38, indicating fair agreement. Where JGE and MS disagreed, 16 records were reviewed by GC. In total, 176 records were excluded, leaving 316 for full text review.

During full text review, JGE reviewed all 316 records. A random sample of 32 records was generated for independent review by MS. Inter-reviewer agreement was again calculated using Cohen's Kappa, yielding a value of 0.21, indicating fair agreement. Where JGE and MS disagreed, 5 records were reviewed by GC. In total, 276 records were excluded during full text review. 40 records were included and proceeded to bibliography search.

The bibliographies of the 40 included papers were searched by manually JGE. Relevant bibliography items were identified, collated, and evaluated against the eligibility criteria, yielding 194 results.

These 194 results were reviewed by JGE. 164 bibliography search records were excluded, leaving 30 for inclusion.

Therefore, a total of 70 records were included in this study and proceeded to bias assessment. This process is illustrated in Figure ??.