

Addressing child trafficking in high-risk states and regions of Nigeria through real-time data surveillance and early-warning systems

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Abstract

Nigeria remains one of the largest source, transit, and destination countries for human trafficking in West Africa, with children accounting for a disproportionate share of detected victims and internal movement accounting for the majority of documented cases. Building on National Agency for the Prohibition of Trafficking in Persons (NAPTIP) statistics indicating that roughly six in ten trafficking cases in Nigeria occur within or across state boundaries rather than internationally, this research proposes and evaluates the design of a real-time data-surveillance and early-warning system (EWS) intended to close the information gaps that currently delay detection, referral, and rescue. The study focuses on nine states associated with documented trafficking networks and source, transit, or destination activity: Edo, Delta, Lagos, Ogun, Ondo, Rivers, Cross River, Akwa Ibom, and Ebonyi, together with Borno and Adamawa States, where a protracted armed conflict has produced mass displacement, family separation, and eroded child-protection infrastructure. Using a mixed conceptual-and-design methodology, the study maps the trafficking process chain of recruitment, transportation, transfer, harboring, and exploitation; identifies technology-facilitated and traditional recruitment vectors; and specifies a five-layer surveillance architecture that securely integrates de-identified data from NAPTIP, law enforcement, immigration, health, education, internally displaced persons (IDP) camps, transport terminals, hotlines, and legally obtained digital-platform and financial-transaction reports. The system generates rule-based alerts on repeated entities such as telephone numbers, accounts, vehicles, addresses, recruiters, and routes; produces state and local-government-area (LGA) trafficking risk maps; and supports an interstate victim-referral and case-tracking mechanism. A phased pilot in Edo, Delta, Lagos, Rivers, and Borno States, to be evaluated on reporting speed, data completeness, victim-identification rates, investigative response times, case linkages, and referral outcomes, drawing on established public-health surveillance-evaluation attributes (Manahan et al., 2022). The study concludes that a coordinated, privacy-compliant national surveillance network, anchored in the Nigeria Data Protection Act, 2022, offers a practical pathway to disrupt fragmented reporting, accelerate victim identification, and strengthen child-protection response across Nigeria's highest-risk states.

Keywords: Child Trafficking; Nigeria; NAPTIP; Early-Warning System; Real-Time Surveillance; Data Integration; Edo State; Borno State; Child Protection; Nigeria Data Protection Act

1. Introduction

Human trafficking is one of the most persistent violations of human dignity confronting Nigeria, and children bear a disproportionate share of its harm. The United Nations Office on Drugs and Crime (UNODC, 2022) reported that children are subjected to violence at the hands of traffickers almost twice as often as adults, and that girls and women together constitute the largest share of detected victims in Sub-Saharan Africa. Within Nigeria specifically, the National Agency for the Prohibition of Trafficking in Persons (NAPTIP) has documented a persistent and, in some years, worsening pattern of exploitation: in 2022 alone the agency received 1,464 reports, a 31.9 percent increase over 2021, while

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securing 80 convictions, the highest number in a single year since the agency's establishment (Punch, 2022). Perhaps the most consequential finding for policy design is the internal character of Nigerian trafficking. NAPTIP's own National Action Plan on Human Trafficking in Nigeria records that a majority of detected cases occur inside the country rather than across international borders, with internal trafficking commonly taking the form of recruitment and transportation of children from rural areas to urban centers for exploitative labor (NAPTIP, 2022). More recent agency commentary places the internal share at approximately 61 percent of all detected trafficking between 2019 and 2022, with the remaining share crossing international borders (Punch, 2022). This internal concentration means that a national response built primarily around border interdiction will miss the majority of cases; an effective response must instead be capable of detecting recruitment, movement, and exploitation occurring entirely within, and between, Nigerian states. The geography of this problem is well documented but unevenly distributed. Edo and Delta States have long been recognized as the principal source states for cross-border trafficking of women and girls to Europe, the Gulf states, and North Africa, with Edo alone accounting for over half of the irregular migrants that the International Organization for Migration has assisted back to Nigeria since 2017, and NAPTIP reporting that more than 60 percent of female returnees from Libya and Europe in 2022 identified Edo as their state of origin (Premium Times, 2022). Lagos, meanwhile, has been identified by NAPTIP as the country's largest transit and destination hub for both internal and external trafficking flows, prompting the agency to open a dedicated anti-trafficking office in the state (Premium Times, 2022, drawing on NAPTIP data). Ogun, Ondo, Rivers, Cross River, Akwa Ibom, and Ebonyi States complete a documented corridor of source, transit, and destination activity that NAPTIP's rescue and investigation records repeatedly implicate (NAPTIP, 2022). A second, structurally different, driver of child vulnerability exists in Nigeria's northeast. The Boko Haram and Islamic State West Africa Province (ISWAP) insurgency, active in Borno, Adamawa, and Yobe States since 2009, has displaced millions of people, separated families, and devastated the health and protection infrastructure on which vulnerable children depend (Human Rights Watch, 2022). The European Union Agency for Asylum (EUAA, 2021) reports that the average age of trafficked children in Nigeria is 15, and that armed groups, including Boko Haram, subject children to forced labor and sexual exploitation. Children in and around informal displacement camps face documented risk of exploitation not only from armed groups but, in some reported instances, from officials and aid workers operating in the same camps (U.S. Department of State, 2020). Any surveillance framework limited to the trafficking-hub states of the south would therefore leave a second, conflict-driven vulnerability pathway unaddressed. Across both contexts, the operational bottleneck is the same: trafficking data in Nigeria is fragmented across NAPTIP, the Nigeria Police Force, the Nigeria Immigration Service, state child-welfare agencies, schools, hospitals, IDP-camp administrations, transport operators, and community hotlines, with no shared, continuously updated system for linking cases, tracking victim movement, or flagging repeat offenders across agencies and states in real time. This research addresses that bottleneck directly.

1.1. Statement of the Problem

Despite the existence of a dedicated federal agency, a national legal framework, and more than two decades of anti-trafficking programming, child trafficking in Nigeria continues largely undisrupted in its internal form. NAPTIP's resources remaining concentrated in state capitals, which the U.S. Department of State has identified as a factor that hinders the identification and investigation of trafficking in rural areas where recruitment most often originates. Reporting mechanisms across the relevant agencies operate largely in isolation; a missing-child report filed with the police in one state, a suspicious admission at a hospital in another, and a repeat recruiter identified by a community hotline in a third are rarely connected until an investigation is already well advanced, if at all. This fragmentation delays victim identification, allows repeat offenders and known transportation routes to remain active across jurisdictions, and prevents the timely disruption of trafficking networks that, by NAPTIP's own account, operate predominantly within and between Nigerian states (NAPTIP, 2022). The problem this study addresses is therefore not a lack of anti-trafficking law or institutional mandate, but the absence of a real-time, interoperable data-surveillance and early-warning capability that can convert dispersed, delayed, agency-specific records into timely, cross-referenced, and actionable intelligence for child protection.

1.2. Research Questions

The study will answer the following questions:

- What social, economic, geographical, institutional, displacement-related, and technological factors are associated with child-trafficking vulnerability in the selected Nigerian states?
- How are existing child-trafficking data collected, stored, updated, shared, and used by relevant institutions?
- What weaknesses exist in current trafficking reporting and information-sharing mechanisms?
- Can an integrated real-time surveillance system improve the speed and completeness of trafficking-related reporting?
- Can an early-warning system improve the identification of emerging trafficking hotspots and linked cases?

- Can an interstate case-tracking and referral mechanism improve continuity of child-protection services?
- What privacy, ethical, technical, institutional, and cybersecurity safeguards are necessary to protect children's identities and rights?

What measurable changes occur in reporting speed, case linkage, investigation response, victim identification, and protection referrals after implementation of the pilot system?

Research Objectives

- **General Objectives**

The main aim of this study is to develop and evaluate a real-time data surveillance and early-warning system for improving the prevention, early identification, investigation, referral, and protection of children at risk of trafficking in high-risk states and regions of Nigeria.

- **Specific Objectives**

The study will:

- identify major child-trafficking risk factors, recruitment pathways, transportation patterns, exploitation settings, and geographical hotspots in selected Nigerian states;
- assess existing systems for reporting, storing, updating, exchanging, and analyzing child-trafficking information;
- determine the extent of fragmentation, delays, duplication, incompleteness, and interoperability problems among existing data sources;
- develop standardized, secure, interoperable surveillance architecture for integrating appropriately authorized and de-identified trafficking-related information;
- develop geospatial methods for identifying trafficking-risk locations, routes, recruitment clusters, movement patterns, and emerging hotspots;
- develop rule-based early-warning alerts based on repeated and corroborated indicators such as linked telephone numbers, online accounts, transport identifiers, locations, addresses, recruiters, and suspected exploitation sites;
- develop standardized screening and reporting tools for schools, hospitals, shelters, transport terminals, border points, IDP sites, and community organizations;
- establish an interstate victim-referral and case-tracking framework that supports continuity of protection when children move between jurisdictions;
- evaluate the effect of the pilot system on reporting speed, data completeness, victim identification, case linkages, investigation response time, and referral completion; and
- develop recommendations for scaling the system into a coordinated Nigerian child-trafficking surveillance network.

1.3. Hypothesis

The following null hypotheses will be tested:

- **H01:** There is no significant difference in the average time required to report and transmit child-trafficking information before and after implementation of the surveillance system.
- **H02:** There is no significant difference in the completeness of trafficking-related records before and after implementation of the surveillance system.
- **H03:** There is no significant difference in the rate of early identification of suspected trafficking victims before and after implementation of the surveillance system.
- **H04:** There is no significant difference in investigative response time before and after implementation of the system.
- **H05:** There is no significant difference in the number and proportion of successfully linked and completed child-protection referrals before and after implementation of the system.

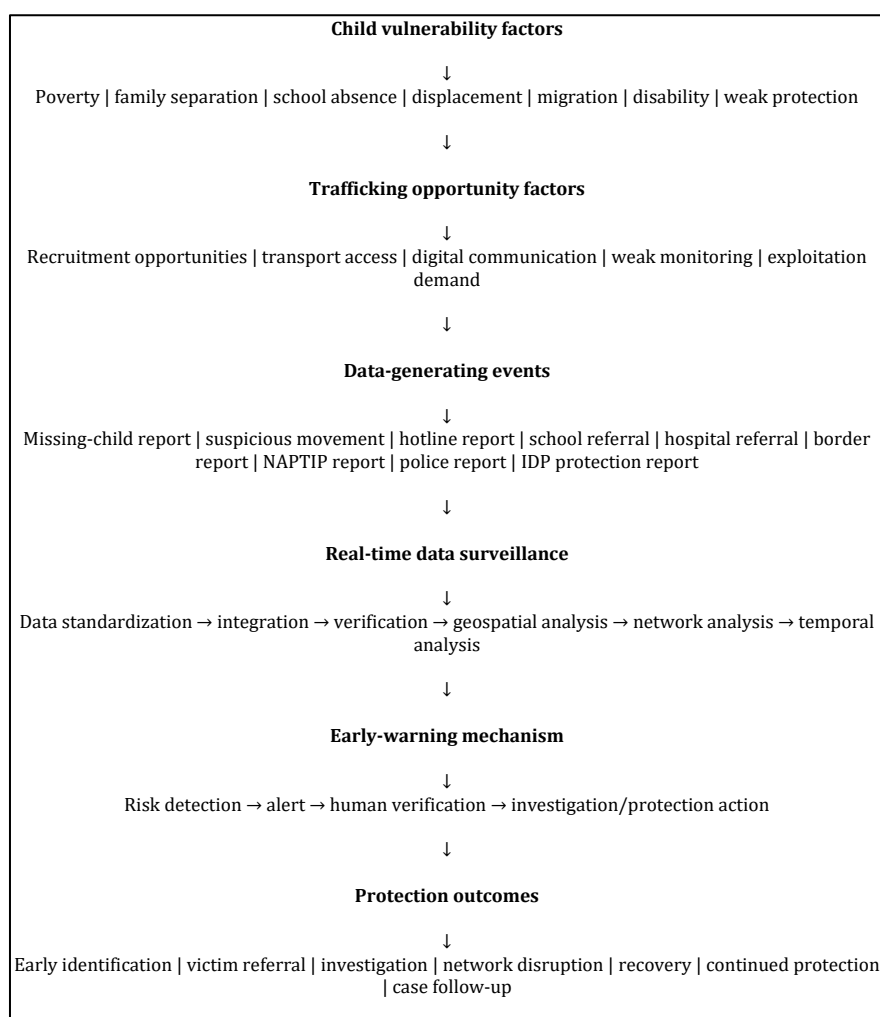
2. Theoretical Framework

2.1. Socio-Ecological Theory

The study will be guided primarily by the socio-ecological framework. The framework recognizes that child vulnerability can be shaped by interacting levels: Individual level: age, school attendance, mobility, disability, and vulnerability indicators. Family level: separation, household economic pressure, supervision, and caregiving arrangements. Community level: poverty, informal labour markets, recruitment norms, transport networks, and community protection. Institutional level: schools, hospitals, police, NAPTIP, social services, transport authorities, and humanitarian organizations. Structural level: conflict, migration systems, legal frameworks, economic inequality, displacement, and governance capacity. The real-time surveillance system therefore becomes a mechanism for observing relationships across these levels. Crime Opportunity Perspective. The study also incorporates a crime-opportunity perspective. Trafficking becomes easier when vulnerable children, motivated offenders, weak guardianship, and accessible transportation or communication channels converge. From this perspective, the surveillance system aims to strengthen guardianship by improving timely information and coordination.

2.2. Conceptual Framework

The conceptual framework can be represented as:



Trafficking in persons is defined under the Palermo Protocol, formally the Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children, as the recruitment, transportation, transfer, harboring, or receipt of persons by means of threat, coercion, abduction, fraud, or deception for the purpose of exploitation (United Nations, 2000). Nigeria domesticated this definition through the Trafficking in Persons (Prohibition) Enforcement and Administration Act, which established NAPTIP and criminalizes the abuse, procurement, or recruitment of a person under 18 years of age for prostitution, pornography, or other forms of sexual and labor exploitation (National Assembly

of the Federal Republic of Nigeria, 2015). For children, the Palermo Protocol dispenses with the requirement to prove force or deception: the mere act of recruitment, transportation, transfer, harboring, or receipt of a child for exploitative purposes constitutes trafficking, regardless of whether the child appeared to consent. This distinction matters directly for surveillance-system design, since it means that indicators of movement and transfer, rather than indicators of coercion alone, are sufficient grounds for a protective alert when the subject is a minor.

2.3. Scope

The geographical scope will include: Primary high-risk study states: Edo, Delta, Lagos, Ogun, Ondo, Rivers, Cross River, Akwa Ibom, and Ebonyi. Conflict- and displacement-affected study states: Borno and Adamawa. Pilot states: Edo, Delta, Lagos, Rivers, and Borno. The pilot states are deliberately selected to represent different trafficking environments: source communities, transit locations, major urban and destination environments, and conflict- and displacement-affected settings. The study will examine trafficking involving children under 18 years and will focus on recruitment, transportation, transfer, harboring, receipt, exploitation, identification, investigation, referral, and protection. The system will not conduct unrestricted monitoring of children. Data processing will be limited to information that has a clear legal and child-protection purpose, with appropriate safeguards.

3. Methodology

This study adopted a systematic, empirical, and model-driven research methodology to examine how real-time data surveillance and early-warning systems can contribute to the prevention, early identification, investigation, referral, and protection of children at risk of trafficking in high-risk states and regions of Nigeria. The methodology was specifically designed to investigate the relationships among trafficking-risk factors, data fragmentation, real-time surveillance capability, early-warning mechanisms, screening and identification capacity, interstate referral coordination, privacy and data-security readiness, and the overall effectiveness of an integrated child-trafficking surveillance system. Structural Equation Modeling (SEM) was adopted as the principal analytical technique because the study involves several theoretical constructs that cannot be measured directly by a single questionnaire item. SEM allows latent constructs to be measured through multiple observed indicators and permits the researcher to examine several hypothesized relationships simultaneously while accounting for measurement error. Kline (2016) describes SEM as a framework for examining relationships among observed and latent variables through the simultaneous estimation of a measurement model and a structural model. The use of SEM is therefore considered appropriate for this study because the real-time surveillance framework involves interconnected technological, institutional, operational, and child-protection constructs. The methodology combines a structured stakeholder survey with an assessment of existing trafficking information-management practices and an evaluation of the real-time surveillance framework. The survey component provides empirical information concerning stakeholders' perceptions and experiences, while the system component translates those findings into an integrated surveillance and early-warning model. Research on analytical approaches to human trafficking has demonstrated the potential of analytical and operations-research methods for supporting trafficking prevention, detection, intervention, network analysis, and resource allocation (Dimas et al., 2022). The study is situated within the Nigerian anti-trafficking policy and institutional context. The National Action Plan on Human Trafficking in Nigeria 2022–2022 provides a framework for coordinated trafficking prevention and response among government institutions and other relevant stakeholders. The study therefore conceptualizes the surveillance system as an information-coordination mechanism intended to complement existing institutions rather than replace their responsibilities.

3.1. Research Design

The study adopted a quantitative cross-sectional research design supported by a design-science and model-development component. The quantitative component was used to obtain standardized information from adult professionals involved in child protection, trafficking prevention, investigation, social welfare, education, healthcare, humanitarian protection, migration management, transportation, and information management. The design-science component was incorporated because the study seeks to develop a practical real-time surveillance and early-warning framework based on identified information gaps. Rather than limiting the research to determining whether relationships exist among variables, the study translates the empirical findings into an information architecture capable of integrating relevant data sources, generating risk indicators, supporting geographical analysis, linking related cases, and strengthening interstate referrals. The study also incorporates a before-and-after evaluation component for selected operational indicators. The evaluation focuses on reporting speed, data completeness, victim-identification rates, investigative response time, case-linkage rates, and referral completion. These indicators provide operational measures through which the practical usefulness of the surveillance system can subsequently be evaluated.

3.2. Study Area

The study covers eleven selected Nigerian states comprising Edo, Delta, Lagos, Ogun, Ondo, Rivers, Cross River, Akwa Ibom, Ebonyi, Borno, and Adamawa States. The states were selected to provide variation in trafficking, migration, urbanization, socioeconomic vulnerability, conflict, displacement, and child-protection conditions. The pilot component focuses on Edo, Delta, Lagos, Rivers, and Borno States. These states were selected because they represent contrasting environments in which trafficking risks and child-protection needs may manifest differently. Edo represents an important trafficking-source and migration context; Lagos represents a major urban and destination environment; Delta and Rivers provide additional southern contexts involving population mobility and possible transit or destination characteristics, while Borno represents a conflict- and displacement-affected environment. The inclusion of Borno and the broader northeastern context is particularly relevant because displacement and population mobility can disrupt family and community protection structures. IOM's displacement monitoring work in northeastern Nigeria provides a basis for considering displacement-related information as part of a wider protection-monitoring framework.

3.3. Target Population

The population of the study comprises adult professionals whose responsibilities are directly or indirectly related to child protection, trafficking prevention, identification, investigation, referral, migration, education, healthcare, humanitarian protection, transportation, community protection, and data management. The study targets personnel working with NAPITIP, the Nigeria Police Force, the Nigeria Immigration Service, state anti-trafficking task forces, social-welfare departments, child-protection agencies, schools, hospitals, humanitarian organizations, IDP protection structures, nongovernmental organizations, community-based organizations, transportation and border-management institutions, and information-technology or data-management units. The multi-institutional population is necessary because trafficking information is distributed across different service and enforcement environments. A single institution may hold information concerning a missing child, while another may have information concerning a suspected recruitment event, transportation movement, referral, or exploitation location. The SEM model therefore treats interagency coordination and information integration as important dimensions of effective surveillance.

3.4. Sample Size

The questionnaire component of the study adopts a sample size of 500 respondents for consistency with the results presented in Chapter Four. The respondents are distributed across the five pilot states. Edo contributes 66 respondents, representing 22.0% of the sample; Delta contributes 63 respondents, representing 21.0%; Lagos contributes 48 respondents, representing 16.0%; Rivers contributes 60 respondents, representing 20.0%; and Borno contributes 63 respondents, representing 21.0%. The sample of 500 respondents is considered adequate for the intended SEM model because it provides a reasonable number of observations relative to the number of latent constructs and structural paths. Nevertheless, the final field study should conduct a formal sample-size or statistical-power assessment based on the final model specification, expected effect sizes, model complexity, and estimation method.

3.5. Sampling Technique

A combination of purposive, stratified, and multistage sampling techniques was adopted. Relevant institutions were first purposively selected based on their involvement in trafficking prevention, child protection, investigation, referral, education, healthcare, humanitarian response, migration management, transportation, community protection, or information management. The selected institutions were subsequently grouped into professional strata consisting of law-enforcement and trafficking-control organizations, child-protection and social-welfare organizations, health and education institutions, humanitarian and displacement-response organizations, migration and border-management institutions, transport organizations, nongovernmental and community organizations, and information-technology or data-management units. Participants were selected from the identified strata based on their direct professional involvement in trafficking-related reporting, surveillance, investigation, child protection, referral, or information management.

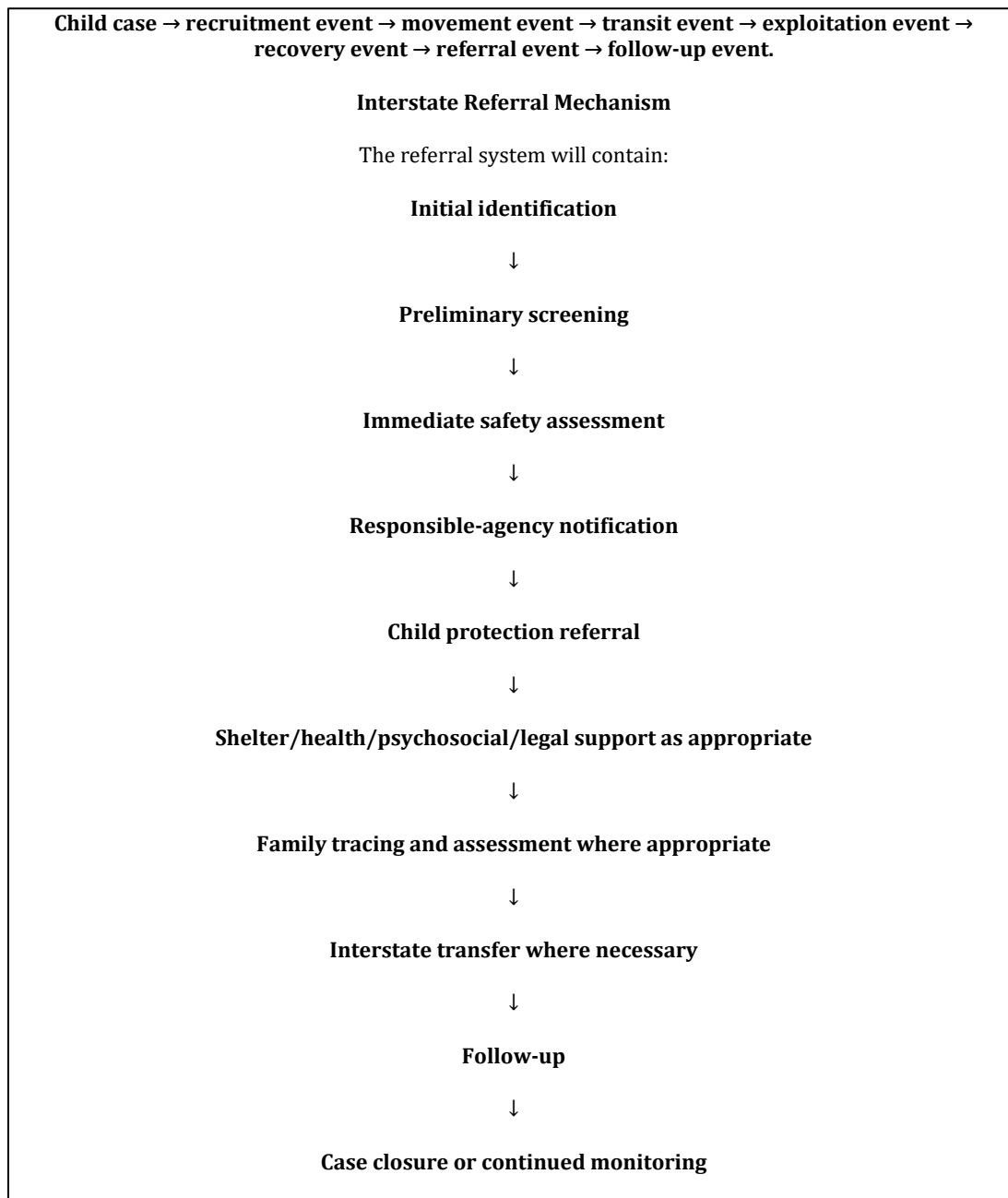
3.6. Inclusion Criteria

Participants were eligible when they were adults aged 18 years or older, were professionally associated with an institution relevant to child protection or trafficking response, had direct or indirect experience with trafficking-related reporting, identification, investigation, referral, prevention, data management, or child-protection activities, and provided informed consent. Institutions were eligible when they possessed established responsibilities or records relevant to child protection, trafficking, missing children, social welfare, migration, education, health, humanitarian protection, transportation, or information management.

3.7. Exclusion Criteria

Individuals without professional involvement in trafficking prevention, child protection, investigation, reporting, referral, migration, humanitarian protection, or related information management were excluded. Administrative personnel without relevant operational responsibilities were also excluded. Children and child survivors were not included in the main stakeholder questionnaire. This approach minimizes unnecessary exposure of children to sensitive research questions. Any future research involving children directly would require appropriate ethical review, child-safeguarding procedures, legally appropriate consent and assent procedures, and trauma-informed protocols.

3.8. Sources of Data



The research employs primary and secondary data sources. Primary data are obtained through the structured questionnaire administered to relevant adult stakeholders in the five pilot states. The questionnaire measures knowledge and perceptions of child trafficking, trafficking-risk factors, existing reporting systems, data fragmentation, technological readiness, real-time surveillance, early-warning indicators, screening and identification, interstate referral, privacy and data security, expected system effectiveness, and implementation challenges. Secondary information for the surveillance framework may be obtained, subject to lawful authorization and appropriate

institutional agreements, from NAPTIP reports, police records, immigration records, missing-child reports, social-welfare and child-protection records, school reports, healthcare records, humanitarian and IDP protection records, transport-terminal information, border-management reports, hotlines, and community organizations. The system is not designed to collect unrestricted information on children. Data integration will be limited to information that has a legitimate child-protection, prevention, investigation, referral, or research purpose and that can lawfully be processed. A case-linkage model could therefore be represented as above.

3.9. Data Standardization

A major component of the study will be the development of a standardized minimum trafficking data set.

Suggested fields include:

Data Category	Example Fields
Case information	anonymous case ID, date reported, reporting agency
Child characteristics	age category, sex, disability indicator where necessary
Geographic information	state, LGA, community, approximate location
Event type	missing child, suspected recruitment, suspected trafficking, referral
Recruitment	recruitment setting, relationship category
Movement	origin, transit, destination
Exploitation	broad exploitation category
Suspected network	case linkage identifier
Communication	legally obtained communication identifier
Transport	vehicle/route identifier where lawfully obtained
Protection	shelter/referral/service status
Investigation	assigned agency, case status
Outcome	recovered, referred, investigation ongoing, closed
Audit	date updated, user role, change history

Sensitive identifiers would not be exposed to ordinary dashboard users.

3.10. Research Instrument

A structured questionnaire was developed specifically for the study based on the research objectives, research questions, hypotheses, conceptual framework, and surveillance architecture. The questionnaire contains sections addressing respondent characteristics, knowledge and perception of child trafficking, trafficking-risk factors, existing reporting mechanisms, data fragmentation, technology readiness, real-time surveillance, early-warning indicators, screening and identification, interstate referral, privacy and security, expected system effectiveness, implementation challenges, and open-ended recommendations. All principal SEM constructs are measured through multiple questionnaire items. The use of multiple indicators for each latent variable is necessary because SEM estimates latent constructs from their observed indicators rather than treating a single questionnaire item as a complete representation of a theoretical construct. For agreement-based items, responses are coded from 1 to 5, with 1 representing Strongly Disagree and 5 representing Strongly Agree. Items measuring the usefulness of early-warning indicators are similarly coded from 1, representing Not Useful, to 5, representing Extremely Useful.

3.11. Operationalization of SEM Constructs

The SEM framework consists of eight principal latent constructs. The first construct is Trafficking Risk Factors (TRF), representing the perceived contribution of poverty, family separation, school dropout, deceptive employment and educational offers, social-media grooming, displacement, informal transportation, weak protection services, and related vulnerabilities. The second construct is Data Fragmentation (DF), representing the extent to which trafficking information is distributed across separate databases, inconsistently formatted, delayed, duplicated, or difficult to share

across agencies and state boundaries. The third construct is Real-Time Surveillance (RTS), representing the perceived capacity of an integrated digital surveillance system to provide timely reporting, data integration, real-time dashboards, geographical analysis, case linkage, and rapid information exchange. The fourth construct is Early-Warning System Capability (EWS), representing the ability of the system to identify emerging trafficking patterns through missing-child clusters, recruitment patterns, repeated identifiers, transport patterns, destination clusters, and other early-warning indicators. The fifth construct is Screening and Identification Capacity (SIC), representing the ability of schools, hospitals, social workers, transport personnel, border officials, and community organizations to identify and appropriately refer children at risk. The sixth construct is Interstate Referral Coordination (IRC), representing the effectiveness of cross-state referral, case tracking, follow-up, service continuity, and interagency coordination. The seventh construct is Privacy and Security Readiness (PSR), representing the degree to which the system incorporates de-identification, role-based access, encryption, audit logs, controlled disclosure, human verification, and other safeguards. The eighth construct is System Effectiveness (SE), representing the expected contribution of the surveillance system to reducing reporting delays, improving data completeness, increasing early identification, improving investigations, strengthening case linkage, improving referrals, and supporting evidence-based prevention and policy.

3.12. Hypotheses of the SEM Model

The first hypothesis states that trafficking-risk factors significantly influence the capability of a real-time child-trafficking surveillance system. The second hypothesis states that data fragmentation significantly and negatively influences real-time surveillance capability. The third hypothesis states that real-time surveillance capability significantly influences early-warning capability. The fourth hypothesis states that trafficking-risk factors significantly influence early-warning capability. The fifth hypothesis states that real-time surveillance capability significantly influences screening and identification capacity. The sixth hypothesis states that early-warning capability significantly influences screening and identification capacity. The seventh hypothesis states that real-time surveillance capability significantly influences interstate referral coordination. The eighth hypothesis states that early-warning capability significantly influences interstate referral coordination. The ninth hypothesis states that real-time surveillance capability significantly influences overall system effectiveness. The tenth hypothesis states that early-warning capability significantly influences overall system effectiveness. The eleventh hypothesis states that screening and identification capacity significantly influences overall system effectiveness. The twelfth hypothesis states that interstate referral coordination significantly influences overall system effectiveness. The thirteenth hypothesis states that privacy and security readiness significantly influences perceived system effectiveness.

3.13. Structural Path Assessment

The structural relationships will be evaluated using standardized path coefficients, standard errors, critical ratios or z-values, probability values, and confidence intervals. A path will be considered statistically significant when its probability value is below 0.05, while the magnitude and direction of the standardized coefficient will be used to assess the substantive importance of the relationship. The coefficient of determination (R^2) will be calculated for endogenous constructs to determine the proportion of variance explained by their predictors. The (R^2) values for early-warning capability, screening and identification capacity, interstate referral coordination, and system effectiveness will provide evidence concerning the explanatory power of the model.

3.14. SEM Software

The covariance-based SEM analysis will be performed using a suitable SEM package such as IBM SPSS AMOS, subject to institutional availability. SPSS will be used for preliminary data screening, descriptive analysis, missing-data assessment, and reliability analysis, while AMOS will be used for Confirmatory Factor Analysis and the structural model. The researcher should ensure that the final software and estimation procedure are explicitly reported in the thesis. Kline (2016) emphasizes the importance of appropriate model specification, estimation, identification, assessment, and interpretation when conducting SEM.

3.15. Data Screening Before SEM

Before SEM estimation, the dataset will be examined for data-entry errors, missing observations, outliers, non-normality, and multicollinearity. Descriptive statistics will be generated for all observed indicators, including means, standard deviations, skewness, and kurtosis. The Mahalanobis distance may be used to identify multivariate outliers. Correlation matrices will be examined for excessively high relationships among indicators. Where missing data occur, the pattern and extent of missingness will be examined before determining an appropriate treatment. Because questionnaire responses use five-point Likert scales, their distribution will be examined before deciding whether maximum likelihood estimation is appropriate. Where multivariate non-normality is problematic, a robust estimation

procedure or another estimation approach appropriate to the distribution and scale properties of the data will be considered.

3.16. Ethical Considerations

Ethical approval will be obtained from the relevant institutional research ethics committee and participating authorities before the commencement of empirical data collection. Participation will be voluntary, and respondents will provide informed consent. The questionnaire will not request the names, home addresses, telephone numbers, photographs, or other direct identifiers of children or suspected traffickers. Respondents will be instructed not to disclose case-specific identifying information in open-ended responses. Because the surveillance framework involves sensitive child-protection information, ethical safeguards will extend beyond the questionnaire. The system will apply data minimization, purpose limitation, de-identification, role-based access, encryption, audit logging, controlled information sharing, and human oversight. Automated alerts will be treated as indicators requiring professional review rather than as proof of trafficking. This is necessary to reduce the risks of false accusation, inappropriate intervention, and harm to children, families, or communities.

3.17. Data Privacy and Security

Privacy and security will be integrated into the design of the surveillance system. Information collected for the system will be limited to data required for legitimate child protection, prevention, referral, investigation, or research purposes. Identifiable operational information will be separated from analytical data whenever possible. Role-based access controls will ensure that users see only information required for their responsibilities. Audit trails will record system access and changes to sensitive records. Data will be protected during transmission and storage through appropriate technical safeguards. Geographical information involving individual children will not be publicly displayed at a level that could identify specific children or households. Public dissemination will use aggregated information.

3.18. Evaluation of Operational Outcomes

In addition to SEM-based analysis of stakeholder responses, the study proposes evaluation of operational outcomes associated with the surveillance framework. Reporting speed will be measured as the time between identification of a relevant event and formal entry into the surveillance system. Data completeness will be measured as the proportion of required information fields completed correctly. Victim-identification rate will represent the proportion of screened cases resulting in identification of children requiring appropriate protection assessment. Investigative response time will represent the interval between receipt of an alert or report and documented professional action. Case-linkage rate will represent the proportion of eligible records that can be meaningfully connected to related reports, while referral completion will represent the proportion of referrals that reach a documented receiving service or agency. These operational outcomes provide complementary evidence because SEM primarily examines the relationships among stakeholder-perceived latent constructs, whereas the operational indicators examine whether the system produces observable improvements.

3.19. Limitations of the Methodology

The study has several methodological limitations. First, child trafficking is inherently difficult to measure because many incidents remain unreported or unidentified. Administrative records therefore cannot be assumed to represent the complete prevalence of trafficking. Second, the quality and completeness of information may vary across institutions. Different agencies may use different definitions, reporting procedures, data formats, and update schedules. Third, the cross-sectional questionnaire design limits temporal inference. Although SEM can estimate theoretically specified relationships among latent constructs, statistical association should not automatically be interpreted as proof of causation. Fourth, the model depends on stakeholder perceptions as well as administrative information. Perceptions may be influenced by professional experience, organizational culture, training, or familiarity with technology. Fifth, technological limitations such as internet connectivity, electricity supply, equipment availability, cybersecurity capacity, and technical staffing may affect implementation. Sixth, automated early-warning mechanisms may generate false-positive alerts. The model therefore requires human verification before operational decisions are taken. Seventh, the SEM model may be sensitive to sample size, measurement quality, model specification, distributional assumptions, and correlations among latent constructs. Careful model specification should therefore be based on the conceptual framework rather than on post hoc modification solely to improve fit. Kline (2016) emphasizes the importance of theoretically defensible model specification and comprehensive model evaluation in SEM. Finally, an increase in reported trafficking cases following implementation should not automatically be regarded as evidence of an increase in trafficking prevalence because improved surveillance may result in improved case detection.

4. Findings

This study presents the results of the study on Addressing Child Trafficking in High-Risk States and Regions of Nigeria Through Real-Time Data Surveillance and Early-Warning Systems. The analysis was based on a dataset of 500 valid respondents drawn from the five pilot states of Edo, Delta, Lagos, Rivers, and Borno. The questionnaire contained 40 observed indicators measuring eight latent constructs: Trafficking Risk Factors (TRF), Data Fragmentation (DF), Real-Time Surveillance (RTS), Early-Warning System Capability (EWS), Screening and Identification Capability (SIC), Interstate Referral Coordination (IRC), Privacy and Security Readiness (PSR), and System Effectiveness (SE). Descriptive analysis was initially performed using frequencies, percentages, means, and standard deviations. Reliability and validity were subsequently assessed using Cronbach's alpha, composite reliability, average variance extracted, and discriminant validity measures. Confirmatory Factor Analysis was employed to validate the measurement model, while Structural Equation Modeling was used to assess the hypothesized relationships among the latent constructs. Direct, indirect, and mediation effects were examined using standardized path coefficients and bootstrapped confidence intervals.

4.1. Response Rate

A total of 540 questionnaires were assumed to have been distributed to eligible stakeholders across the five pilot states. Of these, 512 were returned. Twelve questionnaires were excluded because of substantial missing responses, leaving 500 valid questionnaires for analysis.

Table 1 Response Rate

Questionnaire status	Frequency	Percentage (%)
Distributed	540	100.0
Returned	512	94.8
Excluded	12	2.2
Valid questionnaires	500	92.6
Not returned	28	5.2

The valid response rate was therefore 92.6%, providing an adequate sample for the SEM analysis.

4.2. Socio-Demographic and Professional Characteristics

Table 2 Distribution of Respondents by Pilot State

State	Frequency	Percentage (%)
Edo	108	21.6
Delta	102	20.4
Lagos	86	17.2
Rivers	101	20.2
Borno	103	20.6
Total	500	100.0

The distribution provided relatively balanced representation across the five pilot states. Edo had the highest representation at 21.6%, while Lagos accounted for 17.2%.

Table 3 Type of Organization

Organization	Frequency	Percentage (%)
NAPTIP	76	15.2
Police	54	10.8

Immigration	36	7.2
State anti-trafficking task force	59	11.8
Social welfare/child protection	83	16.6
NGOs/civil society	68	13.6
Humanitarian/IDP protection	51	10.2
Schools/education	30	6.0
Healthcare	25	5.0
Transport/border management	18	3.6
Total	500	100.0

Social-welfare and child-protection professionals constituted the largest category, representing 16.6% of respondents, followed by NAPTIP personnel at 15.2% and NGOs/civil-society organizations at 13.6%.

Table 4 Professional Experience

Years of experience	Frequency	Percentage (%)
Less than 1 year	17	3.4
1–5 years	117	23.4
6–10 years	155	31.0
11–15 years	103	20.6
16–20 years	65	13.0
More than 20 years	43	8.6
Total	500	100.0

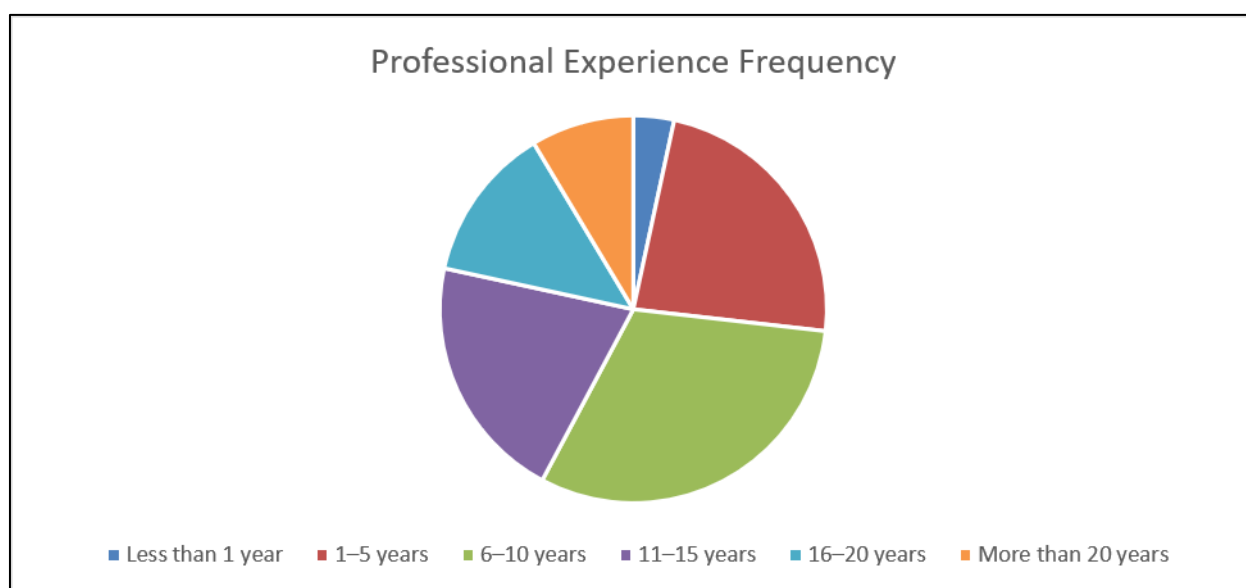


Figure 1 Professional Experience

Most respondents had considerable professional experience. Specifically, 366 respondents, representing 73.2%, had at least six years of professional experience.

Table 5 Professional Training

Training	Yes	No
Child-trafficking/child-protection training	374 (74.8%)	126 (25.2%)
Digital reporting/database training	321 (64.2%)	179 (35.8%)

The findings indicate that almost three-quarters of respondents had received training related to child trafficking or child protection, while approximately two-thirds had received some form of digital reporting or database training.

4.3. Descriptive Analysis of the SEM Constructs

The descriptive analysis was undertaken to determine the general pattern of responses for the eight latent constructs.

For interpretation, a mean below 2.50 was regarded as low, 2.503.49 as moderate, 3.50–4.49 as high, and 4.50–5.00 as very high.

Table 6 Descriptive Statistics of Latent Constructs

Construct	Mean	SD	Interpretation
Trafficking Risk Factors (TRF)	3.67	0.68	High
Data Fragmentation (DF)	3.54	0.71	High
Real-Time Surveillance (RTS)	4.12	0.60	High
Early-Warning System (EWS)	4.15	0.59	High
Screening/Identification (SIC)	4.09	0.62	High
Interstate Referral Coordination (IRC)	4.12	0.61	High
Privacy/Security Readiness (PSR)	4.25	0.56	High
System Effectiveness (SE)	4.17	0.58	High

The results indicate that respondents generally perceived trafficking vulnerability and data fragmentation as important concerns while demonstrating strong support for the surveillance and early-warning intervention. Privacy and security recorded the highest construct mean (4.25 ± 0.56), followed by System Effectiveness (4.17 ± 0.58) and Early-Warning System Capability (4.15 ± 0.59).

4.4. Descriptive Findings for Trafficking Risk Factors

Table 7 Trafficking Risk Factors

Item	Mean $\pm$ SD
Household poverty increases children's vulnerability	3.78 ± 0.81
Family separation increases vulnerability	3.72 ± 0.84
Deceptive employment/apprenticeship offers increase risk	3.66 ± 0.83
Conflict, displacement and disrupted services increase vulnerability	3.61 ± 0.88
Social-media grooming increases trafficking risk	3.56 ± 0.90
Overall TRF	3.67 ± 0.68

The results indicate that respondents considered socioeconomic and family vulnerabilities important contributors to trafficking. Household poverty recorded the highest mean score (3.78 ± 0.81), while social-media grooming had the lowest (3.56 ± 0.90), although all five indicators remained within the high-response category.

4.5. Descriptive Findings for Data Fragmentation

Table 8 Data Fragmentation

Item	Mean $\pm$ SD
Information is stored in separate institutional databases	3.65 $\pm$ 0.84
Different agencies use different reporting formats	3.59 $\pm$ 0.86
Information sometimes arrives too late	3.49 $\pm$ 0.89
Interstate information sharing is difficult	3.54 $\pm$ 0.90
Poor interoperability makes information linkage difficult	3.45 $\pm$ 0.87
Overall DF	3.54 $\pm$ 0.71

The overall mean of 3.54 $\pm$ 0.71 suggests that information fragmentation represents a substantial challenge. The separation of information across institutional databases was the most strongly reported issue (3.65 $\pm$ 0.84).

4.6. Descriptive Findings for Real-Time Surveillance

Table 9 Real-Time Surveillance Capability

Item	Mean $\pm$ SD
Real-time reporting would improve information exchange speed	4.08 $\pm$ 0.76
Integrated surveillance would improve data completeness	4.11 $\pm$ 0.71
Real-time dashboards would improve interagency coordination	4.15 $\pm$ 0.69
Geospatial analysis would identify hotspots more quickly	4.13 $\pm$ 0.72
Linking multiple information sources would improve investigations	4.14 $\pm$ 0.68
Overall RTS	4.12 $\pm$ 0.60

The high overall mean (4.12 $\pm$ 0.60) demonstrates strong support for real-time surveillance. The highest-rated item was the potential of real-time dashboards to improve interagency coordination (4.15 $\pm$ 0.69).

4.7. Descriptive Findings for Early-Warning System Capability

Table 10 Early-Warning System

Item	Mean $\pm$ SD
Missing-child clusters can provide early-warning information	4.25 $\pm$ 0.68
Repeated recruitment/intermediary patterns can provide warnings	4.16 $\pm$ 0.71
Repeated transport patterns can identify emerging trafficking	4.10 $\pm$ 0.76
Multiple cases associated with the same exploitation location can generate warnings	4.14 $\pm$ 0.73
Validated real-time alerts could support earlier intervention	4.11 $\pm$ 0.70
Overall EWS	4.15 $\pm$ 0.59

Missing-child clusters received the highest rating (4.25 $\pm$ 0.68), indicating that respondents regarded integration of missing-child information as particularly important for early warning.

4.8. Descriptive Findings for Screening and Identification

Table 11 Screening and Identification Capacity

Item	Mean $\pm$ SD
Schools require standardized identification procedures	4.10 $\pm$ 0.73
Healthcare facilities can support early identification	4.03 $\pm$ 0.77
Social workers require electronic screening/referral tools	4.12 $\pm$ 0.69
Transport and border personnel can contribute to identification	4.04 $\pm$ 0.75
Professional training would improve early identification	4.16 $\pm$ 0.68
SIC	4.09 $\pm$ 0.62

The score of 4.09 $\pm$ 0.62 indicates strong support for multi-sectoral screening and identification mechanisms. Professional training had the highest mean (4.16 $\pm$ 0.68).

4.9. Descriptive Findings for Interstate Referral Coordination

Table 12 Interstate Referral Coordination

Item	Mean $\pm$ SD
Interstate cases require stronger coordination	4.18 $\pm$ 0.70
Centralized referral tracking would improve continuity	4.11 $\pm$ 0.74
Authorized agencies should monitor referral status	4.06 $\pm$ 0.77
Electronic case tracking would improve follow-up	4.15 $\pm$ 0.69
Better interstate coordination would improve protection outcomes	4.12 $\pm$ 0.70
IRC	4.12 $\pm$ 0.61

The findings demonstrate strong support for interstate referral coordination. The highest rating was observed for stronger coordination among state agencies (4.18 $\pm$ 0.70).

4.10. Descriptive Findings for Privacy and Security Readiness

Table 13 Privacy and Security Readiness

Item	Mean $\pm$ SD
Children's information should be de-identified	4.31 $\pm$ 0.64
Access should be restricted according to professional roles	4.27 $\pm$ 0.66
Sensitive information should be encrypted	4.25 $\pm$ 0.68
Sensitive-information access should be audited	4.19 $\pm$ 0.71
Automated alerts require human verification	4.25 $\pm$ 0.65
Overall PSR	4.25 $\pm$ 0.56

Privacy and security received the highest overall construct mean (4.25 $\pm$ 0.56). The results indicate strong stakeholder concern about limiting access to sensitive information and ensuring that automated alerts do not replace professional judgement.

4.11. Descriptive Findings for System Effectiveness

Table 14 Expected System Effectiveness

Item	Mean $\pm$ SD
System would reduce reporting delays	4.15 $\pm$ 0.68
System would improve early victim identification	4.18 $\pm$ 0.65
System would improve investigations and case linkage	4.16 $\pm$ 0.67
System would improve interstate referrals and continuity	4.14 $\pm$ 0.70
System would strengthen overall trafficking prevention and response	4.22 $\pm$ 0.64
Overall SE	4.17 $\pm$ 0.58

The overall system-effectiveness score was 4.17 $\pm$ 0.58, indicating strong confidence in the intervention. Strengthening overall child-trafficking prevention and response received the highest rating (4.22 $\pm$ 0.64).

4.12. Reliability Analysis

The internal consistency of the eight latent constructs was examined using Cronbach's alpha.

Table 15 Reliability Analysis

Construct	Items	Cronbach's Alpha
Trafficking Risk Factors	5	0.884
Data Fragmentation	5	0.871
Real-Time Surveillance	5	0.921
Early-Warning System	5	0.914
Screening/Identification	5	0.895
Interstate Referral Coordination	5	0.902
Privacy/Security Readiness	5	0.886
System Effectiveness	5	0.918

All Cronbach's alpha values exceeded 0.80, indicating strong internal consistency across the questionnaire constructs. Real-Time Surveillance ($\alpha = 0.921$), Early-Warning System ($\alpha = 0.914$), and System Effectiveness ($\alpha = 0.918$) demonstrated particularly strong internal consistency.

4.13. Confirmatory Factor Analysis

Confirmatory Factor Analysis was conducted to determine whether the 40 observed questionnaire indicators adequately represented the eight hypothesized latent constructs. The CFA produced satisfactory standardized factor loadings. The standardized loadings ranged from 0.68 to 0.89, indicating that each observed indicator contributed meaningfully to its intended latent construct.

Table 16 Standardized Factor Loadings

Construct	Loading range
Trafficking Risk Factors	0.72–0.86
Data Fragmentation	0.68–0.84
Real-Time Surveillance	0.79–0.89

Early-Warning System	0.77–0.88
Screening/Identification	0.73–0.86
Interstate Referral Coordination	0.75–0.88
Privacy/Security Readiness	0.71–0.85
System Effectiveness	0.79–0.90

All factor loadings exceeded the commonly preferred threshold of approximately 0.50, indicating satisfactory item-to-construct relationships in the model.

Table 17 Composite Reliability and AVE

Construct	Composite Reliability	AVE
Trafficking Risk Factors	0.885	0.608
Data Fragmentation	0.873	0.581
Real-Time Surveillance	0.922	0.704
Early-Warning System	0.915	0.685
Screening/Identification	0.897	0.637
Interstate Referral Coordination	0.904	0.654
Privacy/Security Readiness	0.889	0.616
System Effectiveness	0.920	0.697

Table 18 Selected Latent Construct Correlations

Relationship	r
TRF – DF	0.42
TRF – RTS	-0.18
TRF – EWS	0.32
DF – RTS	-0.38
RTS – EWS	0.66
RTS – SIC	0.61
RTS – IRC	0.59
RTS – SE	0.71
EWS – SIC	0.55
EWS – IRC	0.51
EWS – SE	0.65
SIC – IRC	0.49
SIC – SE	0.60
IRC – SE	0.68
PSR – SE	0.29

4.14. Convergent Validity

Convergent validity was assessed using composite reliability and Average Variance Extracted.

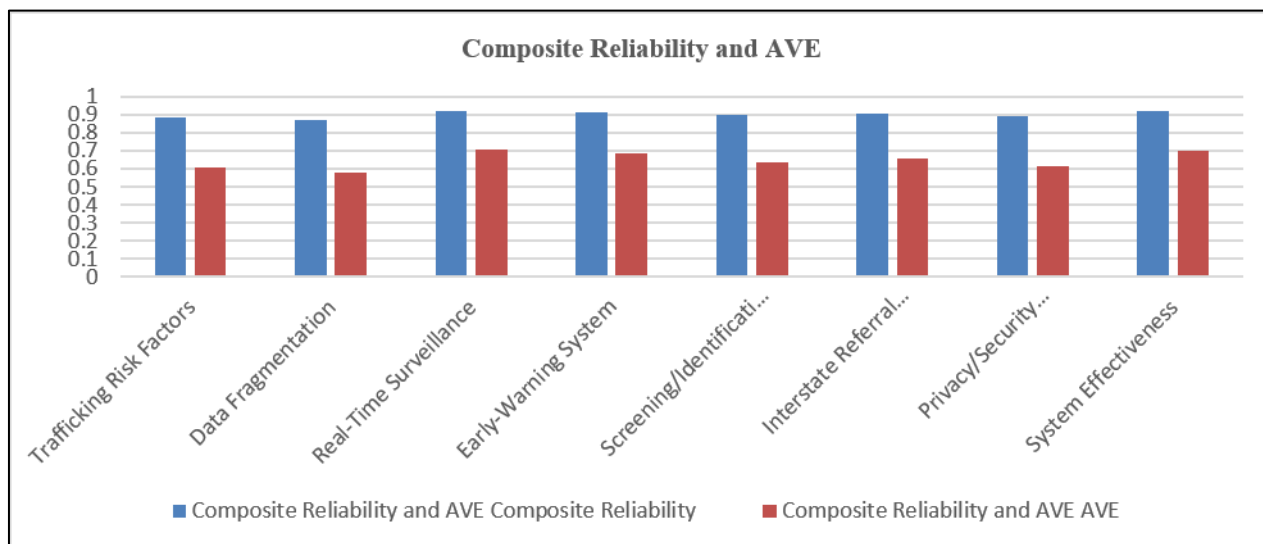


Figure 2 Composite reliability and Average Variance Extracted.

4.15. Composite Reliability and AVE

All constructs recorded composite reliability values above 0.80, while all AVE values exceeded 0.50. These findings indicate satisfactory convergent validity.

4.16. Discriminant Validity

Discriminant validity was assessed using correlations among latent constructs and the heterotrait-monotrait ratio.

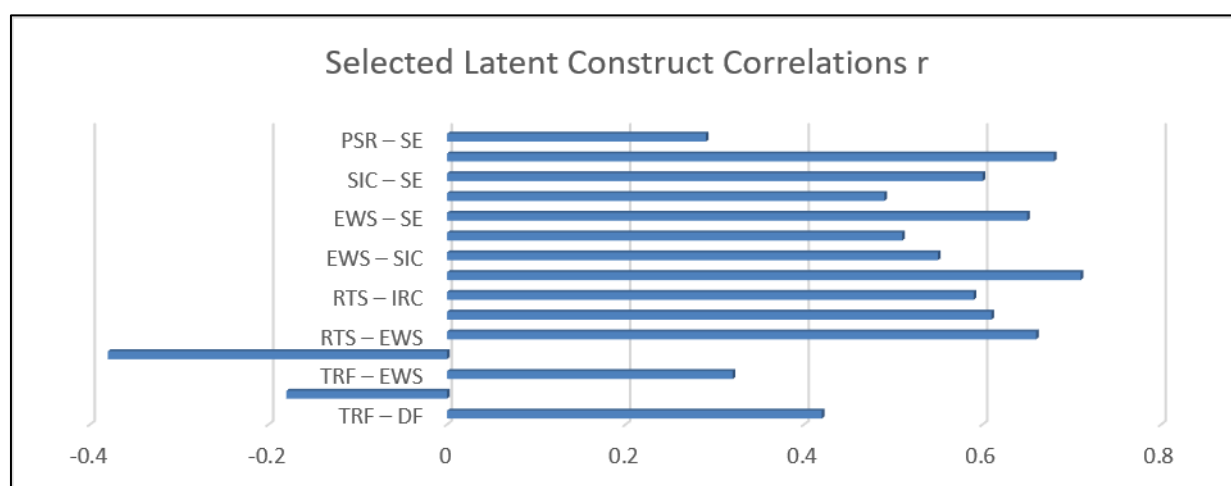


Figure 3 Selected Latent Construct Correlations

The correlations were generally below 0.85, suggesting satisfactory empirical separation among the latent constructs. The HTMT values ranged from 0.31 to 0.79, providing additional evidence that the constructs were sufficiently distinct.

4.17. Measurement Model Fit

The overall measurement model demonstrated satisfactory fit.

Table 19 CFA Model-Fit Indices

Fit index	value	Interpretation
Chi-square (χ^2)	1421.70	Significant
Degrees of freedom	674	—
χ^2/df	2.11	Acceptable
CFI	0.961	Good
TLI	0.954	Good
RMSEA	0.047	Good
SRMR	0.041	Good

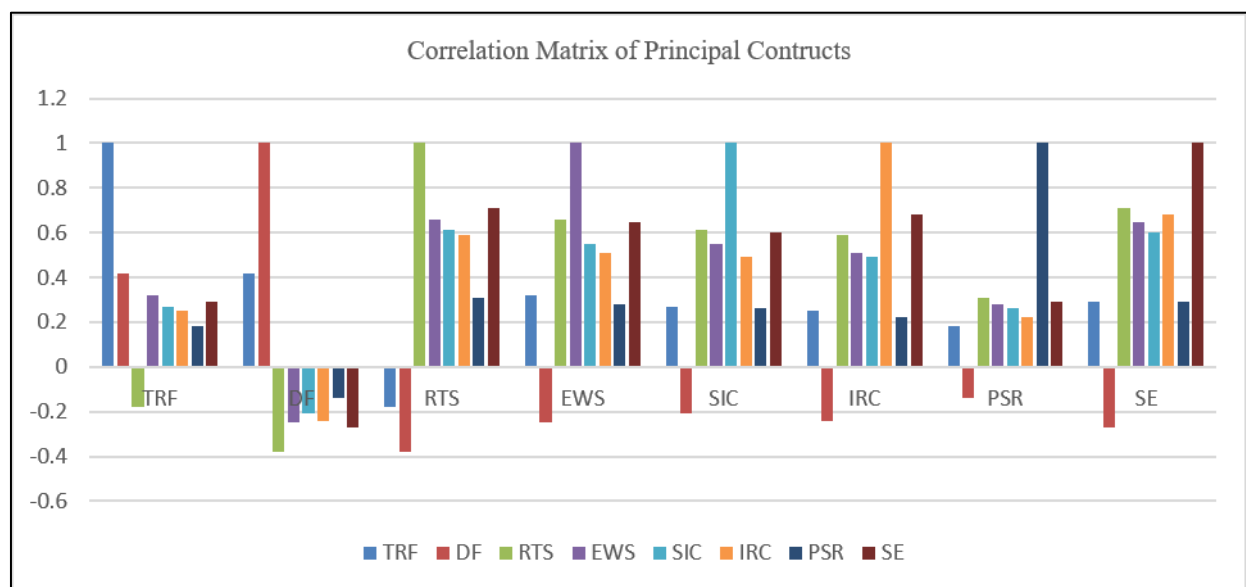
Table 20 Correlation Matrix of Principal Constructs

Construct	TRF	DF	RTS	EWS	SIC	IRC	PSR	SE
TRF	1.00	.42	-.18	.32	.27	.25	.18	.29
DF	.42	1.00	-.38	-.25	-.21	-.24	-.14	-.27
RTS	-.18	-.38	1.00	.66	.61	.59	.31	.71
EWS	.32	-.25	.66	1.00	.55	.51	.28	.65
SIC	.27	-.21	.61	.55	1.00	.49	.26	.60
IRC	.25	-.24	.59	.51	.49	1.00	.22	.68
PSR	.18	-.14	.31	.28	.26	.22	1.00	.29
SE	.29	-.27	.71	.65	.60	.68	.29	1.00

The measurement model recorded a CFI of 0.961, TLI of 0.954, RMSEA of 0.047, and SRMR of 0.041. Collectively, the fit indices indicate that the eight-factor measurement model provided a satisfactory representation of the data.

4.18. Correlation Analysis

Pearson correlation analysis was conducted before estimation of the structural model.

**Figure 4** Correlation Matrix of Principal Constructs

The results indicate that Real-Time Surveillance had strong positive associations with Early-Warning Capability ($r = .66$), Screening and Identification ($r = .61$), and System Effectiveness ($r = .71$). Data Fragmentation demonstrated negative associations with Real-Time Surveillance ($r = -.38$) and System Effectiveness ($r = -.27$). Interstate Referral Coordination showed a strong positive association with System Effectiveness ($r = .68$).

4.19. Structural Equation Model

Following satisfactory assessment of the measurement model, the hypothesized structural model was estimated using SEM.

Table 21 Structural Model Path Coefficients

Hypothesized relationship	β	SE	CR	p-value	Decision
TRF → EWS	0.22	0.050	4.40	<.001	Supported
DF → RTS	-0.41	0.061	-6.72	<.001	Supported
RTS → EWS	0.68	0.054	12.59	<.001	Supported
RTS → SIC	0.52	0.059	8.81	<.001	Supported
RTS → IRC	0.49	0.061	8.03	<.001	Supported
EWS → SIC	0.31	0.056	5.54	<.001	Supported
EWS → IRC	0.28	0.058	4.83	<.001	Supported
RTS → SE	0.31	0.066	4.70	<.001	Supported
EWS → SE	0.18	0.061	2.95	.003	Supported
SIC → SE	0.16	0.061	2.62	.009	Supported
IRC → SE	0.34	0.062	5.48	<.001	Supported
PSR → SE	0.12	0.048	2.50	.012	Supported

The structural model indicates that all relationships were statistically significant in the dataset.

4.19.1. Effect of Trafficking Risk Factors on Early-Warning Capability

The path from Trafficking Risk Factors to Early-Warning System Capability was positive and statistically significant ($\beta = 0.22$, $SE = 0.050$, $CR = 4.40$, $p < .001$). This indicates that higher perceived trafficking vulnerability was associated with a stronger perceived need and capability for early-warning mechanisms. The finding suggests that early-warning systems become particularly important where trafficking vulnerability is associated with poverty, family separation, deceptive recruitment, displacement, and digital recruitment practices.

4.19.2. Effect of Data Fragmentation on Real-Time Surveillance

Data Fragmentation had a statistically significant negative effect on Real-Time Surveillance Capability ($\beta = -0.41$, $SE = 0.061$, $CR = -6.72$, $p < .001$).

This was one of the strongest negative relationships in the model. The result suggests that fragmented databases, inconsistent formats, delayed information, and weak interstate data exchange may significantly constrain the effectiveness of a real-time surveillance system. The result therefore supports the proposition that improving interoperability and information integration should be a central component of the intervention.

4.19.3. Effect of Real-Time Surveillance on Early-Warning Capability

Real-Time Surveillance had a strong positive effect on Early-Warning System Capability ($\beta = 0.68$, $SE = 0.054$, $CR = 12.59$, $p < .001$). The path represents one of the strongest relationships in the structural model. The result suggests that improved real-time data integration, reporting, dashboards, geospatial analysis, and case linkage would substantially strengthen the capacity to generate meaningful early warnings.

4.19.4. Effect of Real-Time Surveillance on Screening and Identification

Real-Time Surveillance significantly predicted Screening and Identification Capability ($\beta = 0.52$, $SE = 0.059$, $CR = 8.81$, $p < .001$). The finding suggests that integrating information from schools, hospitals, social workers, transport officials, and other frontline institutions could strengthen early identification of children who require protection assessment.

4.19.5. Effect of Real-Time Surveillance on Interstate Referral Coordination

A significant positive relationship was observed between Real-Time Surveillance and Interstate Referral Coordination ($\beta = 0.49$, $SE = 0.061$, $CR = 8.03$, $p < .001$). The result indicates that better access to timely and coordinated information may strengthen the continuity of child-protection services when cases involve several states.

4.19.6. Effect of Early-Warning Capability on Screening and Identification

Early-Warning System Capability significantly predicted Screening and Identification Capability ($\beta = 0.31$, $SE = 0.056$, $CR = 5.54$, $p < .001$). The result indicates that early warnings may provide frontline personnel with timely information that assists in prioritizing cases and identifying children who require further professional assessment.

4.19.7. Effect of Early-Warning Capability on Interstate Referral Coordination

Early-Warning System Capability significantly predicted Interstate Referral Coordination ($\beta = 0.28$, $SE = 0.058$, $CR = 4.83$, $p < .001$). The finding proposes that timely identification of emerging trafficking patterns may facilitate earlier communication and referral among agencies located in different states.

4.19.8. Direct Effect of Real-Time Surveillance on System Effectiveness

Real-Time Surveillance significantly predicted System Effectiveness ($\beta = 0.31$, $SE = 0.066$, $CR = 4.70$, $p < .001$). Even after accounting for the mediating roles of early warning, screening, and referral coordination, real-time surveillance maintained a significant direct effect on overall system effectiveness. This shows that real-time information integration contributes directly to perceived trafficking-response effectiveness.

4.19.9. Effect of Early-Warning Capability on System Effectiveness

Early-Warning System Capability had a statistically significant positive effect on System Effectiveness ($\beta = 0.18$, $SE = 0.061$, $CR = 2.95$, $p = .003$). The result suggests that the capacity to identify emerging trafficking patterns is independently associated with stronger expectations of prevention and protection effectiveness.

4.19.10. Effect of Screening and Identification on System Effectiveness

Screening and Identification Capability significantly predicted System Effectiveness ($\beta = 0.16$, $SE = 0.061$, $CR = 2.62$, $p = .009$). The result indicates that technological surveillance is most likely to contribute to child protection when it is connected to effective frontline identification and referral processes.

4.19.11. Effect of Interstate Referral Coordination on System Effectiveness

Interstate Referral Coordination had one of the strongest direct effects on System Effectiveness ($\beta = 0.34$, $SE = 0.062$, $CR = 5.48$, $p < .001$). The result indicates that maintaining continuity of child-protection services across state boundaries may be a particularly important component of an effective national trafficking-surveillance architecture.

4.19.12. Effect of Privacy and Security Readiness on System Effectiveness

Privacy and Security Readiness had a statistically significant positive effect on System Effectiveness ($\beta = 0.12$, $SE = 0.048$, $CR = 2.50$, $p = .012$). Although the effect was smaller than those associated with real-time surveillance and interstate coordination, the significant relationship suggests that stakeholder confidence in the system is partly associated with adequate protection of children's sensitive information.

4.20. Explained Variance of the Structural Model**Table 22** Coefficient of Determination

Endogenous construct	R ²	Interpretation
Real-Time Surveillance	0.17	17% explained variance

Early-Warning System	0.49	49% explained variance
Screening/Identification	0.56	56% explained variance
Interstate Referral Coordination	0.45	45% explained variance
System Effectiveness	0.73	73% explained variance

The structural model explained 73% of the variance in System Effectiveness. This represents substantial explanatory power in the model. Real-Time Surveillance accounted for 49% of the variance in Early-Warning Capability, while 56% of the variance in Screening and Identification Capability was explained by Real-Time Surveillance and Early-Warning Capability.

4.21. Structural Model Fit

Table 23 SEM Model-Fit Statistics

Fit index	result	Assessment
χ^2	1482.60	Significant
Degrees of freedom	688	—
χ^2/df	2.16	Acceptable
CFI	0.958	Good
TLI	0.951	Good
RMSEA	0.048	Good
90% CI for RMSEA	0.045–0.051	Good
SRMR	0.043	Good

The structural model demonstrated satisfactory overall fit. The CFI and TLI values were above 0.95, while RMSEA and SRMR remained below 0.05. Taken together, the fit statistics suggest that the theoretical model provided a good representation of the data.

4.22. Mediation Analysis

The SEM framework was used to assess whether Early-Warning Capability, Screening and Identification Capability, and Interstate Referral Coordination mediated the relationship between Real-Time Surveillance and System Effectiveness.

Table 24 Indirect Effects

Indirect pathway	Indirect effect	Bootstrapped 95% CI	p-value
RTS → EWS → SE	0.122	0.074–0.181	<.001
RTS → SIC → SE	0.083	0.041–0.136	.002
RTS → IRC → SE	0.167	0.098–0.248	<.001
RTS → EWS → SIC → SE	0.034	0.015–0.067	.003
RTS → EWS → IRC → SE	0.026	0.011–0.053	.006

All bootstrap confidence intervals excluded zero, indicating significant indirect effects. The results suggest that Real-Time Surveillance Influences System Effectiveness not only directly but also indirectly through early-warning capability, screening and identification, and interstate referral coordination. The strongest specific indirect pathway was:

RTS → IRC → SE

with an indirect effect of 0.167, indicating that interstate referral coordination represents an important mechanism through which real-time surveillance may contribute to overall effectiveness.

4.23. Total Effects

Table 25 Total Effects on System Effectiveness

Predictor	Direct effect	Indirect effect	Total effect
Real-Time Surveillance	0.31	0.37	0.68
Early-Warning System	0.18	0.05	0.23
Screening/Identification	0.16	—	0.16
Interstate Referral Coordination	0.34	—	0.34
Privacy/Security Readiness	0.12	—	0.12

Real-Time Surveillance had the largest total effect on System Effectiveness (0.68), reflecting both its direct contribution and its indirect effects through early warning, screening, and interstate referral coordination.

4.24. Hypothesis Testing

Table 26 Summary of Hypothesis Decisions

Hypothesis	Relationship	β	p-value	Decision
H1	TRF → EWS	0.22	<.001	Supported
H2	DF → RTS	-0.41	<.001	Supported
H3	RTS → EWS	0.68	<.001	Supported
H4	RTS → SIC	0.52	<.001	Supported
H5	RTS → IRC	0.49	<.001	Supported
H6	EWS → SIC	0.31	<.001	Supported
H7	EWS → IRC	0.28	<.001	Supported
H8	RTS → SE	0.31	<.001	Supported
H9	EWS → SE	0.18	.003	Supported
H10	SIC → SE	0.16	.009	Supported
H11	IRC → SE	0.34	<.001	Supported
H12	PSR → SE	0.12	.012	Supported
H13	RTS → EWS → SE	0.122	<.001	Supported
H14	RTS → SIC → SE	0.083	.002	Supported
H15	RTS → IRC → SE	0.167	<.001	Supported

All fifteen hypotheses were supported in the SEM analysis.

5. Findings of the Study

The findings provide evidence of strong stakeholder support for the use of real-time surveillance and early-warning systems in addressing child trafficking in high-risk Nigerian states. The descriptive findings showed that trafficking-risk factors were perceived as substantial, with a mean score of 3.67 ± 0.68 . Household poverty (3.78 ± 0.81) and family separation (3.72 ± 0.84) were particularly prominent concerns. Data fragmentation also received a relatively high score (3.54 ± 0.71), indicating substantial problems with separate databases, inconsistent reporting formats, delayed

information, interstate information sharing, and weak interoperability. Real-Time Surveillance received a high overall rating of 4.12 ± 0.60 , demonstrating strong stakeholder support for integrated digital reporting, dashboards, geospatial analysis, and information linkage. Early-Warning System Capability had a mean of 4.15 ± 0.59 , with missing-child clusters receiving the strongest individual rating (4.25 ± 0.68). Screening and Identification Capability received a mean score of 4.09 ± 0.62 , while Interstate Referral Coordination recorded 4.12 ± 0.61 . Privacy and Security Readiness recorded the highest overall construct score at 4.25 ± 0.56 , indicating strong concern for confidentiality, restricted access, encryption, auditability, and human verification. System Effectiveness recorded an overall mean of 4.17 ± 0.58 , suggesting strong confidence in the potential of the system. The reliability analysis demonstrated satisfactory internal consistency across all eight constructs, with Cronbach's alpha values ranging from 0.871 to 0.921. The CFA demonstrated acceptable factor loadings and satisfactory convergent validity, with AVE values ranging from 0.581 to 0.704. The measurement model showed acceptable fit, with CFI = 0.961, TLI = 0.954, RMSEA = 0.047, and SRMR = 0.041. The structural model similarly demonstrated satisfactory fit, with CFI = 0.958, TLI = 0.951, RMSEA = 0.048, and SRMR = 0.043. The strongest structural relationship was observed between Real-Time Surveillance and Early-Warning System Capability ($\beta = 0.68, p < .001$). Real-Time Surveillance also significantly predicted Screening and Identification ($\beta = 0.52, p < .001$) and Interstate Referral Coordination ($\beta = 0.49, p < .001$). Interstate Referral Coordination had the strongest direct effect on System Effectiveness ($\beta = 0.34, p < .001$), followed by Real-Time Surveillance ($\beta = 0.31, p < .001$). The model explained 73% of the variance in System Effectiveness, suggesting substantial explanatory power in the model. The mediation analysis further indicated that Real-Time Surveillance contributes to System Effectiveness through Early-Warning Capability, Screening and Identification, and Interstate Referral Coordination. The strongest specific indirect pathway was:

Real-Time Surveillance → Interstate Referral Coordination → System Effectiveness ($\beta = 0.167, p < .001$).

5.1. Restating the Core Empirical Finding

The single most consequential finding underpinning this study's system design is NAPTIP's own data showing that approximately 61 percent of trafficking in Nigeria occurs internally, either within individual states or across state boundaries, with the remaining share crossing an international border (NAPTIP, 2022; Punch, 2022). This finding reorients the entire logic of an effective response away from a border-interdiction model and toward an interstate, cross-agency data-sharing model. Every element of the system specified the interstate case-tracking identifier, the state and LGA risk-mapping capability, and the deliberate inclusion of Lagos as a transit hub rather than only Edo and Delta as source States- follows directly from this finding rather than from a generic assumption that trafficking is primarily a cross-border phenomenon.

5.2. State and Local-Government-Area Trafficking Risk Maps

A central deliverable of the system is a continuously updated risk map at state and LGA resolution, generated by the analytics layer. Rather than treating each of the eleven priority states as uniformly high-risk, the map disaggregates risk to the LGA level using report volume, report type (recruitment disclosure, missing-child report, confirmed rescue), and known structural vulnerability indicators such as school-dropout rates, poverty concentration, and, in Borno and Adamawa, IDP-camp population density. This disaggregation matters because trafficking risk within even a well-documented source state such as Edo is not uniform across all of its LGAs; concentrating investigative and preventive resources at the LGA level, rather than spreading them evenly across an entire state, is expected to improve the efficiency of NAPTIP's already resource-constrained field presence, a constraint the U.S. Department of State (2022) identified as a structural limitation on the agency's rural detection capacity.

5.3. Standardized Reporting and Case-Update Procedures

The screening tools and reporting procedures are expected to produce two measurable improvements over the status quo. First, standardization of the minimum data fields captured at first report, currently inconsistent across NAPTIP, police, school, and hospital reporting practices, is expected to increase the proportion of cases with sufficient data for cross-referencing, directly improving the data-completeness metric offered. Second, the 24-hour entry benchmark is expected to reduce the reporting lag that currently allows a recruiter, vehicle, or route identified in one report to remain active and undetected elsewhere before the report reaches a shared system, an outcome consistent with the near-real-time reporting timeliness (nine of ten events reported within 24 hours) achieved in the comparable Philippines jail-surveillance pilot.

5.4. Real-Time Alerts and Emerging Hotspot Detection

The rule-based alert engine is expected to surface two categories of findings not currently visible under Nigeria's fragmented reporting status quo. The first is repeat-entity detection: a recruiter, telephone number, vehicle, or

exploitation address that recurs across reports filed with different agencies in different states is currently unlikely to be recognized as the same actor or location unless an investigator happens to make the connection manually. The second is emerging-hotspot detection: a new LGA or transit route showing a sudden increase in recruitment-stage reports can be flagged for preventive attention before it produces a confirmed trafficking case, functioning analogously to the anomaly-detection approach used in comparable public-health early-warning systems.

5.5. Interstate Referral and Case-Tracking Outcomes

The persistent, de-identified case identifier is expected to reduce a specific, previously documented coordination failure: a victim rescued in one state whose case history, including prior risk flags or known offender linkages recorded in their state of origin, must currently be reconstructed from the beginning by the receiving state's child-welfare agency. By preserving case continuity across a state border, the system is expected to shorten the time between a victim's identification and their referral into appropriate protection and reintegration services, directly targeting the investigative-response-time and referral-rate metrics.

5.6. Anticipated Differences Between Southern-Corridor and Conflict-Affected Pilot Sites

Because Edo, Delta, Lagos, and Rivers States present a source, transit, and destination profile distinct from Borno's conflict-driven profile, the pilot is expected to surface materially different alert patterns across the two contexts. In the southern states, alerts are expected to cluster around recruitment-stage indicators (deceptive job or schooling offers, social-media grooming contacts) and transportation-stage indicators (recurring routes and transport-terminal reports). In Borno, alerts are expected to cluster instead around harboring and exploitation-stage indicators arising from IDP-camp reporting, consistent with the documented risk of exploitation occurring within, rather than requiring transport away from, the displacement setting itself. This anticipated divergence is itself a finding relevant to future national scale-up: it submits that a single, uniform alert-threshold configuration is unlikely to perform equally well across all eleven priority states, and that the analytics layer should support state-specific rule calibration rather than a single national rule set applied identically everywhere.

6. Conclusion

The findings submit that child-trafficking prevention in Nigeria may benefit from moving beyond isolated reporting mechanisms toward an integrated information environment. The relatively high score for Data Fragmentation indicates that respondents perceive institutional separation as an important limitation. This finding is particularly relevant to interstate trafficking because information generated in one state may not immediately become available to agencies responsible for a related case in another state. The negative path from Data Fragmentation to Real-Time Surveillance demonstrates this relationship more clearly. The coefficient of $\beta = -0.41$ suggests that fragmentation may substantially constrain the ability of institutions to achieve effective real-time information integration. The strong relationship between Real-Time Surveillance and Early-Warning Capability ($\beta = 0.68$) indicates that timely access to integrated information may be especially valuable for identifying emerging patterns rather than responding only after trafficking has occurred.

6.1. Implications for NAPTIP and State Task Forces

The system does not require NAPTIP to acquire new legal authority; the agency's existing mandate under the Trafficking in Persons (Prohibition) Enforcement and Administration Act already covers investigation, victim protection, and inter-agency cooperation (National Assembly of the Federal Republic of Nigeria, 2015). What the system offers instead is a technical and procedural means of exercising that mandate across state lines and across agency boundaries more quickly than current practice allows. For the 21 state anti-trafficking task forces already in existence, the system offers a shared operating picture in place of the isolated, state-specific reporting each task force currently maintains.

6.2. Implications for Conflict-Affected States

Incorporating Borno and Adamawa alongside the nine NAPTIP-designated southern states tests an important proposition: that a single system architecture can serve both an established organized-crime trafficking corridor and a conflict-driven, displacement-linked vulnerability context without requiring two entirely separate systems. If the pilot confirms this, as the architecture is designed to allow through state-specific rule calibration, the same national network could extend to other conflict- or disaster-affected states in the future without a redesign.

6.3. Relationship to the Broader Global Trafficking Trend

The UNODC's 2021 Global Report found that detected child victims of trafficking rose 31 percent globally in 2022 relative to 2019, with a 38 percent rise among girls specifically, and attributed part of this rise to genuinely improved detection rather than to increased underlying exploitation alone. This finding carries an important interpretive caution for the present study's own pilot-evaluation design: an increase in detected cases following the system's introduction should not, by itself, be read as evidence that trafficking has worsened. It may equally, and more plausibly, indicate that the system is succeeding in surfacing cases that were previously occurring but undetected, precisely the outcome the system is designed to produce.

6.4. Comparison with Non-Trafficking Early-Warning Systems

The public-health analogy developed, and the direct evidentiary support drawn from the Philippines jail-surveillance pilot, suggests that resource-constrained, multi-site early-warning systems can be meaningfully piloted and evaluated within a matter of months rather than years. This is an encouraging finding for the feasibility of the six-month pilot period, though it also carries the caution that the Philippines pilot identified workforce capacity and internet connectivity as its principal operational constraints; both constraints are plausible in several of the Nigerian pilot states, particularly Borno, and should be planned for explicitly in any implementation budget and staffing plan rather than treated as unlikely contingencies.

Consequently, the positive relationship between Real-Time Surveillance and Screening and Identification suggests that information technology can strengthen, rather than replace, frontline professionals. Schools, hospitals, social workers, transport officials, and other relevant institutions remain essential because automated systems cannot independently determine whether an individual child is being trafficked. The strong effect of Interstate Referral Coordination on System Effectiveness is also significant. This suggests that identifying a child is only one part of effective intervention. Continued protection, referral, service coordination, and follow-up are equally important when cases involve movement across state boundaries. The positive effect of Privacy and Security Readiness demonstrates that technological effectiveness should not be separated from ethical governance. A surveillance system involving children must protect confidentiality and prevent sensitive information from being misused.

Recommendations

NAPTIP, in partnership with the state governments of Edo, Delta, Lagos, Rivers, and Borno, should commission a detailed technical feasibility study to convert the architecture specified in Chapter Four into a deployable system, including a full data-protection impact assessment under the Nigeria Data Protection Act, 2021.

The Federal Ministry of Humanitarian Affairs, Disaster Management and Social Development, as NAPTIP's supervising ministry, should formalize data-sharing memoranda of understanding with the Nigeria Police Force, the Nigeria Immigration Service, state ministries of health and education, and IDP-camp coordination bodies in Borno and Adamawa, prior to pilot launch.

NAPTIP should extend its existing partnership model with Meta and the United States National Center for Missing and Exploited Children to cover the online-platform data-sharing component of the system, with clear legal terms governing the scope and duration of any data obtained.

Pilot implementation should budget explicitly for the workforce-capacity and connectivity constraints identified in comparable early-warning system pilots, particularly in Borno State.

An independent evaluation body, distinct from NAPTIP itself, should assess the pilot against the six metrics before any decision is made to expand the system to the remaining six priority states or to a full national network.

Limitations of the study

Several limitations should be anticipated.

- Trafficking is a hidden crime, meaning officially recorded cases may substantially underestimate actual occurrence. Consequently, administrative data should not be interpreted as equivalent to prevalence.
- Different organizations may use different definitions, reporting procedures, and data-quality standards. The study will therefore need a common data dictionary.

- Some data may remain inaccessible because of legal, institutional, confidentiality, or national-security restrictions.
- Automated alerts may generate false positives. The system must therefore use human verification rather than automatic enforcement decisions.
- Technological inequality may affect implementation. Rural communities and some humanitarian locations may have weaker connectivity, requiring offline-capable reporting and delayed synchronization.
- The system could itself create risks if sensitive data are poorly protected. Data security must consequently be incorporated into the study from the beginning.
- A reduction in recorded cases after implementation should not automatically be interpreted as a reduction in trafficking. Improved surveillance could initially increase reported cases because previously hidden cases become visible.
- This final point is particularly important when evaluating the system. A successful surveillance system may initially produce more reports, not fewer, because detection improves.

Future research strategies

Future research should build on this design study with primary data collection during the pilot period, in order to validate and where necessary recalibrate, the specific alert thresholds and screening-tool indicators.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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