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A latent class analysis to identify typologies of human trafficking victims: The control-intensity spectrum

Un análisis de clases latentes para identificar tipologías de víctimas de trata de personas: El espectro de intensidad de control

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ABSTRACT. Using latent class analysis on 23,884 trafficking victims from the Counter Trafficking Data Collaborative Global Synthetic Dataset (representing 9.3% of 257,969 total cases after data quality filters), this study identified six distinct victim typologies characterized by varying control intensities. The analysis revealed that 50.3% of victims experienced “low overt control” trafficking with minimal coercive methods, challenging dominant paradigms that equate trafficking with extreme coercion. Classes ranged from high-intensity labor trafficking (9.9% of the sample, with 94.8% experiencing debt bondage) to low-control sexual exploitation (29.2% of the sample, with <5% experiencing traditional control methods). Significant temporal (Cramer’s $V = 0.213$) and geographic ($V = 0.342$) variation in class distributions suggests context-dependent trafficking patterns rather than universal typologies. These findings support reconceptualizing trafficking along a control intensity spectrum and developing differentiated interventions tailored to distinct victim experiences within identified trafficking populations.

KEYWORDS: coercion, global synthetic dataset, human trafficking, latent class analysis, victim identification

RESUMEN. Mediante un análisis de clases latentes aplicado a 23.884 víctimas de trata de personas procedentes del Conjunto de Datos Sintéticos Globales de la Colaboración para la Lucha contra la Trata de Personas (que representan el 9,3% del total de 257.969 casos tras la aplicación de filtros de calidad de datos), este estudio identificó seis tipologías distintas de víctimas caracterizadas por diferentes intensidades de control. El análisis reveló que el 50,3% de las víctimas experimentaron trata con un bajo grado de control manifiesto, con métodos coercitivos mínimos, lo que cuestiona los paradigmas dominantes que equiparan la trata con la coerción extrema. Las clases abarcaron desde la trata laboral de alta intensidad (9,9% de la muestra, de las cuales el 94,8% sufrió servidumbre por deudas) hasta la explotación sexual con bajo grado de control (29,2% de la muestra, de las cuales menos del 5% sufrió métodos de control tradicionales). La significativa variación temporal (V de Cramer = 0,213) y geográfica ($V = 0,342$) en la distribución de las clases sugiere patrones de trata dependientes del contexto, en lugar de tipologías universales. Estos hallazgos respaldan la reconceptualización de la trata de personas a lo largo de un espectro de intensidad de control y el desarrollo de intervenciones diferenciadas adaptadas a las distintas experiencias de las víctimas dentro de las poblaciones de trata identificadas.

PALABRAS CLAVE: análisis de clases latentes, coacción, conjunto de datos sintéticos globales, identificación de víctimas, trata de personas

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Introduction

Human trafficking represents one of the most egregious violations of fundamental human rights in the contemporary world, systematically stripping victims of their dignity, autonomy, and freedom while subjecting them to exploitation. This phenomenon is formally defined by the United Nations Office on Drugs and Crime (UNODC) and most state legislations as the recruitment, transportation, transfer, harboring, or receipt of individuals achieved through means such as force, coercion, fraud, or deception for exploitation, which includes forced labor, sexual exploitation, forced marriage, forced beg and criminal exploitation among others. (United Nations, 2000). Despite widespread international consensus on this definition, the empirical reality of human trafficking has proven far more complex and heterogeneous than traditional conceptualizations suggest.

The persistence and evolution of human trafficking in the 21st century necessitate a critical examination of prevailing assumptions about the nature, scope, and characteristics of this crime. While significant misconceptions persist, including assumptions about transnational dominance (Albright & D'Adamo, 2017; Farrell et al., 2010), sexual exploitation primacy (Cockbain & Bowers, 2019; Kempadoo, 2015; Kempadoo et al., 2005; Weitzer, 2007), and ideas that this crime is monolithically brutal and violent (Albanese et al., 2022; Doezema, 2002), the empirical reality proves more complex.

Building on coercion continua models theorized in labor studies (Guelker, 2024; Skrivankova, 2010), this paper conceptualizes 'control intensity' as the cumulative presence and severity of coercive methods. 'Overt control' refers to multiple, visible control mechanisms (debt bondage, physical confinement, document confiscation). In contrast, 'minimal control' indicates few or no traditional indicators of coercion, potentially reflecting structural rather than direct coercion.

To do this, this study utilizes the Counter Trafficking Data Collaborative (CTDC) Global Synthetic Dataset to examine these assumptions by conducting latent class analysis to identify distinct victim typologies, moving beyond traditional demographic categorizations to explore how age, gender, control methods, exploitation types, and trafficking patterns intersect to create diverse victim classifications and how these patterns manifest differently across temporal and geographic contexts. The availability of large-scale, synthetic datasets, such as the Global Synthetic Dataset, provides unprecedented opportunities to examine trafficking patterns and test long-held assumptions against empirical evidence.

This paper proceeds as follows: Section 2 reviews existing trafficking typologies and their limitations. Section 3 describes the data and latent class analysis methodology. Section 4 presents the Latent Class Analysis and validation results. Section 5 discusses theoretical and practical implications, while Section 6 acknowledges limitations. Section 7 concludes with policy recommendations.

Typologies of human trafficking

The heterogeneity of trafficking experiences has prompted researchers to develop various typological frameworks to categorize and understand distinct patterns of exploitation. These typologies serve different analytical purposes: mapping research coverage, informing targeted interventions, enabling cross-national comparisons, and revealing hidden patterns through empirical analysis.

Johannes et al. (2023) conducted a systematic review of 229 trafficking publications and identified three primary exploitation categories with distinct victim distributions. Their analysis revealed forced labor trafficking as the dominant research focus (56.18% of studies), with general forced labor comprising 48.83% and specific demographic subgroups including children (3.01%), men (0.67%), women (0.33%), and women/children combined (3.34%). Sex trafficking constituted 19.39% of studies, with notable attention to women and children together (11.7%) and general sex trafficking (8.36%). Organ trafficking remained minimally researched (1% of studies). This typology highlights significant research gaps, particularly regarding male victims of sexual exploitation and transgender victims across all exploitation types.

Laszlo & Roth (2023) employed qualitative cluster analysis of victim narratives to develop a seven-fold typology grounded in vulnerability and opportunity theory. Their typology identifies victims based on the intersection of personal vulnerabilities, relationship with traffickers, and protective factors. The first category comprises homeless victims with mental health issues who lack positive attachments, experience abusive relationships, and are without institutional support, with their vulnerability itself becoming their attractiveness to traffickers. The second group consists of victims seeking emotional or material support who are drawn to traffickers offering false promises of care and resources. A third category includes victims with substance dependencies who are exploited through drug and alcohol control mechanisms.

In contrast, economically desperate victims represent a fourth group that accepts risky opportunities due to poverty. The typology also identifies victims recruited through intimate relationships who are exploited by partners or those posing as romantic interests, as well as victims deceived through false job offers, which is particularly prevalent in transnational trafficking. Finally, the framework recognizes child victims exploited by family members, representing failures of traditional protective structures. This vulnerability-based approach reveals how traffickers systematically target specific vulnerabilities, with implications for prevention and early intervention strategies.

Recent studies have employed latent class analysis (LCA) to derive victim typologies from large datasets empirically. Lightowlers et al. (2021) analyzed 540 modern slavery cases from UK police data, identifying four distinct victim classes and two suspect classes through person-centered LCA. Among the victim classes, Class 1 represented 30% of cases and consisted of sexually and domestically exploited women, predominantly involving cannabis

cultivation and domestic servitude. Class 2 comprised 26% of victims and included sexually exploited girls characterized by high rates of sexual exploitation, with victims primarily under 18. Class 3, representing 35% of cases, encompassed men exploited in licit and illicit markets, involving both labor exploitation and forced criminality. The smallest group, Class 4 at 9%, consisted of criminally exploited boys representing the youngest victim group, primarily involved in county lines drug distribution.

The suspect analysis revealed two distinct classes. The first class represented 82% of suspects and consisted of male sex traffickers who were predominantly male perpetrators involved in sexual exploitation. The second class comprised 18% of suspects and included labor and domestic traffickers who were more gender-balanced and involved in diverse exploitation types.

This empirical approach revealed that 26% of victims were predominantly adult males in labor exploitation, challenging assumptions about trafficking as primarily affecting women and children. The identification of criminally exploited boys as a distinct class highlights emerging trafficking patterns related to county lines drug distribution in the UK context. Recent research increasingly recognizes that trafficking types often intertwine to create hybrid forms of exploitation. Mixed exploitation cases, where victims experience multiple forms simultaneously, comprised 5.1% of cases in the current dataset analysis. DiRienzo (2022) documented 152 cases involving both sexual and labor exploitation in the United States, representing 1% of identified cases but potentially indicating more complex trafficking patterns that challenge traditional categorical boundaries.

The evolution from theoretical to empirical typologies represents a significant methodological advance in trafficking research. Early typologies relied primarily on case studies and theoretical frameworks, while contemporary approaches leverage large-scale datasets and sophisticated statistical techniques. Iglesias-Rios et al. (2020) employed LCA with mixture models to identify patterns of violence and coercion correlated with mental health outcomes, revealing distinct victimization profiles associated with differential psychological impacts.

The diversity of typological approaches serves complementary purposes in anti-trafficking efforts. Exploitation-based typologies guide resource allocation and policy priorities. Vulnerability-based typologies inform prevention strategies and victim identification protocols. Empirically-derived typologies reveal hidden patterns and challenge assumptions about trafficking dynamics. Geographic and temporal variations in typologies suggest that trafficking patterns are context-dependent rather than universal, requiring adaptive rather than standardized responses.

The current study

Despite these advances in typological development, significant gaps remain in the trafficking literature. For example, no large-scale empirical study has tested whether trafficking control

operates along a spectrum of intensity rather than as binary coercion. Existing typologies treat trafficking patterns as static across time and geography, overlooking how contextual factors shape victim experiences. The relationships between gender, exploitation type, citizenship status, and control methods remain inadequately understood, with studies examining these factors in isolation rather than exploring their complex interactions. These gaps collectively prevent the development of nuanced, context-sensitive interventions that could better serve the heterogeneous population of trafficking victims.

This study aims to address these critical gaps by developing an empirically-derived typology of trafficking victims using latent class analysis of the CTDC Global Synthetic Dataset. The primary objective is to move beyond traditional demographic categorizations to identify meaningful victim classifications based on the intersection of control methods, exploitation types, and trafficking patterns. Through this approach, this study seeks to test prevailing assumptions about trafficking experiences against large-scale empirical evidence and examine whether trafficking typologies remain stable across temporal and geographic contexts.

The study addresses three primary research questions:

1. What distinct victim typologies emerge when demographic characteristics, trafficking origin, exploitation types, and control methods are analyzed simultaneously using latent class analysis?
2. How do the identified victim typologies vary across temporal periods and geographic regions, and what do these variations reveal about contextual influences on trafficking patterns?
3. What are the implications of empirically-derived victim typologies for current victim identification protocols, service provision models, and anti-trafficking policy frameworks?

By doing this, this study makes an original contribution to both theoretical understanding and practical responses to human trafficking, providing evidence for more nuanced, targeted interventions that recognize the spectrum of trafficking experiences revealed through rigorous empirical analysis.

Methods

Data source

To answer the research questions, this analysis uses the CTDC Global Synthetic Dataset. The dataset contains information on 257,969 victims and survivors of trafficking identified across 197 countries and territories from 2002 to 2023, spanning 22 years of assistance and hotline data.

The CTDC Global Synthetic Dataset is the largest publicly available dataset of individual-level data on human trafficking, containing information on over 222,000 victims identified

across 197 countries from 2002 to 2023 (CTDC, 2025). It was developed through a collaboration between the International Organization for Migration, Polaris, A21, RecollectiV, and the Portuguese Observatory on Trafficking in Human Beings. These datasets use differential privacy technology developed by Microsoft Research to protect the safety of victims while preserving statistical properties for research purposes (Beduschi, 2024).

Some researchers have begun utilizing this dataset to advance understanding of trafficking patterns. Al-Tammemi et al. (2023) analyzed 87,003 victims from the k-anonymized version (2010-2020), conducting descriptive analyses of sociodemographic profiles and control methods. They found that 70% of victims were female, 49.1% experienced sexual exploitation, and the most common control methods were threats (12,343 cases), psychological abuse (11,980), and movement restrictions (11,059). Their work provided critical baseline statistics for understanding the dataset's composition and victim characteristics.

Yoder et al. (2024) employed the 2017 CTDC dataset to examine relationships between citizenship status and control methods. Starting with 48,801 cases but reducing to 25,064 after removing missing data, they conducted logistic regression models, revealing that non-citizens experienced significantly more coercive control across 12 of 14 measured categories. Only sexual abuse and psychoactive substances were more prevalent among citizens, suggesting systematic differences in how traffickers exploit victims based on their legal vulnerabilities.

Richardson (2023) used the CTDC Global Synthetic Dataset to compare domestic and international trafficking patterns across countries. The analysis revealed distinct patterns: domestic trafficking predominantly involved sexual exploitation of females and juveniles, while international trafficking more commonly involved forced labor of adult males. This work highlighted how trafficking manifestations vary based on whether victims cross international borders.

Eryarsoy et al. (2024) employed a sophisticated two-phase analytical approach using the CTDC dataset. After extensive data cleaning, they analyzed 11,000 records from an original dataset of 95,739 records. Phase 1 utilized logistic regression, achieving 89% accuracy in distinguishing between forced labor and forced sex cases, followed by association rules analysis. Phase 2 employed Bayesian Belief Networks (BBNs) to uncover complex pathways to trafficking. Their BBN analysis revealed that when the recruiter is a romantic partner, the probability of forced sex increases to 98.7%. The study extensively documented data limitations, including coverage bias (the majority of cases from the U.S.), sampling bias, and 57% of data missing.

Researchers consistently identify significant limitations in the CTDC dataset. Missing data is pervasive, with rates ranging from 22% for age variables to over 50% for citizenship information. Al-Tammemi et al. (2023) noted that 53.7% of age data were missing. The dataset represents only identified victims who accessed services, introducing selection bias toward more visible trafficking cases. Contributing organizations' varying operational fo-

cuses and data collection methods create geographic and exploitation-type biases. Despite these limitations, the CTDC dataset has proven invaluable for moving beyond anecdotal evidence, enabling large-scale statistical modeling and empirical testing of assumptions about trafficking patterns that were previously based primarily on case studies or theoretical frameworks. The use of differential privacy technology in the CTDC dataset enables researchers to conduct complex typological analyses while protecting victim safety. This technological advance enables unlimited drill-down and interactive analysis that were previously impossible with heavily redacted data, opening new possibilities for understanding trafficking patterns at granular levels while maintaining ethical data protection standards (CTDC, 2025).

Variable construction and coding

Demographic Variables: Gender was coded as Male, Female, Trans/Transgender/NonConforming, or Other (including missing cases). Age groups were constructed from broad age ranges: Minor (0-17 years), Young Adult (18-25 years), Adult (26-40 years), and Older Adult (41+ years). Cases with unknown age comprised 59.8% of the sample and were excluded from the latent class analysis to ensure theoretical clarity regarding age-based vulnerability patterns.

Trafficking Characteristics: Trafficking type is distinguished between domestic cases (where citizenship matched the country of exploitation) and transnational cases.

Control Methods: Seven binary control method variables were constructed from the original data coding scheme, with presence coded as one and absence as missing. Variables included: threats to individual and/or family, psychological/physical/sexual abuse, false promises, psychoactive substances, denial of basic needs (combining financial, movement, medical care, and necessities restrictions), excessive work hours, and withholding documents. Missing values were recoded as “No” in accordance with established conventions in trafficking research.

Exploitation types: Primary exploitation type was constructed using a hierarchical classification system that identified mutually exclusive categories: Labor Only, Sexual Only, Other Only, and mixed exploitation types (Mixed Labor-Sexual, Mixed Labor-Other, Mixed Sexual-Other).

Sample selection and exclusions

Sequential exclusion criteria were applied to ensure data quality and analytical clarity. Starting with 257,969 cases, Table 1 outlines the exclusions and explains how the final analytical sample (n=23,884) was obtained.

Table 1: Excluded cases

Exclusion Step	Criteria	Cases Retained	N Excluded	% of Original Excluded	Cumulative % Retained
1. Original Dataset	-	257,969	-	-	100.0%
2. Gender	Missing or non-binary	204,397	53,572	20.77%	79.2%
3. Age	Missing or uncodeable	85,857	118,540	45.95%	33.3%
4. Exploitation Type	Missing information	58,435	27,422	10.63%	22.7%
5. Mixed Exploitation	Mixed types	55,440	2,995	1.16%	21.5%
6. Region/ Citizenship	Missing information	23,884	31,556	12.23%	9.3%
Total			234,085		

Source: own elaboration

This sample represented 9.3% of the original dataset. While substantial, these exclusions were necessary to ensure complete case analysis for the latent class modelling approach and to maintain theoretical clarity in interpreting demographic and exploitation patterns. This sample was used for all subsequent latent class analyses.

Statistical analysis

Latent class analysis (LCA) has emerged as a valuable methodological tool in human trafficking research for identifying hidden subgroups within heterogeneous populations that may not be apparent through traditional analytical approaches. LCA employs probabilistic modeling to classify individuals into distinct categories based on patterns of observed characteristics, revealing underlying typologies that conventional descriptive statistics might obscure (Collins & Lanza, 2009).

Within trafficking research, LCA has been applied across diverse contexts and populations to uncover meaningful patterns. Studies have used LCA to develop typologies of trafficking offenders based on criminal sophistication and behavioral indicators (H. Hargreaves-Cormany et al., 2022) identify risk profiles among trafficking survivors linked to childhood adversities and substance use (H. A. Hargreaves-Cormany & Patterson, 2016; Reid, 2016), and examine patterns of violence and coercion associated with differential mental health outcomes (Iglesias-Rios et al., 2020). The technique has proven particularly effective

in challenging oversimplified narratives about trafficking by revealing unexpected heterogeneity—for instance, Lightowlers et al. (2021) Lightowlers et al. (2021) identified four distinct victim classes that contradicted conventional gendered assumptions, while Bender et al. (2025) Bender et al. (2025) delineated three risk subtypes ranging from very high to relatively low exploitation risk.

This methodological approach is especially suited to trafficking research because it can accommodate the complex, multidimensional nature of trafficking experiences, handle categorical variables standard in administrative and survey data, and identify subgroups that may require differentiated policy responses or service provision. By revealing latent structures within trafficking populations, LCA enables researchers to move beyond aggregate-level analyses toward more nuanced understandings of how various forms of exploitation, control mechanisms, and vulnerability factors cluster together in practice.

All analyses were conducted in R version 4.3.0 (R Core Team, 2018). Descriptive statistics examined distributions and cross-tabulations. Chi-square tests assessed associations between categorical variables; $p < 0.05$ was considered significant. Latent class analysis was performed using the polCA package in R to identify distinct victim typologies (Linzer & Lewis, 2011). The analysis included twelve variables: gender, age group, trafficking type, primary exploitation type, and seven primary control methods (threats, abuse, false promises).

Models with 2-8 latent classes were estimated using maximum likelihood estimation with 100 random starts to ensure global optimization. Model selection criteria included the Bayesian Information Criterion (BIC), Akaike Information Criterion (AIC), entropy values, and convergence status. While BIC and AIC assess model fit while penalizing complexity, entropy measures classification certainty with values above 0.7 indicating acceptable separation between classes (Collins & Lanza, 2009).

Critically, model convergence was evaluated as a primary selection criterion. Models that failed to achieve maximum likelihood convergence after 100 random starts were deemed unreliable, as non-converged solutions can produce unstable parameter estimates and non-reproducible class assignments (Collins & Lanza, 2009). The optimal model was selected as the one with the lowest BIC among successfully converged solutions, combined with theoretical interpretability and adequate entropy.

Results

Sample characteristics

The final analytical sample comprised 23,884 trafficking victims identified across 57 countries. Table 2 presents the distribution of key demographic and trafficking characteristics in the filtered dataset.

Table 2: Sample Characteristics

Characteristic	Category	N (%)
Gender	Female	17,739 (74.3)
	Male	6,145 (25.7)
Age group	Adult (26+)	12,033 (50.4)
	Young Adult (18-25)	11,337 (47.5)
	Minor (0-17)	514 (2.2)
Trafficking type	Transnational	18,723 (78.4)
	Domestic	5,161 (21.6)
Primary exploitation	Labor Only	11,335 (47.5)
	Sexual Only	11,140 (46.6)
	Other Only	1,409 (5.9)
Region	Europe & Central Asia	9,907 (41.5)
	Asia	5,562 (23.3)
	North America	4,406 (18.4)
	Sub-Saharan Africa	3,377 (14.1)
	Latin America & Caribbean	632 (2.6)

Source: own elaboration

Labor trafficking represented the largest category (47.5%), closely followed by sexual exploitation (46.6%). Other forms of exploitation comprised 5.9% of cases. Table 1 also presents the prevalence of the different control methods used by traffickers. Psychological, physical, and sexual abuse represented the most common control method (33.8% of the total sample), followed by denial of basic needs (29.8%) and threats (24.9%). Furthermore, it shows the regional distribution of victims' countries of origin. Europe & Central Asia accounted for the largest regional share (41.5%), followed by Asia (23.3%) and North America (18.4%). The sample presents a substantial predominance of transnational trafficking cases (78.4%) compared to domestic trafficking (21.6%). This pattern differs from some regional studies that have found higher proportions of domestic trafficking, suggesting that this dataset may reflect particular identification and reporting practices or specific trafficking flows.

Data quality and attrition analysis

A critical methodological consideration is the substantial attrition from the original dataset to the analytical sample. The sequential exclusion process reduced 257,969 cases to 23,884 (9.3% retention), with implications for generalizability and interpretation. The

exclusion cascade operated as follows: First, gender exclusions (20.77% of the original) removed cases with missing or non-binary gender data, potentially excluding victims from contexts with less formalized data collection or more fluid gender categorizations. Second, age exclusions represented the most significant single reduction (45.95%), likely biasing toward institutional settings that systematically collect demographic data. Third, exploitation type exclusions (10.63%) may have removed victims in informal or emerging exploitation contexts where categorization is complex. Finally, the exclusion of mixed exploitation cases (5.1% of the remaining) removed complex trafficking patterns that challenge traditional boundaries.

This 90.7% attrition rate may shape the findings of this study. The retained 9.3% likely represents the most visible, formally documented subset of trafficking victims, those identified through established assistance programs with comprehensive data protocols. Three selection mechanisms appear operative: (1) **institutional selection**, where only victims accessing formal services are captured; (2) **documentation selection**, where cases with complete records are retained; and (3) **categorical selection**, where cases fitting clear exploitation categories are preserved.

The implications are substantial. The finding that 78.4% of the analytical sample involves transnational trafficking diverges from research suggesting greater domestic trafficking prevalence (Richardson, 2023; UNODC, 2024). This likely reflects selection bias: transnational victims may be more visible to authorities through border enforcement, more likely to access formal assistance due to a lack of local support networks, and more comprehensively documented due to international cooperation protocols. Also, taking into account that the data is historical, earlier years may have minimal counts of domestic trafficking. Similarly, the near-equal distribution of sexual (46.6%) and labor (47.5%) exploitation may reflect documentation practices rather than true prevalence.

Therefore, the six-class typology developed here should be understood as a classification of *identified and formally documented trafficking victims within institutional frameworks*, not a representative sample of all trafficking victims globally. This limitation, while significant, does not invalidate the analysis but somewhat clarifies its scope: understanding patterns within the subset of trafficking cases that come to official attention.

Latent Class Analysis results

Model selection

Latent class models with 2-8 classes were systematically evaluated to identify the optimal solution. Table 3 presents fit statistics for each model:

Table 3: Model Fit Statistics for Latent Class Solutions

Classes	BIC	Entropy	AIC	Log-likelihood	Convergence Status
2	625,810	0.898	625,551	-312,747	Converged
3	608,408	0.791	608,015	-303,964	Converged
4	597,913	0.810	597,387	-298,635	Converged
5	592,801	0.821	592,141	-295,997	Converged
6	590,170	0.762	589,376	-294,599	Converged
7	588,549*	0.787*	587,621*	-293,707*	Failed†
8	587,460*	0.781*	586,398*	-293,080*	Failed†

*Values from non-converged solutions are unreliable

†Maximum likelihood not found after 100 random starts

Source: own elaboration

The 6-class solution was selected as optimal based on multiple criteria:

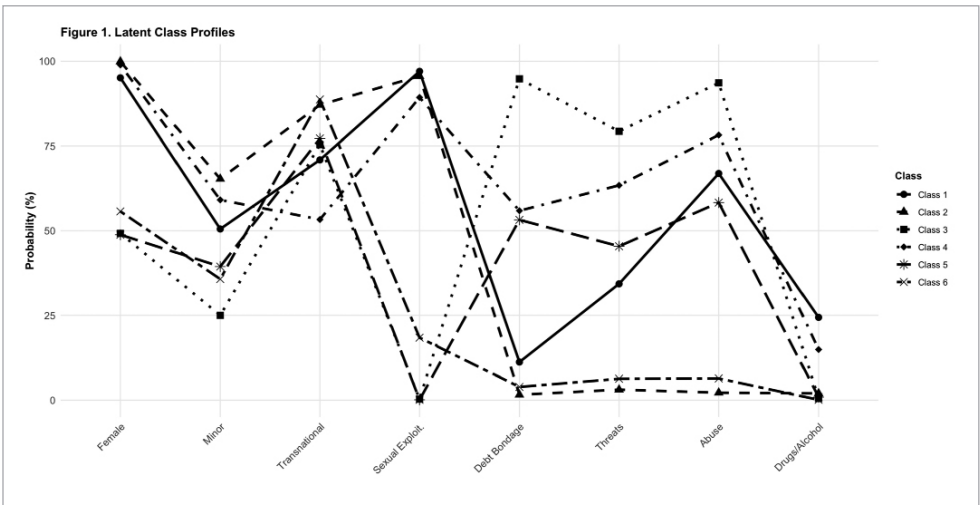
1. **Convergence:** The 6-class model is the most complex solution to achieve maximum likelihood convergence. While the seven and eight-class models showed nominally lower BIC values, both failed to converge despite 100 random starts, rendering their estimates unreliable and potentially unstable.
2. **Model fit:** Among the converged models, the 6-class solution had the lowest BIC (590,170), with a substantial improvement over the 5-class model ($\Delta\text{BIC} = -2,631$).
3. **Classification quality:** The entropy value of 0.762 indicates good class separation, with most individuals having >0.70 probability of belonging to their assigned class.
4. **Theoretical interpretability:** Each of the six classes represents distinct trafficking experiences aligned with existing literature while revealing novel patterns of control intensity.

The failure of more complex models to converge suggests the data naturally supports six distinct trafficking typologies without overfitting. This convergence boundary provides additional validation that the 6-class solution captures the optimal level of complexity supported by the data.

Class Assignment and Classification Quality

The selected 6-class model demonstrated an entropy of 0.762, indicating acceptable class separation. The estimated class population shares were: Class 1 (20.9%), Class 2 (29.2%), Class 3 (9.9%), Class 4 (6.2%), Class 5 (12.7%), and Class 6 (21.1%). The predicted class memberships based on modal posterior probabilities closely aligned with these estimates: Class 1 (20.3%), Class 2 (32.1%), Class 3 (10.0%), Class 4 (5.5%), Class 5 (12.4%), and Class 6 (19.8%). Figure 1 displays the posterior probability distributions for class membership across the six identified typologies. Analysis of individual posterior probabilities reveals that

the majority of cases are assigned to their most likely class with high confidence—the average maximum posterior probability across all cases exceeds 0.80, indicating that most victims can be clearly classified into one of the six typologies with minimal ambiguity. The divergent probability profiles across classes confirm that the six-class solution captures meaningfully distinct trafficking experiences rather than artificial statistical divisions.



Class	Size	Gender	Age	Type	Exploitation	Control.Lev
Class 1: Female Sexual + Substance	20.9%	95% Female	51% Minor	71% Trans.	97% Sexual	Moderate
Class 2: Minimal Overt Control	29.2%	100% Female	65% Minor	87% Trans.	96% Sexual	Minimal
Class 3: High-Intensity Labor	9.9%	49% Female	75% Adult	75% Trans.	100% Labor	Very High
Class 4: Moderate Sexual	6.2%	99% Female	59% Minor	53% Trans.	89% Sexual	Moderate-High
Class 5: Mixed Gender Labor	12.7%	49% Female	59% Adult	77% Trans.	94% Labor	Moderate
Class 6: Minimal Overt Mixed	21.1%	56% Female	57% Adult	89% Trans.	72% Labor	Minimal

Figure 1. Latent class profiles

Source: own elaboration

For instance, Class 3 shows near-certainty probabilities (>0.90) for debt bondage, abuse, false promises, denial of basic needs, excessive work hours, and document withholding—representing a high-intensity control pattern. In contrast, Class 2 shows minimal prob-

abilities (<0.05) for most control methods despite a high probability of sexual exploitation, representing a low-control trafficking pattern. This clear differentiation in posterior probabilities validates both the classification quality and the theoretical meaningfulness of the identified typologies.

Six-class victim typology

The analysis revealed six distinct victim classes characterized by systematic differences in demographics, exploitation types, and control method intensities. Rather than simple demographic clusters, these classes represent qualitatively different trafficking experiences along a spectrum of control intensity.

Class 1: Female sexual exploitation with substance control (20.93% of sample)

Class 1 represents approximately one-fifth of the sample and displays a distinctive pattern of female sexual exploitation combined with substance-based control. This class is 95.1% female and almost exclusively involves sexual exploitation (96.95%). The age distribution shows 43.33% of adults, 6.16% of young adults, and 50.51% of minors, indicating a mixed-age vulnerability pattern. Trafficking is predominantly transnational (70.89%).

The control method profile reveals moderate to high use of traditional coercive tactics combined with a distinctive reliance on substance control. While debt bondage is relatively low (11.16%), this class shows elevated rates of threats (34.27%), psychological/physical/sexual abuse (66.92%), and denial of basic needs (31.59%). Critically, this class has the highest rate of drug/alcohol control among all classes at 24.37% suggesting traffickers use substance dependency as a primary control mechanism. Document withholding and excessive work hours remain minimal (0.83% and 0.08% respectively), indicating control is maintained through psychological and chemical dependency rather than bureaucratic or labor-based restrictions.

Class 2: Minimal overt control female sexual exploitation (29.18% of sample)

Class 2, the largest single class at nearly 30% of the sample, presents a complex pattern. This class is almost entirely female (99.85%) and involves sexual exploitation (95.63%) with a predominance of minors (65.31%). The trafficking is transnational mainly (87.13%).

This class exhibits minimal use of overt control methods across nearly all measured dimensions. Debt bondage affects only 1.57%, threats 3.11%, abuse 2.18%, false promises 1.41%, drug/alcohol control 1.95%, denial of basic needs 2.83%, excessive work hours 0.09%, and document withholding 0.56%. The predominance of minors suggests potential grooming relationships or exploitation of developmental vulnerabilities not captured by traditional control measures. This minimal overt control pattern, representing nearly one-third of all victims, indicates the need to expand understandings of coercive mechanisms beyond traditional force, fraud, and explicit coercion.

Class 3: High-intensity labor trafficking (9.93% of sample)

Class 3 exemplifies severe labor exploitation with the highest overt control intensity across multiple dimensions. This class shows gender balance (49.18% female, 50.82% male) and focuses almost exclusively on labor exploitation (99.56%). The age profile is predominantly adult (74.61%) with 24.95% minors. Trafficking is primarily transnational (75.37%).

This class exhibits extreme levels of overt control across nearly all methods. Debt bondage is nearly universal at 94.77%, accompanied by threats (79.25%), abuse (93.62%), false promises (93.40%), denial of basic needs (97.81%), excessive work hours (92.88%), and document withholding (79.91%). Only drug/alcohol control remains low (0.47%), suggesting traffickers rely on comprehensive structural and physical control rather than substance dependency. This pattern indicates highly organized operations with systematic exploitation mechanisms employing multiple overlapping control strategies to ensure compliance.

Class 4: Moderate overt control mixed sexual exploitation (6.15% of sample)

Class 4, the smallest class, represents a moderate overt control variant primarily involving sexual exploitation. This class is 98.87% female, with 89.29% in sexual exploitation. The age distribution shows 59.07% minors, making this a predominantly young victim class. Uniquely, this class shows the most balanced trafficking pattern with 46.66% domestic and 53.34% transnational cases.

Overt control methods are moderate to high across several dimensions: debt bondage (55.87%), threats (63.38%), abuse (78.18%), false promises (49.92%), denial of basic needs (73.58%), and document withholding (33.95%). Drug/alcohol use is elevated at 14.85%, and excessive work hours affect 21.33%. This profile suggests a middle-intensity exploitation pattern that employs selective but substantial overt control, possibly representing cases where traffickers calibrate control intensity based on victim resistance or compliance.

Class 5: Mixed gender labor exploitation with selective control (12.71% of sample)

Class 5 demonstrates gender-balanced labor trafficking with selective overt control methods. The gender distribution is nearly equal (48.79% female, 51.21% male), with 93.86% experiencing labor exploitation. Adults comprise 59.18%, with minors at 39.38%. Trafficking is predominantly transnational (77.22%).

This class shows moderate levels of specific overt control methods: debt bondage (53.18%), threats (45.40%), abuse (58.34%), false promises (37.49%), and denial of basic needs (64.29%). Excessive work hours affect 39.87%, while document withholding impacts 24.90%. Drug/alcohol control remains minimal (0.86%). This pattern suggests labor exploitation operations that employ selective rather than comprehensive overt control strategies. The moderate levels across multiple dimensions may indicate situations in which structural vulnerabilities (such as irregular immigration status or economic desperation) reduce the need for extreme, overt coercion.

Class 6: Minimal overt control mixed exploitation (21.10% of sample)

Class 6 represents a minimal overt-control, mixed-exploitation pattern affecting over one-fifth of the sample. Gender distribution is relatively balanced (55.71% female, 44.29% male) with exploitation primarily in labor (71.76%) but also including sexual (18.40%) and other forms (9.84%). The age distribution shows 56.75% adults and 35.74% minors. Trafficking is highly transnational (88.65%).

This class exhibits minimal overt control across all measured methods: debt bondage (3.86%), threats (6.31%), abuse (6.35%), false promises (1.54%), drug/alcohol (0.09%), denial of basic needs (5.05%), excessive work hours (0.85%), and document withholding (1.04%). Similar to Class 2, this minimal overt control pattern does not necessarily indicate voluntary participation. Structural factors such as poverty, lack of legal status, language barriers, social isolation, or family obligations may create conditions of exploitation without requiring sustained overt coercion. The high proportion of transnational trafficking suggests immigration-related vulnerabilities may substitute for overt control mechanisms.

Statistical associations

As shown in Tables 4 and 5, all variables were statistically significantly associated with class membership ($p < 0.001$). Effect sizes were large for primary exploitation type (Cramer's $V = 0.672$) and gender (Cramer's $V = 0.573$), indicating these variables strongly differentiate the classes.

Table 4: Statistical Associations

Variable	Chi-square	df	p-value	Cramer's V
Gender	18,176.45	5	< 0.001	0.573
Age Group	5,736.58	10	< 0.001	0.227
Trafficking Type	3,332.24	5	< 0.001	0.245
Primary Exploitation	50,123.43	10	< 0.001	0.672

Source: own elaboration

Table 5 illustrates the distribution of control methods per class. Control methods showed powerful associations (Cramer's V range: 0.409-0.807), confirming their importance in defining class membership.

Table 5: Control Method Prevalence by Class

Control Method	C1	C2	C3	C4	C5	C6	p-value	Cramer's V
Debt Bondage/Earnings	11.6%	1.5%	96.0%	60.6%	54.5%	3.9%	< 0.001	0.740
Threats	36.8%	2.6%	77.2%	66.8%	49.7%	5.8%	< 0.001	0.596
Abuse (Psy/Phy/Sex)	74.8%	0%	94.2%	78.5%	61.7%	5.1%	< 0.001	0.780
False Promises	1.5%	1.2%	95.1%	58.1%	37.8%	1.6%	< 0.001	0.787
Drugs/Alcohol	26.0%	1.5%	0.5%	15.6%	0.7%	0.1%	< 0.001	0.409
Deny Basic Needs	33.8%	2.5%	98.5%	76.3%	66.3%	5.4%	< 0.001	0.722
Excessive Work Hours	0%	0.1%	95.0%	23.2%	39.4%	1.1%	< 0.001	0.807
Withhold Documents	0.3%	0.5%	81.8%	39.4%	24.6%	0.9%	< 0.001	0.733

Source: own elaboration

External Validation Results

External validation examined the stability of the 6-class typology across temporal and regional contexts by excluding cases with unknown classifications.

Analysis revealed significant temporal variation in class distributions. As Table 6 demonstrates, the 4-period analysis (2002-2007, 2008-2013, 2014-2018, 2019-2023) showed substantial changes over time ($\chi^2 = 6,068.3$, $df = 15$, $p < 0.001$, Cramer's $V = 0.213$). Notable temporal patterns included:

- Class 2 (low-control sexual exploitation) increased from 25.6% in 2008-2013 to 31.8% in 2019-2023
- Class 6 (mixed low-control) decreased from 38.6% in 2008-2013 to 15.5% in 2019-2023
- Classes 1, 3, 4, and 5 were absent from the earliest period (2002-2007), appearing only from 2008 onward

Table 6: External Validation - Temporal Distribution

Class	2002-2007	2008-2013	2014-2018	2019-2023
1	0	105	3,998	5,603
2	3,438	505	4,947	6,686
3	0	152	1,637	1,939
4	0	111	969	1,070
5	0	339	1,896	2,496
6	836	762	3,840	3,263

Source: own elaboration

Spatial analysis demonstrated significant regional variation ($\chi^2 = 15,423.5$, $df = 20$, $p < 0.001$, Cramer's $V = 0.342$). Regional patterns showed:

- North American cases were predominantly Classes 1 and 2 (sexual exploitation: 38.0% and 41.3% respectively)
- European cases showed high representation of Class 3 (high-intensity labor: 33.4%)
- Asian and Sub-Saharan African cases were predominantly Class 6 (mixed low-control: 55.6% and 52.6% respectively)

The regional analysis excluded a substantial proportion of cases (40.5%) due to unknown geographical information, potentially limiting generalizability. Both temporal and regional analyses contained some cells with expected frequencies below 5, though the proportion remained acceptable for chi-square testing.

Discussion

The 6-class solution reveals substantial heterogeneity within human trafficking victimization, challenging monolithic conceptualizations of trafficking experiences. While sexual exploitation victims were predominantly female and clustered into distinct control-method profiles, labor trafficking showed more gender balance and varied intensity patterns. The external validation indicates that these class patterns vary significantly across both time periods and geographic regions, suggesting that trafficking typologies may be influenced by contextual factors rather than representing universal patterns.

The Control-intensity spectrum: reconceptualizing trafficking means

This study's most significant contribution lies in demonstrating that means of control operate along a spectrum of intensity rather than as binary present/absent phenomena. As Albanese et al. (2022) critique, familiar human trafficking narratives have mainly treated this phenomenon as uniformly involving high levels of coercion and control. This is consistent with dominant legal and policy frameworks that emphasize force, fraud, and coercion as defining elements of human trafficking (Murphy, 2022).

In this study, 50.3% of victims (Classes 2 and 6) experienced minimal overt control trafficking characterized by minimal use of traditional coercive methods. Class 2, representing nearly 30% of all victims, involved sexual exploitation with negligible debt bondage (1.6%), threats (3.1%), or document confiscation (0.6%). This finding directly contradicts legal and policy frameworks that position force, fraud, and coercion as definitional elements of trafficking. However, the absence of measured overt control does not necessarily indicate the absence of coercion. As Albanese et al. (2022) note, structural factors such as economic desperation, limited alternatives, family pressures, or immigration vulnerabilities may maintain exploitation without requiring overt force.

The spectrum is equally evident within exploitation types. Labor trafficking bifurcates into high-intensity (Class 3: 94.8% debt bondage, 92.9% excessive work hours) and moderate-control variants (Class 5: 53.2% debt bondage, selective control methods). This heterogeneity suggests that trafficking encompasses diverse operational models, from heavily coercive enterprises to situations where structural vulnerabilities and limited alternatives maintain exploitation without extensive force.

These findings both support and complicate previous research on citizenship and control relationships. While previous latent class analyses have identified victim subgroups based primarily on demographic and exploitation characteristics (Lightowlers et al., 2021), this study advances the field by incorporating means of control as key differentiating variables, revealing previously hidden heterogeneity within trafficking experiences. The gender-exploitation patterns largely align with existing literature. Like Lightowlers et al. (2021), this study found sexual exploitation to be predominantly female-centered, with their identification of “sexually and domestically exploited women” and “sexually exploited girls” classes paralleling Classes 1, 2, and 4. However, the inclusion of control methods revealed important distinctions within female sexual exploitation - from the minimal control used in Class 2 (29.2% of the sample) to the intensive control documented in Class 4 (6.2% of the sample).

Regarding citizenship and control relationships, the findings diverge from previous research. Yoder et al. (2024) demonstrated that non-citizen victims experienced significantly more coercive control methods, with transnational cases showing a higher prevalence of debt bondage, document withholding, and movement restrictions. However, the analysis reveals a more nuanced picture where trafficking type (domestic vs. transnational) does not consistently predict control intensity across classes. For instance, Class 4 showed the most balanced distribution between domestic (46.7%) and transnational (53.3%) trafficking while still exhibiting high control method usage (55.9% debt bondage, 63.4% threats). This suggests that factors beyond simply crossing international borders may drive control intensity.

These findings challenge this monolithic conceptualization. Class 2, representing nearly 30% of victims, experienced sexual exploitation with minimal control methods - contradicting assumptions that sexual trafficking inherently involves intensive coercion. Similarly, the contrast between Classes 3 and 5 in labor trafficking (94.8% vs. 53.2% experiencing debt bondage) demonstrates that even within exploitation types, control intensity varies dramatically.

This spectrum approach aligns with emerging critiques of binary trafficking conceptualizations (Albanese et al., 2022; O'Brien, 2016) but provides the first large-scale empirical evidence of systematic variation in the use of control methods. The identification of “low-control” trafficking classes (Classes 2 and 6, representing 50.3% of the sample) challenges victim identification protocols and service models designed around high-intensity control assumptions. However, it is important to note that these findings may also be an artifact of this specific, highly filtered sample. For instance, the most marginalized victims

experiencing the highest control may be the least likely to have complete data records or to have been identified by authorities at all.

Temporal and geographic variation: Context matters

The external validation revealed significant variation in class distributions across both temporal and regional contexts, with moderate to large effect sizes (Cramer's $V = 0.213-0.342$). Rather than indicating methodological weakness, this variation provides valuable insights into how contextual factors shape trafficking patterns. Several mechanisms likely explain these patterns. **Policy evolution** appears to influence temporal changes; the absence of Classes 1, 3, 4, and 5 during the 2002-2007 period coincides with early anti-trafficking enforcement, when detection capabilities were more limited. The subsequent emergence and growth of these classes may reflect improved identification of diverse trafficking forms beyond stereotypical high-visibility cases.

Geographic context shows distinct regional specializations. European cases' high representation in Class 3 (high-intensity labor trafficking at 33.4%) may reflect regional economic structures emphasizing manufacturing and agriculture sectors, where intensive control methods are more feasible. Conversely, North American cases' concentration in sexual exploitation classes (79.3% in Classes 1 and 2 combined) could reflect both detection bias toward sex trafficking and different market structures, as well as the full criminalization of sex work in the United States.

Data collection changes also influence patterns. The increase in Class 2 (low-control sexual exploitation) from 25.6% in 2008-2013 to 31.8% in 2019-2023 may reflect expanded victim identification reaching beyond the most visible, heavily controlled cases to encompass subtler forms of exploitation. **Selection effects** likely explain some regional variation, as different victim populations access services in different regions based on local support infrastructure, legal frameworks, and enforcement priorities. The high proportion of unknown cases in the regional analysis (40.5% excluded) suggests substantial data-collection challenges that may systematically bias toward certain victim types in certain regions.

Limitations

Several important limitations should be acknowledged. First, as previously argued, the data quality constraints significantly limited the analytical sample. Second, the dataset lacked key sociodemographic characteristics that could provide deeper insights into trafficking patterns. Variables such as ethnicity, education level, socioeconomic background, family structure, migration history, and previous victimization experiences were not available, limiting understanding of victim vulnerabilities and recruitment pathways. The absence of perpetrator characteristics also prevented analysis of trafficker-victim dynamics.

Along this line, the limited number of variables constrained the comprehensiveness of trafficking profiles. The dataset focused primarily on basic demographics, exploitation types,

and control methods, but lacked information on trafficking duration, recruitment methods, financial arrangements, escape attempts, or post-trafficking outcomes. These omissions may result in incomplete characterization of trafficking experiences.

Fourth, as previously stated, the dataset represents identified trafficking cases, potentially introducing selection bias toward more visible or stereotypical trafficking situations. Cases that never come to official attention may follow different patterns. The exclusion of mixed exploitation cases (5.1% of the sample) may have eliminated trafficking patterns that blur traditional categorical boundaries. Additionally, the binary coding of control methods may not capture the full spectrum, intensity, or temporal variation of coercive practices.

Conclusion

The heterogeneity revealed by this typology has implications for anti-trafficking responses, suggesting that intervention approaches should account for different forms of coercion. The identification of low-control classes, representing over half the sample, challenges existing victim identification protocols that rely heavily on indicators of severe coercion. Current screening tools, designed around assumptions of physical confinement, document confiscation, and explicit threats, may systematically fail to identify victims in Classes 2 and 6 who experience minimal traditional control methods. These victims may not recognize themselves as trafficked under conventional definitions, and their experiences may not trigger existing support mechanisms. Identification protocols must therefore expand beyond coercion-focused indicators to encompass structural vulnerabilities, economic desperation, and subtle forms of manipulation that maintain exploitation without overt force.

For high-intensity labor trafficking victims (Class 3), who experience near-universal debt bondage (94.8%) and excessive working hours (92.9%), interventions require different approaches. These cases demand emergency extraction protocols, comprehensive protection measures, and specialized trauma-informed services designed for severe exploitation. The systematic nature of control in this class suggests organized criminal operations requiring coordinated law enforcement responses, proactive workplace investigations, and strengthened labor inspection systems. Recovery services must address not only immediate safety needs but also the complex psychological impacts of sustained, intensive coercion.

The identification of Class 1, characterized by sexual exploitation with substance-based control, reveals a gap in current anti-trafficking frameworks that often treat substance use as a complicating factor rather than a central control mechanism. This finding necessitates integration of addiction services within anti-trafficking responses, training substance abuse counselors in trafficking identification, and developing harm reduction approaches that recognize the intersection of dependency and exploitation. Traditional protection models may be inappropriate for victims whose substance use is intrinsically linked to their trafficking experience, requiring instead trauma-informed addiction treatment that addresses both exploitation and dependency simultaneously.

The substantial variation in class distributions across temporal and geographic contexts further complicates policy recommendations. The growth of low-control sexual exploitation (Class 2) from 25.6% to 31.8% between 2008-2013 and 2019-2023 may reflect evolving trafficking methods that rely less on physical coercion and more on psychological manipulation, online recruitment, and exploitation of structural vulnerabilities. Policy responses must therefore be adaptive, with regular reassessment of trafficking patterns and corresponding adjustments to identification, prosecution, and service provision strategies. Regional variations, such as the concentration of high-intensity labor trafficking in Europe (33.4% of cases) versus the predominance of mixed low-control exploitation in Asia (55.6%), suggest that practical anti-trafficking efforts must be tailored to local trafficking ecologies rather than implementing standardized global approaches.

This study advances trafficking scholarship by demonstrating that victim experiences exist along a spectrum of control intensity rather than conforming to binary high-control assumptions. This shift from categorical to spectrum-based understanding challenges how trafficking is conceptualized in policy and practice, particularly regarding victim identification protocols that may miss many of the victims experiencing minimal overt control. The six-class typology reveals meaningful heterogeneity that has implications for theory, policy, and practice. While class distributions vary across temporal and geographic contexts, this variation provides insights into how trafficking patterns are shaped by local factors rather than representing methodological limitations. The findings support arguments for context-sensitive anti-trafficking approaches that recognize diverse victim experiences and move beyond monolithic conceptualizations of trafficking relationships.

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