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

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I. Abstract

II. Introduction

Rationale

The global displacement crisis has reached unprecedented levels, with over 100 million forcibly displaced individuals reported by the United Nations High Commissioner for Refugees (UNHCR) as of May 2024 [1]. Refugees and asylum seekers often endure extreme hardships, compelling them to seek asylum in foreign countries [2,3]. This vulnerable population frequently faces compounded mental health challenges due to traumatic pre-migration experiences, hazardous journeys, and difficult post-migration realities, including detention and instability of legal status [4–7].

Self-harm, encompassing various behaviours where individuals inflict harm on themselves, is a particularly alarming manifestation of these mental health challenges. Rates of self-harm are significantly elevated among asylum seekers and refugees compared to general populations, especially among those who are detained, with rates up to 216 times higher in offshore detention facilities than in the general population [8–10].

Methods of suicide and self-harm among refugees differ based on available means, cultural factors, and motivating factors [11]. Common methods include cutting, self-battery, attempted hanging, self-poisoning by medication or chemicals, and intentional ingestion of foreign objects [9].

Intentional ingestion of foreign objects (IIFO) is defined as non-accidental ingestion of a true foreign body (non-nutritive items)[12]. Most ingested foreign bodies (80–90%) pass spontaneously, but 10–20% require endoscopic removal and up to 1% need surgery. Timely assessment and intervention are critical [13,14]. In refugee contexts, however, geographic isolation and limited access to advanced care complicate timely management, potentially increasing morbidity and mortality [15].

Globally, rates of IIFO are increasing. In the United States, rates doubled in 2017, with 14% of cases deemed intentional [16]. A 2009 review found intentional ingestions in up to 92% of adults from lower socioeconomic populations, suggesting that rates may be even higher among refugees and asylum seekers [17].

Management of IIFO has been evolving since 1635, when Daniel Schwaban recorded the first gastrotomy on a man who had swallowed a knife [18]. In 1738, Gorsauld is credited as the first surgeon to perform a cervical esophagotomy for the removal of a foreign body (FB) [19]. In 1906, José Goyanes extracted a coin impacted in the esophagus using a rigid esophagoscope for the first time [20]. The early 20th century saw the emergence of rigid esophagoscopy as the first large-scale method for foreign body extraction, with further case series detailing technical refinements appearing in the literature [21,22]. Among the most extraordinary documented cases is that by Chalk, who reported a psychiatric patient ingesting 2,533 objects weighing a total of 21,268 grams [23]. The largest single ingested item reported measured 28 cm in length [24].

Clinical outcomes are influenced by various factors, including patient age, comorbidities, object characteristics (size, shape, composition, anatomical location), and the time elapsed since ingestion and current guidance advises invasive foreign object extraction guidance based on these factors [13].

Literature to date largely focuses on IIFO in prisons or psychiatric contexts, with sparse data from displaced or asylum-seeking populations. In detention, where traditional communication channels are obstructed, ingestion may serve as a form of protest or distress signal [25]. Conversely, in psychiatric settings, ingestion may reflect mental illness or affective dysregulation [26–30].

Psychiatric conditions most frequently associated with intentional ingestion of foreign objects (IIFO) include psychosis, malingering, pica, and personality disorders [26,31].

Malingering can present in various forms, particularly in prison populations where manipulation to trigger medical transfer is a noted motivation [26,31,32]. In such cases, the optimal management often involves brief medical intervention with minimal reinforcement, followed by prompt return to custody [33]. In contrast, individuals with obsessive-compulsive disorder (OCD) may describe escalating anxiety prior to ingestion followed by a sense of relief afterward [31].

In cases involving borderline personality disorder, Gitlin et al. [26] suggest that IIFO may function as an affect regulation strategy, particularly during episodes of perceived abandonment. While such behaviour may appear life-threatening, it should not be presumed to indicate suicidal intent [31].

In rare and severe cases, some authors have proposed a palliative care approach to repeated IIFO, recognising the limited prognosis associated with treatment-resistant psychiatric illness and the cumulative harms of repeated surgical intervention [34].

Despite the rising prevalence, the heterogeneity in populations engaging in, and the potential severity of IIFO, there is limited research exploring how motivations for ingestion differ across populations and how these motivations may influence clinical outcomes [35–37]. Varying motivations likely influence clinical management, including decisions around the need for endoscopic or surgical intervention. For instance, if ingestion is primarily intended as protest, patients may avoid behaviours that risk

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severe harm, potentially lowering the threshold for conservative management.

This systematic review aims to address these gaps by evaluating how motivation for IIFO influences clinical outcomes. Specifically, we aim to examine how different motivations impact rates of endoscopic and surgical interventions, in the hope of informing future clinical strategies and healthcare responses. The protocol adheres to PRISMA guidelines [38].

Objectives

This systematic review aims to quantify the rates of endoscopic and surgical interventions following intentional ingestion of foreign objects in human populations. It also seeks to examine how individual factors—such as demographic characteristics, object characteristics and motivations for ingestion (including protest, self-harm, or suicidal intent)—influence the likelihood of requiring endoscopic or surgical procedures and the incidence of complications.

III. Methods

Eligibility Criteria

This review included studies involving human participants of any age who had non-accidental ingestion of a true foreign body (non-nutritive items). Studies were only included if they reported on all of the following data: motivations for ingestion (such as protest, suicidal intent, self-harm, or psychiatric conditions); management strategies (including whether conservative, endoscopic, or surgical treatment was used); and object characteristics such as type (e.g., blunt, sharp, long, short, multiple objects). All settings were eligible, and a wide range of study designs were accepted, including observational studies (cohort, case-control, cross-sectional), case series, clinical trials, and case reports.

A full list of eligibility criteria is availabe in Appendix **??** and a full list of exclusion criteria is available in Appendix **??**.

Information Sources

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. Included articles then had their bibliography's searched by the primary author (JGE) on 14th May 2025.

Search Strategy

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 **??**.

Selection Process

All identified articles were collated, duplicate articles were identified and removed. Following duplicate removal, all remaining articles underwent independent 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) during both stages. Any discrepancies identified between these two reviewers were resolved by a third reviewer (GC). Inter-reviewer agreement was calculated at each screening stage using Cohen's Kappa.

Data Collection Process

Data were extracted by a single reviewer (JGE) into an Excel [39] spreadsheet. Variables for extraction were developed through an iterative process of engaging with the literature and identifying consistent patterns in the data reported. A preliminary analysis of the first 30 case reports informed the development of additional data categories, which were subsequently applied to the remaining reports. Once the case report data were extracted, these structured variables were used to guide the extraction of aggregate data from case series. Studies were grouped for extraction according to 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 was based on whether they met 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.

Data Items

Data were extracted for a range of outcomes, including rates of endoscopic and surgical intervention, conservative management, mortality, and ingestion-related complications such as perforation or obstruction. Where reported, other outcomes including injuries requiring intervention or additional medical consequences were also recorded.

Additional variables included demographic characteristics (e.g. psychiatric history, prisoner or displacement status), motivational factors (e.g. intent to self-harm, protest, psychiatric or psychosocial drivers), and object features (e.g. length, sharpness, presence of magnets or batteries, and quantity ingested). Full definitions of all variables are provided in Appendix **??**.

The full dataset of extracted case-level and study-level data (including bias assesments), is available as Supplementary Tables S1 and S2 (provided as separate files).

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* [40]. 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.

Effects Measures

For binary outcomes (endoscopy, surgery, and death), the effect measure used was the odds ratio (OR), calculated from 2x2 contingency tables. Each odds ratio was accompanied by a 95% confidence interval (CI) and a p-value from a chi-square test of independence.

This approach was used consistently across all pairwise comparisons between binary exposure variables (e.g., motivations, object types, population characteristics) and binary outcome variables. Significant associations were identified at a threshold of $p < 0.05$ and reported alongside their respective ORs and CIs.

IV. Results

Study Selection

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 **??**.

Risk of Bias

Case Reports: 75 cases from 67 studies [32,41–106] were evaluated using the JBI Checklist for Case Reports [40]. 4 cases were excluded. Cases were excluded at this stage as they failed to meet critical criteria in the following domains: current condition (2 cases, 50%), post intervention condition (2 cases, 50%), harms (2 cases, 50%), takeaway lessons (2 cases, 50%), history timeline (1 cases, 25%), and intervention treatment (1 cases, 25%). The excluded cases came from the following studies: [43,79,91]. Of the remaining cases (71), most clearly described intervention treatment (100%), history timeline (99%), post intervention condition (97%), takeaway lessons (97%), patient demographic (96%), and current condition (96%). Reporting was also strong for diagnostic assessment (92%), and harms (90%).

Case Series: Seperately, 3 studies [107–109] were evaluated using the JBI Checklist for Case Series [40]. Reporting quality was generally high across all JBI domains. All included case series fully reported clear inclusion criteria, standard condition measurement, valid id method, complete inclusion, clear demographic reporting, clear clinical info reporting, clear outcome followup reported, and appropriate statistical analysis. However, fewer studies reported consecutive inclusion, and clear site demographic reporting.

Study Characteristics

A total of 67 studies were included in the synthesis. Case reports made up 64 studies [32,41,42,44–78,80–90,92–106], yielding 71 cases. Case Series made up 3 studies [107–109], yielding 90 cases.

1) Case Studies: A total of 71 cases from 64 studies were included in the case synthesis. The mean age of this 30.7 (range: 7.0-100.0) 60.6% were male gender (43); 38.0% were female gender (27); 1.4% were unknown gender (1).

a) Population Characteristics: Cases were recorded in 32 countries: 13 cases from USA [44,49,56,66,69–71,75,77,81,94,96,99]; 7 cases from India [54,55,73,74,78,84,100] and UK [51,53,58,60,67,88]; 6 cases from Bulgaria [32,82]; 5 cases from Iran [63–65]; 4 cases from Turkey [41,50,95,104]; 2 cases from China [72,80], Poland [76,102], and Spain [57,105]; 1 case from Australia [48], Bahrain [46], Croatia [98], Ecuador [62], Egypt [47], Ethiopia [83], Germany [106], Greece [90], Hungary [61], Iraq [42], Israel [68], Italy [89], Japan [86], Nepal [97], Netherlands [52], Pakistan [103], Portugal [87], Qatar [45], Saudi Arabia [93], South Africa [92], Sweden [85], Switzerland [101], and Taiwan [59]. 35 cases (49.3%) had a psychiatric history documented , 19 cases (26.8%) had a history of prior ingestion , 12 cases (16.9%) were detained at the time of ingestion , 7 cases (9.9%) had a severe disability history , 4 cases (5.6%) were psychiatric inpatients , 3 cases (4.2%) were under the influence of alcohol at the time of ingestion , 2 cases (2.8%) were displaced people . 35 cases (49.3%) had a psychiatric history documented , 19 cases (26.8%) had a history of prior ingestion , 12 cases (16.9%) were detained at the time of ingestion , 7 cases (9.9%) had a severe disability history , 4 cases (5.6%) were psychiatric inpatients , 3 cases (4.2%) were under the influence of alcohol at the time of ingestion , 2 cases (2.8%) were displaced people .

TABLE I: Summary of population characteristics.

Characteristic	Count (N)	Percentage (%)
NaN	90.0	100.0
NaN	88.4	98.3
NaN	29.8	33.2
NaN	2.0	2.2
NaN	0.0	0.0
NaN	0.0	0.0
NaN	0.0	0.0
NaN	0.0	0.0

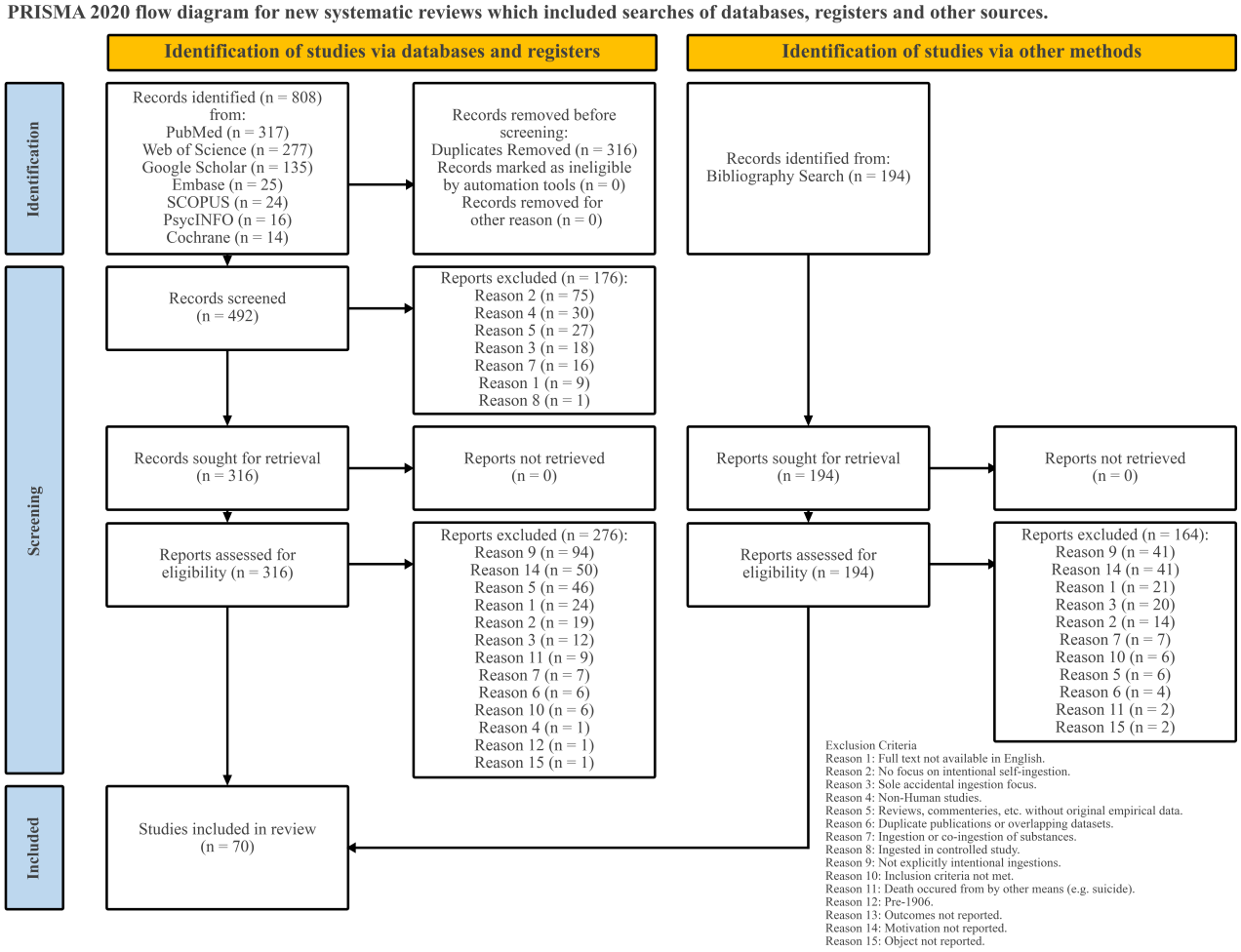

Fig. 1: PRISMA flow diagram summarising the study selection process.

TABLE II: Summary of motivations for ingestion.

Motivation	Motivation_Long	Count	Percentage
Motivation_Psychiatric	Psychiatric	34.0	35.4
Motivation_Intent_To_Harm	Self-Harm	20.0	20.8
Motivation_Psychosocial	Psychosocial	17.0	17.7
Motivation_Protest	Protest	9.0	9.4
Motivation_Other	Other	5.0	5.2
Motivation_Other_Psych_Hx	Other (with Psychiatric History)	2.0	2.1
Motivation_Other_Severe_Disability_Hx	Other (with Severe Disability History)		

TABLE III: Summary of outcomes following ingestion.

Outcome	Count	Percentage
Outcome_Injury_Needing_Intervention	44.0	19.3
Outcome_Surgery	43.0	18.9
Outcome_Endoscopy	31.0	13.6
Outcome_Other	27.0	11.8
Outcome_Injury_Other	26.0	11.4
Outcome_Perforation	22.0	9.7
Outcome_Obstruction	16.0	7.0
Outcome_Endoscopy_Surgery	10.0	4.4
Outcome_Conservative	7.0	3.1
Outcome_Death	2.0	0.9
Outcome_Intervention_Other	0.0	0.0

Synthesis

Population Characteristics: No significant associations were found.

Motivation: Motivation_Intent_To_Harm was significantly associated with Outcome_Surgery (OR = 5.10, 95% CI [1.28, 20.35], p = 0.032). Motivation_Other was significantly associated with Outcome_Surgery (OR = 0.15, 95% CI [0.03, 0.77], p = 0.031). All other comparisons were non-significant.

Object Characteristics: No significant associations were found.

Data Availability

The data and code used in this systematic review are available at *http://github.com/jackgedge/iifo_systematic_review*.

TABLE IV: Combined chi-square test results.

Group	Variable	Outcome	OR	95% CI	P-value
Population	?	Outcome_Endoscopy	0.99	[0.28, 3.53]	1.000
Population	?	Outcome_Surgery	0.86	[0.24, 3.08]	1.000
Population	?	Outcome_Death	0.00	—	1.000
Population	?	Outcome_Endoscopy	0.44	[0.04, 4.54]	0.861
Population	?	Outcome_Surgery	2.25	[0.22, 22.99]	0.861
Population	?	Outcome_Death	0.00	—	1.000
Population	?	Outcome_Endoscopy	—	—	0.399
Population	?	Outcome_Surgery	0.67	[0.03, 12.84]	1.000
Population	?	Outcome_Death	0.00	—	1.000
Population	?	Outcome_Endoscopy	0.88	[0.07, 10.69]	1.000
Population	?	Outcome_Surgery	1.00	[0.08, 12.27]	1.000
Population	?	Outcome_Death	0.00	—	1.000
Population	?	Outcome_Endoscopy	0.84	[0.30, 2.33]	0.942
Population	?	Outcome_Surgery	1.29	[0.46, 3.59]	0.827
Population	?	Outcome_Death	0.74	[0.04, 12.33]	1.000
Population	?	Outcome_Endoscopy	4.02	[0.72, 22.47]	0.202
Population	?	Outcome_Surgery	0.83	[0.17, 4.04]	1.000
Population	?	Outcome_Death	0.00	—	1.000
Population	?	Outcome_Endoscopy	0.83	[0.26, 2.65]	0.986
Population	?	Outcome_Surgery	0.74	[0.23, 2.36]	0.832
Population	?	Outcome_Death	1.61	[0.09, 27.40]	1.000
Motivation	Motivation_Intent_To_Harm	Outcome_Endoscopy	0.53	[0.17, 1.67]	0.419
Motivation	Motivation_Intent_To_Harm	Outcome_Surgery	5.10	[1.28, 20.33]	0.032*
Motivation	Motivation_Intent_To_Harm	Outcome_Death	0.00	—	0.774
Motivation	Motivation_Protest	Outcome_Endoscopy	0.32	[0.06, 1.69]	0.302
Motivation	Motivation_Protest	Outcome_Surgery	5.68	[0.66, 48.72]	0.170
Motivation	Motivation_Protest	Outcome_Death	0.00	—	1.000
Motivation	Motivation_Psychiatric	Outcome_Endoscopy	1.37	[0.52, 3.61]	0.699
Motivation	Motivation_Psychiatric	Outcome_Surgery	0.49	[0.18, 1.33]	0.248
Motivation	Motivation_Psychiatric	Outcome_Death	—	—	0.486
Motivation	Motivation_Psychosocial	Outcome_Endoscopy	0.86	[0.28, 2.63]	1.000
Motivation	Motivation_Psychosocial	Outcome_Surgery	0.65	[0.21, 1.99]	0.644
Motivation	Motivation_Psychosocial	Outcome_Death	0.00	—	0.980
Motivation	Motivation_Other	Outcome_Endoscopy	2.96	[0.68, 12.95]	0.259
Motivation	Motivation_Other	Outcome_Surgery	0.15	[0.03, 0.77]	0.031*
Motivation	Motivation_Other	Outcome_Death	7.62	[0.43, 134.24]	0.595
Motivation	Motivation_Other_Psych_Hx	Outcome_Endoscopy	2.04	[0.32, 13.01]	0.767
Motivation	Motivation_Other_Psych_Hx	Outcome_Surgery	0.41	[0.06, 2.60]	0.616
Motivation	Motivation_Other_Psych_Hx	Outcome_Death	0.00	—	1.000
Motivation	Motivation_Other_Severe_Disability_Hx	Outcome_Endoscopy	1.30	[0.08, 21.65]	1.000
Motivation	Motivation_Other_Severe_Disability_Hx	Outcome_Surgery	0.64	[0.04, 10.72]	1.000
Motivation	Motivation_Other_Severe_Disability_Hx	Outcome_Death	0.00	—	1.000
Object	Object_Button_Battery	Outcome_Endoscopy	—	—	0.365
Object	Object_Button_Battery	Outcome_Surgery	0.00	—	0.297
Object	Object_Button_Battery	Outcome_Death	0.00	—	1.000
Object	Object_Magnet	Outcome_Endoscopy	1.04	[0.25, 4.24]	1.000
Object	Object_Magnet	Outcome_Surgery	2.53	[0.49, 13.17]	0.444
Object	Object_Magnet	Outcome_Death	0.00	—	1.000
Object	Object_Long	Outcome_Endoscopy	0.84	[0.33, 2.18]	0.912
Object	Object_Long	Outcome_Surgery	2.32	[0.86, 6.30]	0.154
Object	Object_Long	Outcome_Death	1.27	[0.08, 21.10]	1.000
Object	Object_Diameter_Large	Outcome_Endoscopy	1.46	[0.49, 4.32]	0.679
Object	Object_Diameter_Large	Outcome_Surgery	1.60	[0.55, 4.66]	0.556
Object	Object_Diameter_Large	Outcome_Death	—	—	0.935
Object	Object_Sharp	Outcome_Endoscopy	0.35	[0.13, 0.94]	0.061
Object	Object_Sharp	Outcome_Surgery	2.07	[0.78, 5.50]	0.221
Object	Object_Sharp	Outcome_Death	1.16	[0.07, 19.24]	1.000
Object	Object_Multiple	Outcome_Endoscopy	0.46	[0.17, 1.21]	0.181
Object	Object_Multiple	Outcome_Surgery	1.09	[0.41, 2.91]	1.000
Object	Object_Multiple	Outcome_Death	—	—	0.700
Object	Object_Long_Sharp	Outcome_Endoscopy	0.35	[0.10, 1.21]	0.155
Object	Object_Long_Sharp	Outcome_Surgery	3.61	[0.92, 14.11]	0.102
Object	Object_Long_Sharp	Outcome_Death	3.60	[0.21, 61.02]	0.933
Object	Object_Short	Outcome_Endoscopy	1.25	[0.49, 3.22]	0.820
Object	Object_Short	Outcome_Surgery	0.41	[0.15, 1.11]	0.128
Object	Object_Short	Outcome_Death	0.82	[0.05, 13.58]	1.000
Object	Object_Short_Sharp	Outcome_Endoscopy	0.72	[0.23, 2.26]	0.781
Object	Object_Short_Sharp	Outcome_Surgery	0.79	[0.26, 2.45]	0.912
Object	Object_Short_Sharp	Outcome_Death	0.00	—	1.000
Object	Object_Unknown	Outcome_Endoscopy	—	—	—
Object	Object_Unknown	Outcome_Surgery	—	—	—
Object	Object_Unknown	Outcome_Death	—	—	—

* indicates p ¡ 0.05.

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* [110]. 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* [110]. 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 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.

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APPENDIX A
ELIGIBILITY CRITERIA

A. Inclusion Criteria

Category	Details
Population	Any human. Any age group.
Interventions or exposures	Humans that have: – Non-accidental – Ingestion of a true foreign body (non-nutritive items)
Comparators / Control group	Motivation/reason for ingestion: – Protest – Suicidal intent – Self-harm – Psychiatric and other documented motivations Intervention details: – Number of ingestions – Management strategies (Conservative, Endoscopic, Surgical) Object characteristics: – Multiple objects – Blunt objects – Sharp-pointed objects – Long objects ($>$6 cm) – Short objects ($\leq$6 cm) Setting/location
Outcomes of interest	– Endoscopic intervention – Surgical intervention – Conservative management – Complication rates – Mortality rates
Setting	Any setting.
Study designs	– Observational studies (cohort, case-control, cross-sectional) – Case series – Clinical trials – Case reports

B. Exclusion Criteria

#	Exclusion Criterion
1	Full text not available in English.
2	Studies not focusing on intentional self-ingestion (into the gastrointestinal tract) of foreign object via the oral cavity (mouth) or where unclear if ingested.
3	Studies focussing solely on accidental ingestion.
4	Non-human or animal studies.
5	Reviews, editorials, commentaries, and opinion pieces without original empirical data.
6	Duplicate publications or studies with overlapping data sets (the most comprehensive or recent study will be included).
7	Studies focusing on ingestion or co-ingestion of substances (e.g. poisons, medications) rather than physical foreign objects.
8	Ingestions undertaken in controlled environments as part of a voluntary study.
9	Ingestions not explicitly stated to be intentional and history not suggestive of deliberate ingestion (i.e. Age ¡ 8, no history of previous ingestions, no psychiatric co-morbidities, not a prisoner/detainee/vulnerable group).
10	Does not meet inclusion criteria.
11	Ingestions where death resulted from other means (i.e. suicide).
12	Studies before the advent of endoscopy (1906).

APPENDIX B
KEYWORDS AND MESH TERMS

A. PubMed

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

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

B. Embase

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

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

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

D. 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*	ALL=
Ingestion Behavior	swallowing ingest* swallow*	ALL=
Interventions	endoscopy surgery conservative treatment drug therapy surg* endoscop* EGD Esophagogastroduodenoscopy Oesophagogastroduodenoscopy manag*	ALL=

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

E. 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 IX: Concepts with associated keywords and Scopus syntax used in the search strategy.

F. PsycINFO

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

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

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

APPENDIX C
VARIABLE DEFINITIONS

Used for case report data extraction. Aggregates of which where used to create Variable_Rate and Variable_Count.

Variable	Definition
Is_Prisoner	Documented in prison, police custody, or detained (including immigration detention) at the time of the encounter; 'N' if not detained; 'UK' if unknown.
Psych_Hx	Documented DSM-V mental disorder (including substance-related disorders) [111]; 'N' if no diagnosis; 'UK' if data unavailable.
Is_Displaced_Person	'Y' if: meets the UN General Assembly [112] definition of 'Refugee'; or meets UNHCR [113] definition of an 'internally displaced person'; or meets the UNHCR [114] definition for 'asylum seeker'; 'N' if not displaced; 'UK' if unknown.
Under_Influence_Alcohol	Evidence, suspicion, or self-report of alcohol influence at presentation; 'N' if no indication; 'UK' if unknown.
Is_Psych_Inpat	Admitted (voluntarily or involuntarily) to a psychiatric facility/ward at encounter; 'N' if not admitted; 'UK' if unknown.
Severe_Disability_Hx	History of severe learning disability or impaired consciousness; 'N' if absent; 'UK' if unknown.
Previous_Ingestions	Prior episode of foreign-body ingestion documented; 'N' if first ingestion; 'UK' if history unknown.
Motivation_Intent_To_Harm	Ingestion intended for self-harm, self-injury, or suicide; 'N' if other motive; 'UK' if unclear.
Motivation_Protest	Ingestion as protest, demonstration, or manipulation (e.g., objection to detention conditions); 'N' if not protest-related; 'UK' if unclear.
Motivation_Psychiatric	Ingestion driven primarily by an underlying psychiatric condition (psychosis, impulsivity, etc.); 'N' if not psychiatric; 'UK' if unclear.
Motivation_Psychosocial	Ingestion motivated by social or interpersonal factors (imitative acts, shock value, body-image, safekeeping, etc.); 'N' if not psychosocial; 'UK' if unclear.
Motivation_Unknown	No clear motivation identified in documentation; 'N' if specific motive recorded; 'UK' if ambiguous.
Object_Button_Battery	Button battery ingested; 'N' if not; 'UK' if object type not recorded.
Object_Magnet	Magnet ingested; 'N' if none; 'UK' if unknown.
Object_Long	Ingested object length $>$ 5 cm; 'N' if $\leq$ 5 cm; 'UK' if dimensions unknown.
Object_Long_Sharp	'Y' when both Object_Long and Object_Sharp are 'Y'; 'N' otherwise; 'UK' if either unknown.
Object_Short	Derived: object length $<$ 5 cm when Object_Long='N'; retains 'UK' if dimensions unknown.
Object_Short_Sharp	'Y' when both Object_Short and Object_Sharp are 'Y'; 'N' otherwise; 'UK' if either unknown.
Object_Sharp	Object described as sharp or pointed (e.g., blades, nails, needles); 'N' if not sharp; 'UK' if unclear.
Object_Multiple	More than one object ingested in same episode; 'N' for single object; 'UK' if number unspecified.
Object_Unknown	Where object characteristics are unknown. 'N' if known; 'UK' if Unknown.
Outcome_Endoscopy	Endoscopic intervention performed during episode; 'N' if not; 'UK' if unavailable.
Outcome_Surgery	Surgical intervention performed (operative procedure under anaesthesia); 'N' if not; 'UK' if not documented.
Outcome_Endoscopy_Surgery	'Y' if both Outcome_Endoscopy and Outcome_Surgery are 'Y'; 'N' otherwise; 'UK' if data insufficient.
Outcome_Conservative	'Y' if managed without endoscopy or surgery; 'N' if either procedure performed.
Outcome_Death	Death causally related to ingestion complications; 'N' if survived; 'UK' if outcome unknown.
Outcome_Perforation	Clinical or radiological evidence of gastrointestinal or airway perforation; 'N' if absent; 'UK' if unknown.
Outcome_Obstruction	Confirmed or suspected gastrointestinal obstruction; 'N' if none; 'UK' if not documented.
Outcome_Injury_Needing_Intervention	Injury necessitating medical/procedural intervention and influencing decision for endoscopy/surgery; 'N' if no such injury; 'UK' if data unavailable.
Outcome_Other	Other clinically significant outcomes (aspiration, sepsis, prolonged stay, etc.); 'N' if none; 'UK' if data insufficient.
Outcome_Unknown	Where no outcome identified; 'N' if outcome identified; 'UK' if Unknown.