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

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Abstract

A. Objectives

To synthesise evidence on outcomes following intentional ingestion of foreign objects (IIFO) and determine whether patient motivation, object characteristics, or demographics influence the need for intervention, complications, or mortality.

B. Methods

A systematic search of PubMed, Embase, CENTRAL, Web of Science, Scopus, PsycINFO, and Google Scholar identified studies reporting intentional ingestion of non-nutritive foreign bodies in humans. Eligible studies included any design and age group reporting endoscopic, surgical, or conservative outcomes. Exclusions were accidental or substance ingestion, non-English full texts, animal studies, and reports lacking motivation, object, or outcome data. Screening was performed by a single reviewer with 10% double-checked. Data were extracted at both study and case level. Meta-analysis of proportions summarised outcomes, and associations were explored using χ^2 testing and univariate meta-regression.

C. Results

Seventy-one case reports ($n = 71$) and three case series ($n = 90$) were included. Pooled outcome rates were: endoscopy 50%, surgery 30%, conservative management 20%, complications 30%, and mortality $< 1\%$. Case series populations were uniformly male and detained, with protest motivations ($\approx 80\%$) and sharp objects ($\approx 90\%$) predominant. Protest motivation significantly reduced surgical intervention (OR = 0.98, 95% CI 0.98–0.98, $p = 0.003$). Intent-to-harm increased surgical risk six-fold (OR = 5.68, 95% CI 1.43–22.64, $p = 0.020$). Adults aged 40–64 had lower surgical rates but higher mortality, often with psychiatric comorbidity.

D. Conclusions

Motivation significantly influences IIFO outcomes. Protest ingestion may be managed conservatively, whereas intent-to-harm and psychiatric comorbidity indicate higher surgical risk. Improved prospective reporting is needed.

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Highlights

- Motivation predicts intervention type in intentional ingestion cases.
- Protest-related ingestion lowers surgical need in detained patients.
- Psychiatric comorbidity raises risk despite lower intervention rates.

Key Words

Self-harm, Foreign Body, Ingestion, Endoscopy, Surgery, Detention

Abbreviations

- BB – Button Battery
- CENTRAL - Cochrane Central Register of Controlled Trials
- CI – Confidence Interval
- HK – Hartung–Knapp adjustment
- IIFO – Intentional Ingestion of Foreign Object(s)
- IQR – Interquartile Range
- REML – Restricted Maximum Likelihood
- OR – Odds Ratio

I. 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 – defined as the non-accidental true 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 intentional ingestion of foreign objects (IIFO) are rising globally and vary across populations. In the United States, incidence nearly doubled between 1997 and 2017, from 3 to 5.3 cases per 100,000 people [17]. Among adults from lower socioeconomic backgrounds, up to 92% of ingestions are intentional [17, 18]. In the UK, a forensic mental health study reported 133 IIFO incidents in a single year, involving just 27 patients – equating to one episode every 2.7 days [19].

Complications vary widely. While most involve perforation, gastro-intestinal bleeding, obstruction and mucosal erosion [14], rare incidents of aortoesophageal perforation, fistula and haemothorax [20], cardiac injury [21], liver [22] and pancreatic injury [23] are reported in the literature.

While techniques for foreign body removal have advanced—from early gastrotomy to modern endoscopy—clinical outcomes depend on multiple factors including object characteristics, patient co-morbidities, and timeliness of intervention [14, 24–30].

IIFO motivations vary widely. In detention, it may be a form of protest or communication [31, 32]; in psychiatric contexts, it may stem from conditions like psychosis, personality disorders, pica, or malingering [19, 32–37]. In borderline personality disorder, it may function as emotional regulation rather than a suicide attempt [33]. Rare cases of treatment-resistant recurrent IIFO have prompted palliative approaches to care [38].

Despite this, little research explores how these differing motivations affect clinical management and outcomes across different populations [39–41]. Understanding motivation is crucial, as it may influence decisions around intervention [42, 43].

This review aims to examine how motivation shapes IIFO outcomes – specifically rates of endoscopic and surgical intervention, conservative management, complications, and mortality – to better inform treatment in this vulnerable patient group.

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.

II. Methods

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.

A. Eligibility Criteria

A full list of eligibility criteria is shown in Table I. This is reproduced in a larger format for clarity in Appendix A-A in Table I. A full list of exclusion criteria is available in Table II in Appendix A-A and in the PRISMA diagram shown in Figure 1.

B. 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 A-B.

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.

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 reviewer (MS). Any discrepancies identified between these two reviewers were resolved by a third reviewer (GC). Inter-reviewer agreement was calculated using Cohen's kappa [44]. Remaining articles proceeded to full text review, where the same independent screening process was repeated on full text articles.

C. Data Extraction

Data were extracted by a single reviewer (JGE) into *Microsoft Excel* [45] and processed in *Python* [46] using *Pandas* [47]. This process is outlined in Appendix A-E.

Data was first extracted from case reports. Predictors were grouped into five subgroups: gender; age group; demographic characteristics, motivation; object characteristics. Ages were grouped into age groups based on clinical relevance. 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 ingesters – 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 psychiatric, 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 A-E. The full dataset of extracted case-level and series-level data (including bias assesments), is available on Github and online.

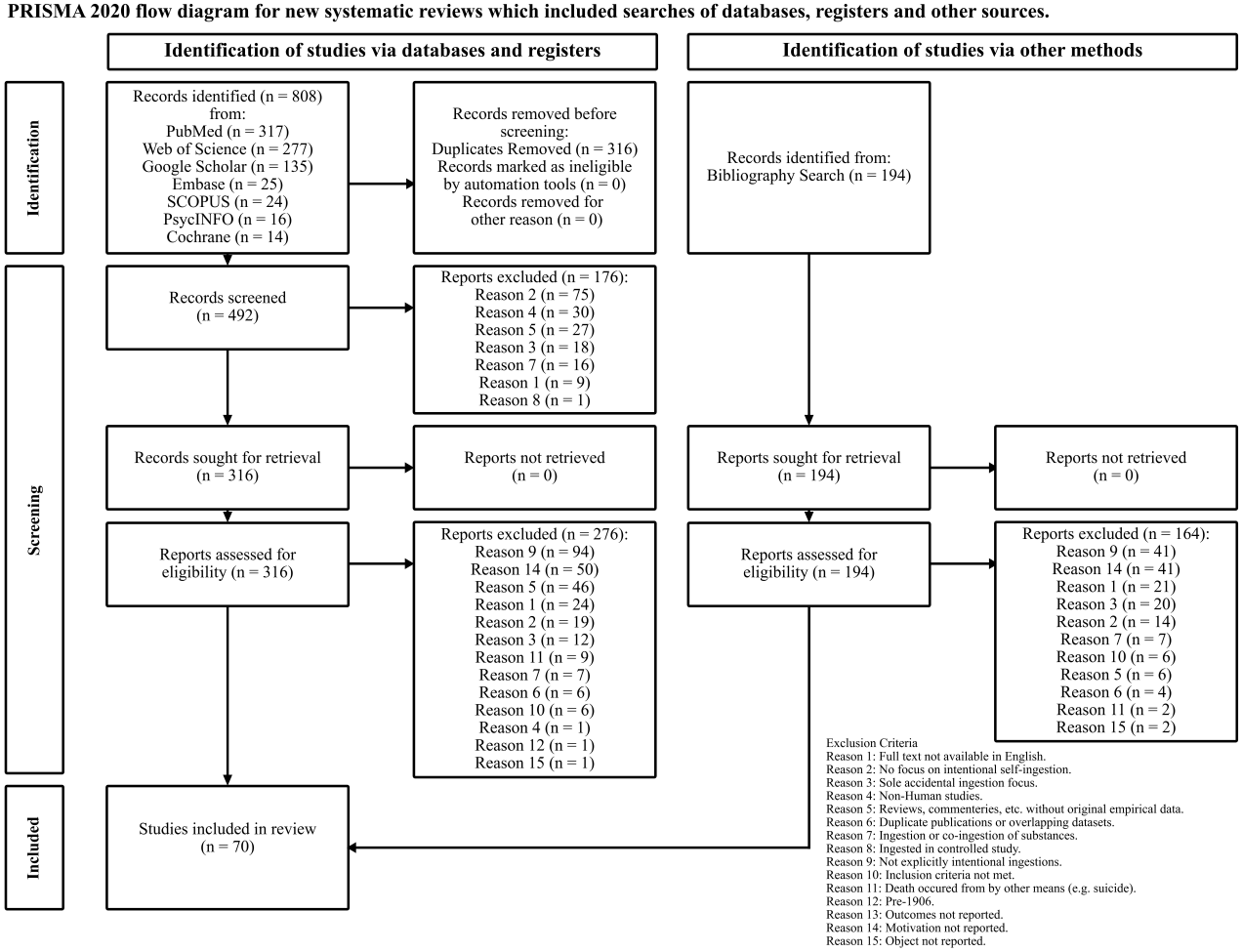

Fig. 1: PRISMA flow diagram summarising the study selection process.

D. 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* [48]. 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* [47]. That process is outlined in Appendix A-F

E. Synthesis Methods

For case-level associations between binary predictors and outcomes were assessed using χ^2 Test and Fisher's exact test, reporting odds ratios (ORs), 95% confidence intervals, and p-values. Where appropriate, further χ^2 tests were also used to evaluate differences in outcome proportions between groups [44].

Univariate logistic regression was considered but ultimately not used, as the primary aim was to explore associations without assuming a specific functional relationship between predictors and outcomes. Given the binary nature of most predictors and the categorical outcomes, χ^2 tests offered a more transparent and assumption-light approach. This choice also avoided complications from sparse data and convergence issues that can arise with logistic models in small exploratory datasets.

Multivariate logistic regression was not performed due to the limited sample size, high co-linearity 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 over-fitting. Effect estimates were reported as odds ratios (ORs) with REML estimation [49].

Initially, a meta-analysis of outcome proportions was conducted using a random-effects model to estimate pooled outcome rates across included studies. The random-effects approach was chosen due to the anticipated heterogeneity in study populations, motivations, and object types to analyse the effect of pooling case reports.

REML estimation was used to compute between-study variance (τ^2), while HK adjustments were applied to produce more accurate confidence intervals, particularly in the presence of small sample sizes.

Heterogeneity was quantified using the I^2 statistic, which describes the percentage of total variation across studies that is due to true between-study differences rather than chance. Following the Cochrane Handbook's guidelines, I^2 values were

interpreted as follows: 0–40% may not be important; 30–60% may indicate moderate heterogeneity; 50–90% may represent substantial heterogeneity; and 75–100% may reflect considerable heterogeneity [50]. These thresholds are intended as general guidance rather than strict rules and were interpreted in the context of the number of studies, consistency of effect sizes, and confidence interval overlap.

First, meta-analysis was undertaken on case series alone, and then on case series with pooled case report data. This method was given in anticipation of the case reports introducing heterogeneity into the case series meta-analysis.

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

Details on the screening and selection process are demonstrated in Figure 1. Detail on independent inter-reviewer agreement and third author review can be found in Appendix A-D. Significantly, 135 reports were excluded for failing to explicitly state whether the ingestion report was intentional. Another 91 were excluded for not reporting motivation.

B. Risk of Bias

Case Reports: 75 cases from 67 studies [32, 35, 42, 51–114] were evaluated using the *JBI Checklist for Case Reports* [48]. 3 cases were excluded. Cases were excluded at this stage if they failed to describe the following domains: patient history and timeline (1 case) [87], current patient condition (2 cases) [87], interventions and treatments (1 case) [99], patient post-intervention condition (2 cases) [87], harms (2 cases) [87], and takeaway lessons (2 cases) [87]. The excluded cases came from the following studies: [87, 99]. Of the remaining 71 cases, all reported interventions and treatments (71 cases, 100%) [32, 35, 42, 51–86, 88–98, 100–106, 108–114]. Most clearly described patient history and timeline (70 cases, 99%) [32, 35, 42, 51–64, 66–86, 88–98, 100–106, 108–114], patient post-intervention condition (69 cases, 97%) [32, 35, 42, 51–85, 88, 90–98, 100–106, 108–114], takeaway lessons (69 cases, 97%) [32, 35, 42, 51–64, 66, 68–86, 88–98, 100–106, 108–114], patient demographic (68 cases, 96%) [35, 42, 51–59, 61–86, 88–98, 100–106, 108, 109, 111–114], and current patient condition (68 cases, 96%) [32, 35, 42, 51–70, 72–86, 88–98, 100–106, 108–114]. Reporting was also strong for harms (38 cases, 93%) [54, 55, 59–64, 66, 68, 72, 74, 75, 81, 82, 84, 85, 89, 90, 92–94, 101–106, 108–110, 112, 113], and diagnostic assessments (65 cases, 92%) [32, 35, 42, 51–64, 66–70, 72–76, 78–86, 88–98, 100–106, 108–114].

Case Series: Separately, 3 studies [115–117] were evaluated using the *JBI Checklist for Case Series* [48]. 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 [115–117]. However, fewer studies (2) reported consecutive inclusion, and clear site demographic information [115, 116].

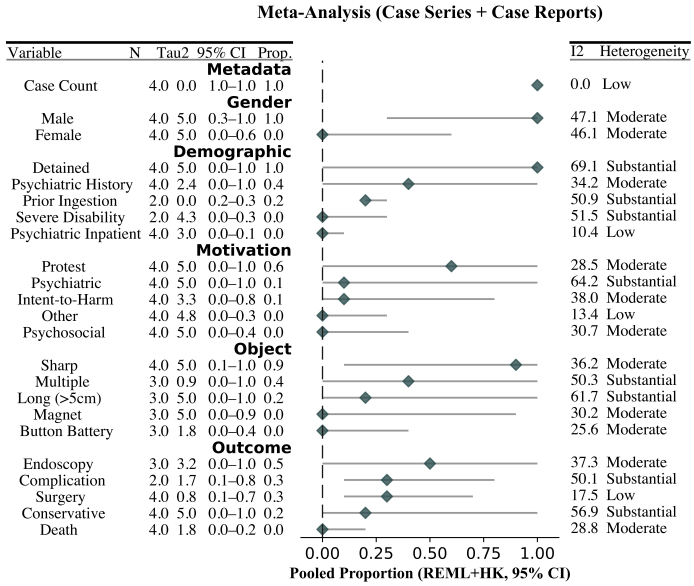

Fig. 2: Meta-Analysis of case series and pooled case reports. Meta-analysis of case series. Prop = Pooled Proportion; Tau2 = τ^2; N = n; I2 = I^2; REML and HK estimated 95% Confidence Intervals.

C. Study Characteristics

Case Reports: A total of 71 cases were reported 33 countries [32, 35, 42, 51–86, 88–98, 100–106, 108–114].

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 (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% (n = 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 long (> 5cm, 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%.

A table of case-level characteristics is shown in Table II

TABLE II: Case-level summary statistics.

Variable	Count	Percentage	References
Age			
Max	100		[88]
Mean	30		
Median	28		
IQR	18		
Min	7		[89, 94]
Age Group			
Adult (25–39)	25	35%	[42, 53, 56, 57, 60, 62, 67, 68, 70, 73–75, 77, 80, 86, 90, 92, 96–98, 102, 106, 110, 112, 113]
Young Adult (18–24)	17	24%	[32, 51, 54, 58, 63, 69, 81, 82, 84, 90, 91, 95, 100, 111]
Child/Adolescent (<18)	13	18%	[52, 55, 66, 71, 76, 89, 93, 94, 103, 104, 109]
Middle-Aged (40–64)	11	16%	[35, 64, 65, 72, 78, 79, 85, 101, 105, 108, 114]
Older Adult (65+)	3	4%	[59, 83, 88]
Gender			
Male	43	61%	[32, 35, 51, 53, 54, 56–58, 60, 61, 64, 65, 69, 72–75, 77, 79, 80, 84–86, 89–92, 96, 97, 100, 102–106, 108, 111, 114]
Female	27	38%	[42, 52, 55, 59, 62, 63, 66–68, 70, 71, 76, 78, 81–83, 88, 93–95, 98, 101, 109, 110, 112]
Unknown	1	1%	[113]
Demographic			
Psychiatric History	36	51%	[42, 52, 53, 55, 57–59, 65, 67, 70, 71, 73, 74, 77–81, 83–86, 89, 91, 92, 94, 95, 98, 101–103, 112–114]
Prior Ingestion	19	27%	[53, 57, 61, 63, 69, 71, 72, 77, 79, 80, 89, 98, 103, 105, 112–114]
Detained	12	17%	[32, 53, 56, 57, 90, 96, 102, 106]
Severe Disability	7	10%	[58, 83, 89, 94, 95, 112, 114]
Psychiatric Inpatient	4	6%	[71, 113, 114]
Alcohol Influence	3	4%	[60, 69, 105]
Displaced Person	2	3%	[51, 75]
Motivation			
Psychiatric	34	48%	[35, 42, 53, 55, 57, 58, 62, 63, 70–73, 77–86, 88, 89, 92, 94, 98, 101–103, 111, 114]
Intent-to-Harm	21	30%	[32, 35, 52–54, 65, 67–69, 74, 88, 90, 91, 98, 102, 103, 113]
Psychosocial	16	22%	[51, 60, 63, 66, 76, 78, 84, 88, 93, 96, 97, 100, 104, 105, 109, 110]
Other	9	13%	[55, 56, 72, 77, 95, 98, 106, 108, 112]
Protest	8	11%	[32, 64, 75, 90]
Object			
Large (>2.5cm) Diameter	51	72%	[32, 35, 51–54, 56–58, 61, 62, 65–69, 71, 72, 75, 77, 79, 80, 82–86, 90–98, 101, 103, 105, 106, 110, 112–114]
Multiple	44	62%	[42, 55, 57–59, 63–66, 72–74, 76–82, 84–86, 88–94, 100–105, 108, 109, 111, 113, 114]
Sharp	34	48%	[32, 42, 52, 53, 57, 60, 62, 63, 65, 69–74, 77–80, 82, 84, 86, 90–92, 100, 111, 114]
Long (>5cm)	32	45%	[35, 52, 54, 56, 58, 62, 65, 67–69, 71, 72, 74, 75, 80, 82–84, 86, 91, 92, 94, 96, 98, 101, 105, 106, 111, 112, 114]
Magnet	9	13%	[55, 64, 66, 89, 93, 94, 103, 104, 109]
Button Battery	2	3%	[61, 64]
Outcome			
Complication	47	66%	
Surgery	43	61%	
Endoscopy	31	44%	
Conservative	7	10%	
Death	2	3%	

Case Series: 3 studies were case series, yielding 90 cases [115–117]. Case series were present from the United States of America [116] ($n = 19$), South Korea [117] ($n = 52$) and Tunisia [115] ($n = 19$).

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 [116]. In the other two series, overall ingestion involed a sharp object in most cases (76%, range 64-100%). Long objects were ingested 37% of cases (36%, range 0-67%), multiple objects were ingested in (27.8%, range 0-67%)

In terms of outcomes, complications were only reported in one series [117], data was absent from the other two. Endoscopy occuring in 52% (range 5-89%), although it was unreported in one series [116]. Surgery occured 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 IV.

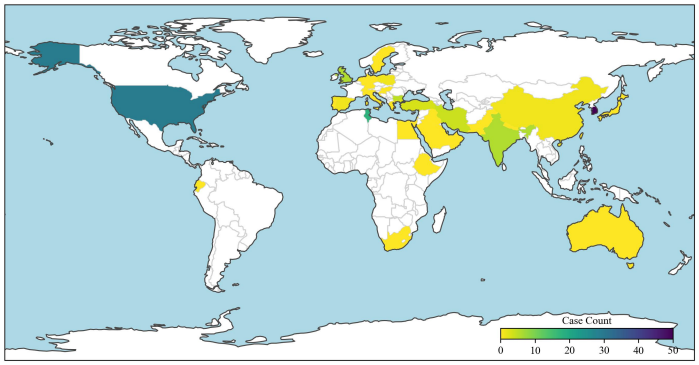

Fig. 3: Heat map of all cases per country.

TABLE III: Case counts per country.

Country	Case Count	%	References
South Korea	52	32.3%	[117]
United States of America	31	19.3%	[42, 53, 64, 74, 77–79, 83, 85, 89, 102, 104, 116]
Tunisia	19	11.8%	[115]
United Kingdom	7	4.3%	[59, 61, 66, 68, 75, 96]
India	7	4.3%	[62, 63, 81, 82, 86, 92, 108]
Bulgaria	6	3.7%	[32, 90]
Iran	5	3.1%	[71–73]
Turkey	4	2.5%	[51, 58, 103, 112]
Spain	2	1.2%	[65, 113]
Poland	2	1.2%	[84, 110]
China	2	1.2%	[80, 88]
Pakistan	1	0.6%	[111]
Switzerland	1	0.6%	[109]
Taiwan	1	0.6%	[67]
South Africa	1	0.6%	[100]
Saudi Arabia	1	0.6%	[101]
Qatar	1	0.6%	[54]
Portugal	1	0.6%	[95]
Sweden	1	0.6%	[93]
Australia	1	0.6%	[57]
Oman	1	0.6%	[52]
Netherlands	1	0.6%	[60]
United Arab Emirates	1	0.6%	[55]
Japan	1	0.6%	[94]
Italy	1	0.6%	[97]
Israel	1	0.6%	[76]
Iraq	1	0.6%	[35]
Hungary	1	0.6%	[69]
Greece	1	0.6%	[98]
Germany	1	0.6%	[114]
Ethiopia	1	0.6%	[91]
Egypt	1	0.6%	[56]
Ecuador	1	0.6%	[70]
Croatia	1	0.6%	[106]
Nepal	1	0.6%	[105]

Note: % rounded to one decimal place.

D. Synthesis

1) Univariate Association Testing: In case reports, middle-age (40–64 years) was associated with significantly reduced odds of surgery (OR = 0.19, 95% CI: 0.04–0.78, $p = 0.020$). There were non-significant trends towards increased of endoscopy (OR 2.62, 95% CI: 0.69-9.95, p=0.192) and conservative management (OR 2.44, 95% CI: 0.41-14.57, p=0.295)

Further analysis of this subgroup ($n = 11$ vs $n = 60$) revealed a significantly higher proportion of males and individuals ingesting multiple objects (+25% and +8%, respectively). There was a non-significant tendency toward higher rates of psychiatric motivation (+13.5%) and history of prior ingestion (+9.3%). Conversely, fewer individuals in this age group were detained, and intent-to-harm motivation appeared less common.

Two deaths occurred in this age group, outside of a detention context: one from metal ingestion in the context of pica in schizophrenia [85] and another from drug-induced acuphagia [72].

There were no other observed statistical relationships in any of the age groups.

Intent-to-harm motivation was associated with increased odds of surgery (OR = 5.68, 95% CI: 1.43–22.64, $p = 0.020$). This subgroup ($n = 21$ vs $n = 50$) included significantly more young adults (+20%), males (+16%), and individuals ingesting large-diameter objects (+6%) and sharp objects (+4%). A significant reduction in psychosocial co-motivation was observed in this group (–25%).

The presence of other motivation was associated with significantly reduced odds of surgery (OR = 0.15, 95% CI: 0.03–0.77, $p = 0.024$). There were non significant increases in the odds of conservative management (OR 1.17, 95% CI: 0.12, 10.99, p=1.000), endoscopy (OR 2.96, 95% CI: 0.68-12.95, p=0.165), death (OR 7.62, 95% CI: 0.43-134.24, p=0.239)

One death occurred in this subgroup [72], from 3,4-methylenedioxymethamphetamine (MDMA) induced acuphagia as the other motivation.

Although no statistically significant demographic differences were observed in this subgroup ($n = 9$ vs $n = 62$), there was a non-significant tendency toward more adults (+22%), individuals with prior ingestion history (+9%), those ingesting long objects (+9%), and those with severe disability (+8%). This group also

TABLE IV: Grouped series-level summary.

Variable	Average	Karp *et al.* (1991) [116]	Lee *et al.* (2007) [117]	Elghali *et al.* (2016) [115]
Total Cases	90	19	52	19
Gender				
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%)
Demographic				
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 Influence	0 (0%)	—	—	—
Severe Disability	0 (0%)	—	0 (0%)	—
Motivation				
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%)
Object				
Sharp	68 (76%)	19 (100%)	33 (64%)	16 (84%)
Long (>5cm)	32 (36%)	—	32 (62%)	0 (0%)
Multiple	25 (28%)	—	24 (46%)	1 (5%)
Button Battery	0 (0%)	—	0 (0%)	0 (0%)
Magnet	0 (0%)	—	0 (0%)	0 (0%)
Large (>2.5cm) Diameter	0 (0%)	—	—	—
Outcome				
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%)
Age				
Mean	24	24	—	24
Min	17	17	25	19
Median	35	—	35	—
Max	50	40	50	27

Key: *n* (%). Average = predictor and outcome mean average rates across series.

showed lower prevalence of intent-to-harm motivation (–20%), fewer sharp object ingestions (–10%), and reduced psychiatric history and psychiatric motivation. This suggests a diverse subgroup.

Sharp object ingestion was associated with decreased odds of endoscopy. Subgroup analysis ($n = 34$ vs $n = 37$) revealed a significant reduction in large-diameter object ingestion (–11%) and magnet ingestion (–13%). There was a non-significant tendency to towards more conservative management (OR 1.51, 95% CI: 0.31-7.30, p=0.703) and surgery (OR 2.27 95% CI: 0.85-6.06, p=0.157).

All subgroup comparisons were conducted within the overall case-level dataset ($n = 71$). While observed differences may reflect genuine patterns in clinical behavior, they should be interpreted with caution due to the small sample sizes and potential for unmeasured confounding.

Subgroup analysis of predictors significantly associated with outcomes are shown graphically in Figure 5.

2) Meta-Analysis of Proportions: Pooled predictors and outcomes rates for the three included case series were first examined using meta-analysis of proportions, employing REML estimation with HK-adjusted 95% CIs. Results are presented in Figure 4.

All patients in the included case series were male and detained, resulting in a demographically homogenous cohort with respect to gender and detention status.

The pooled prevalence of psychiatric history was ≈40% (range: 0.1–99.8% across three studies), with substantial heterogeneity (I^2 = 68%, τ^2 = 5.0). Motivational subgroups showed moderate to high heterogeneity (I^2 = 33–69%). Protest motivation was reported in ≈78% of patients (range: 0–100%), with moderate heterogeneity (I^2 = 32.7%, τ^2 = 4.3). Intent-to-harm motivation was present in ≈4% of cases (range: 0–98%), with moderate

TABLE V: Univariate associations between predictors and outcomes.

Variable	Conservative	Endoscopy	Surgery	Death	Complication
Gender					
Male	0.22 [0.04, 1.25] (p=0.104)	1.34 [0.51, 3.53] (p=0.722)	0.99 [0.37, 2.62] (p=1.000)	—	1.49 [0.55, 4.06] (p=0.595)
Female	4.77 [0.86, 26.63] (p=0.097)	0.82 [0.31, 2.18] (p=0.887)	0.92 [0.34, 2.44] (p=1.000)	—	0.79 [0.29, 2.17] (p=0.847)
Age Group					
Child/Adolescent (<18)	1.93 [0.33, 11.24] (p=0.604)	0.32 [0.08, 1.29] (p=0.178)	2.53 [0.63, 10.15] (p=0.307)	—	1.89 [0.47, 7.65] (p=0.521)
Young Adult (18–24)	1.31 [0.23, 7.44] (p=0.670)	0.31 [0.09, 1.06] (p=0.101)	2.60 [0.75, 9.01] (p=0.210)	—	1.30 [0.40, 4.25] (p=0.885)
Adult (25–39)	0.28 [0.03, 2.45] (p=0.409)	2.17 [0.81, 5.85] (p=0.195)	0.96 [0.36, 2.61] (p=1.000)	—	0.86 [0.31, 2.39] (p=0.979)
Middle-Aged (40–64)	2.44 [0.41, 14.57] (p=0.295)	2.62 [0.69, 9.95] (p=0.192)	**0.19 [0.04, 0.78] (p=0.020)***	—	0.56 [0.15, 2.05] (p=0.490)
Older Adult (65+)	—	0.63 [0.05, 7.32] (p=1.000)	1.32 [0.11, 15.25] (p=1.000)	—	1.02 [0.09, 11.88] (p=1.000)
Demographic					
Detained	—	0.96 [0.27, 3.42] (p=1.000)	0.89 [0.25, 3.18] (p=1.000)	—	0.64 [0.18, 2.32] (p=0.515)
Psychiatric Inpatient	—	0.43 [0.04, 4.40] (p=0.630)	2.32 [0.23, 23.75] (p=0.630)	—	0.15 [0.01, 1.54] (p=0.108)
Displaced Person	—	—	0.67 [0.03, 12.84] (p=1.000)	—	0.50 [0.03, 9.77] (p=1.000)
Alcohol Influence	—	0.83 [0.07, 10.20] (p=1.000)	1.05 [0.09, 12.88] (p=1.000)	—	—
Psychiatric History	0.92 [0.19, 4.51] (p=1.000)	0.74 [0.27, 2.06] (p=0.749)	1.45 [0.52, 4.07] (p=0.657)	0.69 [0.04, 11.51] (p=1.000)	0.74 [0.25, 2.17] (p=0.780)
Severe Disability	—	4.02 [0.72, 22.47] (p=0.120)	0.83 [0.17, 4.04] (p=1.000)	—	1.35 [0.24, 7.54] (p=1.000)
Prior Ingestion	1.62 [0.29, 9.05] (p=0.669)	0.78 [0.24, 2.50] (p=0.902)	0.78 [0.24, 2.51] (p=0.911)	1.56 [0.09, 26.48] (p=1.000)	0.36 [0.10, 1.29] (p=0.203)
Motivation					
Protest	—	0.39 [0.07, 2.09] (p=0.447)	4.81 [0.55, 41.92] (p=0.239)	—	4.12 [0.47, 35.95] (p=0.247)
Psychiatric	6.86 [0.78, 60.48] (p=0.105)	1.37 [0.52, 3.61] (p=0.699)	0.49 [0.18, 1.33] (p=0.248)	—	0.70 [0.25, 1.94] (p=0.670)
Psychosocial	1.29 [0.22, 7.37] (p=1.000)	0.99 [0.32, 3.08] (p=1.000)	0.56 [0.18, 1.75] (p=0.482)	—	0.86 [0.27, 2.76] (p=1.000)
Intent-to-Harm	—	0.47 [0.15, 1.48] (p=0.307)	**5.68 [1.43, 22.64] (p=0.020)***	—	0.88 [0.29, 2.67] (p=1.000)
Other	1.17 [0.12, 10.99] (p=1.000)	2.96 [0.68, 12.95] (p=0.165)	**0.15 [0.03, 0.77] (p=0.024)***	7.62 [0.43, 134.24] (p=0.239)	0.60 [0.14, 2.46] (p=0.475)
Object					
Sharp	1.51 [0.31, 7.30] (p=0.703)	**0.32 [0.12, 0.85] (p=0.037)***	2.27 [0.85, 6.06] (p=0.157)	1.09 [0.07, 18.15] (p=1.000)	1.13 [0.42, 3.04] (p=1.000)
Long (>5cm)	0.44 [0.08, 2.44] (p=0.442)	0.76 [0.29, 1.97] (p=0.746)	2.56 [0.94, 6.94] (p=0.106)	1.19 [0.07, 19.88] (p=1.000)	1.96 [0.70, 5.49] (p=0.304)
Multiple	4.11 [0.47, 36.14] (p=0.240)	0.46 [0.17, 1.21] (p=0.181)	1.09 [0.41, 2.91] (p=1.000)	—	2.79 [1.01, 7.71] (p=0.081)
Button Battery	—	—	—	—	—
Magnet	—	1.04 [0.25, 4.24] (p=1.000)	2.53 [0.49, 13.17] (p=0.467)	—	—
Large (>2.5cm) Diameter	0.22 [0.04, 1.10] (p=0.070)	1.29 [0.43, 3.86] (p=0.857)	1.83 [0.62, 5.44] (p=0.413)	—	1.00 [0.32, 3.13] (p=1.000)

OR: Odds Ratio; CI: Confidence Interval; p: p-value. * indicates $p < 0.05$. Bold = statistically significant. — = missing or unstable estimate.

heterogeneity (I^2 = 40%, τ^2 = 4.0). Psychiatric motivation was reported in ≈2% of cases (range: 0–100%), with high heterogeneity (I^2 = 69%, τ^2: 3.6).

Meta-analysis was not feasible for several predictors—namely, displaced person status, alcohol use, severe disability, history of prior ingestion, large-diameter objects, and complications—as

each was reported in only a single study. Similarly, meta-analysis of complication rates was not possible due to insufficient data.

Cases from case reports were collapsed and pooled for meta-analysis alongside the case series data. The results are shown in Fig 2.

Substantial heterogeneity was introduced in this process. Heterogeneity in detention status rose (I^2 = 69%, τ^2 = 5), as did gender heterogeneity.

Heterogeneity was only low in; psychiatric inpatient pooled proportions between 0–10% (I^2 = 10, τ^2 3); other motivation pooled proportion between 0–30% (I^2 = 13, τ^2 = 4.8); and surgery pooled proportion of 10–60% (I^2 = 17.5, τ^2 = 0.8).

These findings should be interpreted cautiously, as the wide confidence intervals and substantial heterogeneity likely reflect limited and inconsistent reporting across the small number of included studies.

3) Meta-Regression: Univariate meta-regression revealed exploratory associations between several predictors and the likelihood of surgical intervention across the three included studies. With this heterogeneity in mind, it was decided not to pool case series for univariate meta-regression, to examine detained case series as a subgroup against the more heterogenous case reports.

In detained populations, protest motivation was associated with a significantly lower likelihood of surgery (OR = 0.98, 95% CI: 0.98–0.98, $p = 0.003$). However, this result must be interpreted with caution due to the extremely small standard error and the limited number of studies. It is possible that this reflects quasi-complete separation (i.e. the outcome is nearly perfectly predicted by one variable) or instability in the regression estimates due to sparse data or model instability rather than a reliable effect.

Intent-to-harm motivation showed a positive association with surgery (OR = 1.29, 95% CI: 1.16–1.44, $p = 0.133$), though this was not statistically significant.

Male gender and prisoner status were both associated with a non-significant trend toward lower odds of surgery (OR = 0.97, 95% CI: 0.96–0.99, $p = 0.157$ for both).

Presence of a sharp object also trended toward reduced odds of surgery (OR = 0.95, 95% CI: 0.91–0.99, $p = 0.250$), but this was not statistically significant.

Neither psychiatric motivation (OR = 1.06, 95% CI: 0.96–1.18, $p = 0.448$) nor a history of psychiatric illness (OR = 1.03, 95% CI: 0.89–1.18, $p = 0.771$) showed a meaningful association with surgical intervention.

Given the limited number of series ($n = 3$), these findings should be regarded as exploratory, and interpreted with caution.

TABLE VI: Univariate meta-regression results (series-level).

Variable	Surgery
Demographic	
Detained	0.97 [0.96, 0.99] (p=0.157)
Psychiatric History	1.03 [0.89, 1.18] (p=0.771)
Gender	
Male	0.97 [0.96, 0.99] (p=0.157)
Motivation	
Intent-to-Harm	1.29 [1.16, 1.44] (p=0.133)
Protest	**0.98 [0.98, 0.98] (p=0.003)***
Psychiatric	1.06 [0.96, 1.18] (p=0.448)
Object	
Long (>5cm)	—
Multiple	—
Sharp	0.95 [0.91, 0.99] (p=0.250)

OR: Odds Ratio; CI = 95% Confidence Interval.
* indicates $p < 0.05$; — = missing or unstable estimate.

E. Discussion

1) Intention is poorly reported: A total of 135 reports were excluded for not reporting intention and 91 were excluded for not reporting outcomes. The absence of these key variables meant that these studies could not be meaningfully integrated into the analysis. Collectively, these exclusions represent a substantial portion of the available literature and could have more than doubled the total sample size of this review. Their omission not only limits statistical power but also reflects a broader issue in the literature – namely, inconsistent or incomplete documentation of psychosocial factors and clinical outcomes. This under-reporting may introduce bias and restrict the generalisability of findings, particularly regarding the relationship between patient motivations and clinical decision-making.

2) Protest motivation, and intent-to-harm in detention, could modulate outcomes: Outcomes among detained individuals differed markedly across motivations. In case reports involving lesser-detained ingesters ($n = 71$), the pooled surgery rate was high (58%), with intent-to-harm as the dominant motivation (80%) and protest present in 55%. Sharp object ingestion was common (67%). Intent-to-harm was associated with nearly a six-fold increase in odds of surgery.

However, case series involving exclusively detained men ($n = 90$) in three countries revealed a contrasting trend. Despite pooled sharp object ingestion rates of approximately 90%, protest motivation was associated with an 80% reduction in odds of surgery. This inverse association emerged despite moderate heterogeneity and wide confidence intervals.

In the largest series ($n = 52$) [117], protest motivation was nearly universal (97%), intent-to-harm was absent, and 64% of objects were sharp, yet the surgery rate was only 12%. In contrast, an older series ($n = 19$) [116] reported lower protest motivation (16%) and higher intent-to-harm (12%), with a surgery rate of 26%. Endoscopy rates were not reported in that series. A third series published in 2016 [115]—falling chronologically between the two—reported protest in 90%, sharp object ingestion in 84%, and an intent-to-harm rate of 10%, with a surgery rate of 21%, 79% managed conservatively, and one death.

These findings suggest that motivational context may shape clinical decisions, even when object risk is high. However, publication bias in case the case report cohort likely inflates surgery rates. For example, a Bulgarian series [32, 90] – reported in this review as cases due to the level of detail – described five inmates who ingested a total of 20 metal crosses – all required laparotomy for perforation.

3) Middle-age with differing motivations - reduced surgery but increased mortality: In case reports, individuals in the middle-aged group demonstrated a non-significant tendency towards reduced ingestion of sharp and large-diameter objects (–5% for both) and lower rates of intent-to-harm motivation. As intent-to-harm was associated with increased odds of surgery in this review, its lower prevalence may partly explain reduced surgical intervention in this group.

However, this apparent protective trend was offset by increased

mortality. Two deaths occurred among middle-aged individuals, both outside custodial settings but with psychiatric motivations and history. One case involved a 54-year-old man with a 15-year history of repeated ingestions, who ultimately died after refusing surgery multiple times [85]. The other involved a patient who died after ingesting metal as a result of acuphagia linked to MDMA use [72].

This duality suggests middle age may represent a complex and vulnerable subgroup. On one side is a cohort with significant psychiatric comorbidities—reflected in higher recurrence—who may present late or decline treatment, thereby increasing mortality risk. On the other, a lower prevalence of intent-to-harm may contribute to reduced rates of surgical intervention.

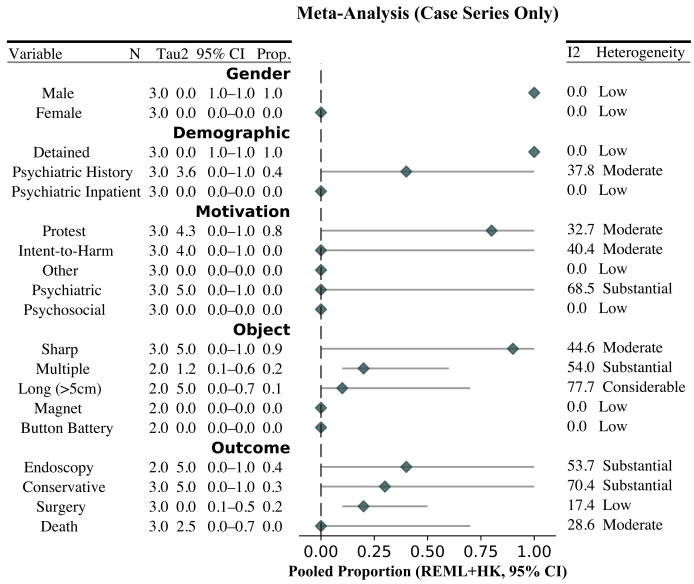

Fig. 4: Meta-Analysis of case series. Prop = Pooled Proportion; Tau2 = τ^2; N = n; I2 = I^2; REML and HK estimated 95% Confidence Intervals.

F. Limitations

1) Publication bias, extraordinary cases and countertransference anger: Both of the above effects could be explained by publication bias, were deaths was published as they were exemplary and extraordinary cases.

This is demonstrated in the case reports. Authors appear to enjoy publishing extraordinary cases with sarcastic and sometimes offensive titles. Examples include: “Loose Screws”, in reference to a female with an extensive psychiatric history who, “as advised by her rastafarian”, ingested nails in a milkshake [78]; *Ingested Magnets: the force within* [104]; *Now You See It, Endo You Don’t: Case of the Disappearing Knife* [118]; and *A Jackass And A Fish* [60]. Extreme cases of IIFO are remarkable, publication-worthy and interesting to read, likely leading to publication bias.

Furthermore, extreme cases of recurrent intentional ingestion cause “countertransference anger” [119] among clinicians who have to endure sometimes years of repeat encounters with prolific recurrent ingesters, who are often complex patients with complex mental health needs. This is well described by Gitlin *et al.* [33] who describes how clinicians are “held hostage” by ingesters “in the midst of their self-harming process” after an initiating an “ongoing injurious sequence”. This anger, perhaps, finds an outlet in publication.

2) Selection Bias: This review was conducted by a single reviewer (JGE), which introduces the potential for selection bias, motivation miss-classification and inconsistent application of eligibility criteria. Although inclusion decisions were guided by a predefined protocol and supervision by an experienced reviewer (GC), dual independent screening was not performed due to resource limitations. This may have affected reproducibility and sensitivity of the search and screening processes.

3) Unmeasured confounding: The review did not record or analyse item location. This could have introduced an unmeasured confounding factor, perhaps reducing rates of perceived high risk ingestion, modulating outcome odds.

Time to presentation was not recorded. Ingesters that present early have increased successful endoscopy. This may have skewed endoscopy rates in some cases reports and case series, but the effect cannot be quantified in this review. It was attempted, but was difficult to standardise.

Also, this review did not record any alteration of objects that ingesters may have undertaken. Although, in clinical practice, this is likely difficult to assess. Sharp objects may wrapped to appear radiopaque and sharp on imaging, but in reality not be sharp or high risk, reducing the odds of morbidity [42, 43]. The opposite is also observed, as demonstrated in Bulgaria by the of home-made “gastrointestinal crosses”. Paperclips were wrapped with paper and elastic and designed to spring open in the distal gastrointestinal tract. This lead to five perforations in five patients in one week in one prison [90]. Intention and motivation in both examples playing a clear role.

4) Information Bias: Information bias from missing data in studies likely distorted true effects in the case series analysis. This is particularly in age group and object characteristics analysis, but also endoscopic outcomes and demographic characteristics.

G. Conclusion

This review represents the first systematic synthesis of outcomes following intentional ingestion of foreign objects (IIFO) with a focus on patient motivation. Across both case reports and case series, the nature of the ingestion—particularly protest versus intent-to-harm—appears to modulate clinical decision-making, especially in detained populations. While protest-motivated ingestion was often managed conservatively, intent-to-harm cases were associated with significantly increased rates of surgical intervention.

Middle-aged adults (40–64 years) were significantly less likely to undergo surgery with a non-significant tendency to increased surgical and conservative management. Subgroup analysis suggests that psychiatric history, prior ingestion, and multiple object ingestion may contribute to more conservative management strategies and refusal of treatment, modulating this effect. Sharp object ingestion, traditionally viewed as high-risk, was not uniformly associated with surgical outcomes, particularly in the context of protest motivations and detention settings. However, outside of protest motivations in this age group, those with psychiatric comorbidities had a tendency towards increased mortality.

Findings must be interpreted in light of limitations including small sample sizes, publication bias, selection bias, missing data, and unmeasured confounding factors such as object location, modification, and timing of presentation. Nonetheless, this review

highlights the complexity of IIFO and the influence of both psychosocial context and clinical framing on treatment decisions.

Future research should focus on prospective, standardised reporting of IIFO cases to better understand how patient characteristics and motivations influence management. Greater clarity around risk stratification may help clinicians provide safer, more consistent care for this often-complex population.

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Disclosure

The authors report there are no competing interests to declare.

Data Availability

Data collection, manipulation and analysis in this review were conducted using *Python* [46] in *Visual Studio Code* [120] and *Jupyter Notebooks* [121]. The manuscript was compiled using *LaTeX* [122]. Specific *Python* packages used include: *Pandas* [47], *scikit-learn* [123], *statsmodel* [124], *seaborn* [125], *matplotlib* [126], *Cartopy* [127], *Forestplot* [128].

The data and code used in this systematic review are available on Github at https://github.com/jackgedge/iifo_systematic_review and on Queen Mary Research Online at https://qmro.qmul.ac.uk/xmlui/handle/123456789/113411 (DOI pending).

All appendices are supplied in the supplementary material.

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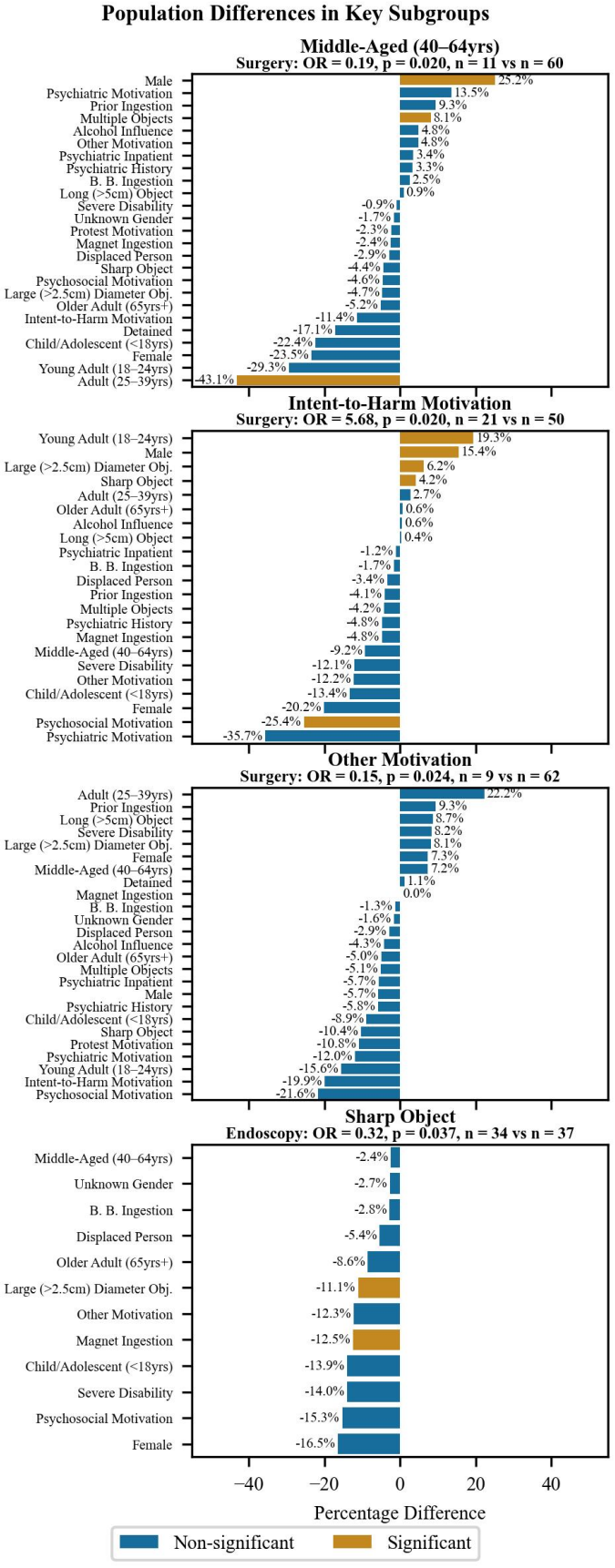

Fig. 5: Significant associated predictors from univariate analysis.

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