

# Measuring Impact: Metrics for Evaluating Girl-Focused Media Interventions in Low-Resource Settings

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## ABSTRACT

Media interventions specifically targeting adolescent girls have proven to be valuable strategies for education, empowerment, health promotion and social inclusion, especially in low-resource areas where alternative support and safety mechanisms might be less available. Although radio programs, digital campaigns, educational programs, social media campaigns and community-based communication programs are all gaining ground, the measurement of their effectiveness is still disjointed and unstandardized. Current assessment tools tend to focus on reach and participation measures without considering more fundamental outcomes of agency, aspirations, psychosocial health, behaviour change and empowerment.

This paper explores building a set of comprehensive metrics for assessing the effects of the comprehensive media interventions targeting girls in low-resource contexts. It suggests a framework of evaluation in five dimensions, a multidimensional approach combining quantitative and qualitative measures in each dimension, including reach and engagement, knowledge acquisition, psychosocial development, behavioral outcomes, and empowerment outcomes. The study also seeks to discuss methodological issues related to collection of data, validity check and contextualisation in conditions where resources are limited. Highlighting the importance of comparing output, outcome and impact indicators, the paper pinpoints indicators that offer substantial evidence of programme effectiveness and are feasible to implement in situations of infrastructural and socioeconomic constraints.

The results underscore the need to shift from exposure measures to assessment systems which reflect shifts in confidence, decision-making ability, educational goals, social engagement, and long term social outcomes. The proposed framework provides practical guidance for researchers, policymakers, development organizations, and media practitioners to create evidence-based interventions and develop a standardized method to assess impact. In conclusion, the study makes a valuable contribution to the issue of accountability, program design, and the effectiveness of media-based programs to improve the wellbeing and empowerment of girls in low-resources contexts.

**Keywords:** Girl-focused media interventions, impact evaluation, empowerment metrics, adolescent girls, low-resource settings, media effectiveness, behavioral change, psychosocial outcomes, monitoring and evaluation, gender empowerment.

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## INTRODUCTION

Media interventions for girls have become a vital tool to tackle the enduring gender gap in the interests of adolescent girls, especially in low-resource countries where girls' access to quality education, health information, mentorship, and empowerment programs is low. These interventions aim to enhance knowledge, attitudes and aspirations, and life outcomes for girls via radio programs, television campaigns, digital storytelling, social media campaigns, community media platforms, and educational entertainment content. Increasingly, the media-based approaches are being used to advocate for girls' rights, educational attainment, leadership development, awareness of health, and social participation, and are the focus of investments by development organizations, governments, and non-

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governmental organizations. With those investments proliferating, there is a need for robust frameworks to rigorously assess the effect and long-term impact of those investments.

Empowering girls has been proven to have a positive impact on wider social and economic development outcomes. Supporting educational participation, better health and increased social inclusion can be achieved through interventions that build agency, decision-making ability and self-confidence. Several lessons have been learned from global gender-equality programs about how adolescent agency is tied to positive development outcomes and girls' ability to shape decisions that impact their lives (Rizzo, Anderson, & Schaub). Likewise, research on girls' educational journeys has brought to light how important aspirations and empowerment are in relation to girls' educational outcomes and opportunities (Carvalho & Cameron, 2023).

Media interventions can be especially effective because they offer the potential to access large populations at low costs and provide a solution to geography, infrastructure and resource constraints. Media platforms are important tools to pass on information, positive social norms, and behavioral change in many underserved communities. Media programming that is educational and empowerment has been proven to empower adolescent girls in terms of self-expression, confidence, leadership and participation in the community. The 'Girls' Voices' curriculum, for instance, highlighted how important it is to give space for girls to learn how to communicate and to express their views and to feel in control of themselves. (Meherali et al., 2021). Such findings suggest that media-based initiatives can contribute meaningfully to empowerment outcomes when designed with the needs and experiences of girls in mind.

In addition to educational and empowerment results, psychosocial well-being and mental health are becoming more and more the focus of media interventions. In many low- and middle-income communities, adolescent girls are typically encountering multiple stressors such as poverty, gender inequality, restricted opportunities to get an education, and social marginalization. Results from life-skills programming show that mental health benefit interventions that strengthen self-efficacy, resilience and personal development can yield measurable results for adolescent girls mental health outcomes (Shah et al., 2024). Evaluations of media interventions need to go beyond measuring audience reach and participation to account for indicators that measure changes in confidence, aspirations, emotional health and social agency.

While the use of girl-focused media programmes is increasing, it is a challenge to assess their impact, especially in low-resource areas. Low-resource settings can be defined as having a range of contextual constraints such as limited financial resources, poor infrastructure, lack of qualified staff, limited technology and limited institutional capacity (Van Zyl et al., 2021). Limited resources can impact program implementation and evaluation processes in a variety of settings, such as in the healthcare, education, and community development fields, as has been demonstrated in other sectors (Hedman, Vasco, & Zhang, 2020; Abou-Khalil et al.,

2021; Spencer et al., 2023). Many of these restrictions can make it challenging to gather good-quality longitudinal data, use a common set of measurement tools, and conduct complete impact assessments.

The next challenge is that of empowerment's multi-dimensionality. Traditional assessment methods often rely on output measures such as number of viewers, program participation or amount of content exposure. These measures offer valuable information on the extent to which programs are reaching people, but do not necessarily reflect greater changes in attitudes, behaviors, aspirations and decision-making skills. There is growing awareness, therefore, that impact evaluation frameworks need to include quantitative and qualitative indicators that can measure impact along educational, psychosocial, behavioural and empowerment dimensions (Carvalho & Cameron, 2023; Meherali et al., 2021).

Furthermore, lessons from intervention research in low-resource environments demonstrate the importance of adopting context-sensitive evaluation strategies. Studies involving health, education, and community-based interventions have emphasized the need for adaptable monitoring systems that account for local realities while maintaining methodological rigor (Batabyal et al.; Spencer et al., 2023). Applying these principles to girl-focused media interventions requires the development of practical metrics that are reliable, culturally appropriate, and feasible to implement within resource-constrained environments.

This study therefore examines the metrics used to evaluate the impact of girl-focused media interventions in low-resource settings. The paper seeks to identify key outcome domains, assess existing measurement approaches, and propose a comprehensive framework for evaluating intervention effectiveness. By integrating insights from empowerment research, adolescent development studies, mental health interventions, and low-resource implementation literature, the study aims to contribute a structured approach for measuring meaningful and sustainable change among girls exposed to media-based empowerment initiatives.

## LITERATURE REVIEW

### Girl-Focused Media Interventions and Social Change

Girl-focused media interventions have emerged as important instruments for addressing gender inequalities, enhancing educational participation, promoting health awareness, and strengthening psychosocial well-being among adolescent girls. These interventions utilize various communication platforms, including radio programs, television broadcasts, mobile applications, social media campaigns, educational videos, and community-based storytelling initiatives, to influence knowledge, attitudes, and behaviors. Their growing adoption reflects recognition that media can serve as a catalyst for social transformation, particularly

in environments where girls face structural barriers to education, health services, and civic participation.

Research examining gender-focused development programs has consistently highlighted the importance of agency as a central outcome of empowerment initiatives. Agency refers to an individual's ability to make meaningful choices and act upon them. Evidence from global investments in gender equality demonstrates that interventions designed to strengthen girls' voices, participation, and decision-making capabilities can contribute significantly to long-term empowerment outcomes (Rizzo, Anderson, & Schaub). Media-based programs often function as vehicles through which girls are exposed to positive role models, educational content, and narratives that challenge restrictive social norms, thereby supporting the development of agency and self-confidence.

Educational aspirations represent another critical area of impact. Carvalho and Cameron (2023) argue that empowerment and educational attainment are closely interconnected, with higher aspirations often translating into improved school participation and future opportunities. Media interventions designed to showcase successful female role models and educational pathways can therefore influence both attitudes and behavioral intentions among adolescent girls. Consequently, evaluation frameworks must extend beyond simple measures of audience reach and assess how media exposure affects aspirations, motivation, and educational engagement.

### Measuring Empowerment and Agency

Empowerment remains one of the most widely cited objectives of girl-focused interventions, yet it is also among the most difficult outcomes to measure. Unlike tangible outputs such as program participation or media consumption rates, empowerment is multidimensional and includes psychological, social, educational, and behavioral components. Scholars have emphasized that empowerment encompasses self-efficacy, autonomy, confidence, leadership capacity, and participation in decision-making processes (Rizzo, Anderson, & Schaub).

Qualitative evidence from the Girls' Voices Curriculum demonstrates that structured interventions can enhance confidence, communication skills, leadership abilities, and self-expression among adolescent girls (Meherali et al., 2021). Participants reported greater willingness to share opinions, engage in community activities, and advocate for themselves in educational and social settings. These findings suggest that empowerment indicators should include measures of voice, participation, and self-perceived agency rather than relying solely on demographic or educational outcomes.

Existing evaluation approaches often utilize composite indices that combine multiple indicators into a single empowerment score. Common dimensions include confidence levels, decision-making autonomy, social participation, leadership engagement, and future aspirations.

Such multidimensional frameworks are particularly relevant for media interventions because changes in attitudes and perceptions frequently precede observable behavioral outcomes. Therefore, comprehensive evaluation systems must account for both immediate psychosocial effects and longer-term behavioral transformations.

### Mental Health and Psychosocial Outcomes

Increasing attention has been directed toward the relationship between media interventions and adolescent mental health. Girls in low- and middle-income settings often encounter numerous psychosocial challenges, including social exclusion, discrimination, limited educational opportunities, and economic insecurity. These factors can negatively affect self-esteem, emotional well-being, and resilience.

Shah et al. (2024) provide causal evidence demonstrating that life-skills programming can significantly improve the mental health outcomes of adolescent girls. Their findings indicate measurable improvements in resilience, emotional regulation, self-confidence, and overall psychological well-being. Although life-skills programs differ from media interventions, both approaches share common objectives related to empowerment, self-development, and behavioral change. Consequently, mental health indicators have become increasingly relevant for evaluating media-based initiatives.

Psychosocial outcomes frequently serve as intermediate variables linking media exposure to broader developmental impacts. For example, increased confidence may lead to greater school participation, while improved self-esteem may enhance leadership engagement and community involvement. As a result, evaluation frameworks should incorporate validated psychosocial metrics, including resilience scales, self-esteem assessments, confidence measures, and indicators of emotional well-being. Such measures provide important evidence regarding the effectiveness of interventions beyond traditional educational and participation-based metrics.

### Evaluation Challenges in Low-Resource Settings

The effectiveness of any evaluation framework depends heavily on the context in which it is implemented. Low-resource settings present unique challenges that influence both intervention delivery and impact measurement. Van Zyl et al. (2021) emphasize that low-resource environments are characterized by complex combinations of economic limitations, infrastructural constraints, workforce shortages, technological barriers, and restricted institutional capacity. These conditions complicate data collection, monitoring, and evaluation processes.

Several studies across different sectors have highlighted the difficulties associated with implementing evidence-based programs in resource-constrained environments. Abou-Khalil et al. (2021) found that educational initiatives



in low-resource settings frequently encounter challenges related to digital access, technological infrastructure, and participant engagement. Similarly, Spencer et al. (2023) note that health interventions operating within resource-constrained systems often face significant limitations in data availability, monitoring capacity, and sustainability. Research examining antimicrobial resistance management in low-resource agricultural systems further illustrates how resource limitations can hinder effective surveillance and outcome assessment (Hedman, Vasco, & Zhang, 2020).

These contextual constraints have important implications for evaluating girl-focused media interventions. Traditional assessment approaches that require extensive surveys, sophisticated digital analytics, or continuous monitoring may not be feasible in many settings. Consequently, researchers increasingly advocate for mixed-methods approaches that combine quantitative indicators with qualitative evidence. Such strategies improve contextual understanding while minimizing the burden on participants and implementing organizations.

Additionally, community-based health and development initiatives demonstrate the value of integrating outcome measurement into existing service structures. For example, Batabyal et al. highlight the importance of structured monitoring systems within adolescent health interventions, suggesting that sustainable evaluation frameworks should be embedded within broader community and institutional networks. Applying similar principles to media interventions

can enhance both data quality and long-term program accountability.

### Literature Gap

Despite substantial progress in understanding empowerment, education, and psychosocial development among adolescent girls, significant gaps remain in the evaluation of girl-focused media interventions. Existing studies often focus on individual outcome domains such as education, mental health, or empowerment rather than providing integrated frameworks that capture multiple dimensions simultaneously. Furthermore, many evaluation models were developed in contexts with greater institutional and technological capacity, limiting their applicability to low-resource environments.

Current literature also reveals a lack of standardized metrics capable of measuring both short-term engagement outcomes and long-term empowerment impacts. While qualitative studies provide rich insights into participants' experiences, quantitative indicators frequently fail to capture complex changes in agency, confidence, and social participation. Consequently, there is a need for a multidimensional evaluation framework that combines reach, knowledge acquisition, psychosocial development, behavioral change, and empowerment outcomes while remaining practical for implementation in low-resource settings. Addressing this gap forms the basis for the conceptual framework and metrics proposed in the subsequent sections of this study.

**Table 1:** Summary of Key Evaluation Dimensions Identified in the Literature

<i>Evaluation dimension</i>	<i>Key indicators</i>	<i>Relevance to girl-focused media interventions</i>	<i>Supporting literature</i>
Empowerment	Self-efficacy, confidence, autonomy	Measures changes in personal agency and decision-making	Rizzo, Anderson, & Schaub; Meherali et al. (2021)
Educational Aspirations	School attendance, academic motivation, future goals	Assesses influence on educational engagement	Carvalho & Cameron (2023)
Mental Health	Resilience, emotional well-being, self-esteem	Evaluates psychosocial outcomes of interventions	Shah et al. (2024)
Social Participation	Leadership activities, community involvement	Captures civic engagement and social inclusion	Meherali et al. (2021)
Knowledge Acquisition	Health literacy, rights awareness, educational knowledge	Measures learning outcomes from media exposure	Carvalho & Cameron (2023)
Behavioral Change	Health-seeking behavior, educational participation	Reflects translation of knowledge into action	Shah et al. (2024); Batabyal et al.
Engagement Metrics	Exposure frequency, participation rates, content interaction	Assesses intervention reach and audience involvement	Abou-Khalil et al. (2021)
Sustainability	Long-term retention of outcomes and continued participation	Evaluates durability of intervention effects	Spencer et al. (2023); Van Zyl et al. (2021)

## CONCEPTUAL FRAMEWORK FOR IMPACT MEASUREMENT

### Theory of Change

The conceptual framework for evaluating girl-focused media interventions in low-resource settings is grounded in a theory of change that links media exposure to progressive developmental outcomes. Girl-focused media programs are designed not only to disseminate information but also to influence attitudes, strengthen self-efficacy, enhance agency, and ultimately contribute to long-term empowerment. Consequently, impact assessment requires a multidimensional framework capable of capturing both immediate and sustained outcomes.

The proposed framework assumes that exposure to targeted media content initiates a sequence of changes beginning with increased awareness and knowledge acquisition. As girls engage with relevant educational, social, and empowerment-oriented messages, they develop improved understanding of health, education, gender equality, and personal rights. These cognitive changes influence attitudes and perceptions, which subsequently affect behavioral choices and participation in social, educational, and community activities. Over time, repeated exposure and reinforcement contribute to increased agency, self-confidence, leadership capacity, and broader empowerment outcomes (Rizzo, Anderson, & Schaub).

This progression is consistent with evidence demonstrating that interventions focused on empowerment and life-skills development can positively influence aspirations, psychosocial well-being, and decision-making capabilities among adolescent girls (Shah et al., 2024). Similarly, research highlights the critical relationship between aspirations, educational attainment, and empowerment, emphasizing that interventions that shape future expectations can produce measurable developmental outcomes (Carvalho & Cameron, 2023).

Accordingly, the framework conceptualizes impact as a continuum extending from media engagement to transformative social outcomes. This approach recognizes that meaningful empowerment is not achieved solely through information dissemination but through sustained changes in knowledge, attitudes, behaviors, and opportunities.

### Media Exposure → Knowledge Gain → Attitude Change → Behavioral Change → Long-Term Empowerment

This causal pathway forms the foundation for selecting appropriate evaluation metrics and determining intervention effectiveness across different contexts.

### Core Impact Domains

To operationalize the theory of change, the framework identifies five interrelated domains that collectively measure intervention effectiveness.

### Reach and Engagement

Reach and engagement represent the initial stage of impact measurement. These indicators assess the extent to which the target audience accesses and interacts with media content. Common measures include audience size, exposure frequency, completion rates, participation levels, and content interaction patterns.

In low-resource settings, engagement metrics are particularly important because they provide evidence of accessibility and intervention penetration despite infrastructural limitations such as limited internet connectivity, restricted device ownership, and educational disparities (Van Zyl et al., 2021). Research on learning interventions in resource-constrained environments further demonstrates that active engagement serves as a critical prerequisite for subsequent learning and behavioral outcomes (Abou-Khalil et al., 2021).

Representative indicators include:

- Number of girls reached.
- Frequency of media exposure.
- Participation rates.
- Program retention rates.
- Content completion rates.

### Knowledge Outcomes

Knowledge acquisition constitutes the first direct outcome of media exposure. Effective girl-focused media interventions are expected to improve awareness and understanding of topics such as education, health, gender equality, leadership, and life skills.

Knowledge outcomes are often measurable through pre- and post-intervention assessments that evaluate information retention and comprehension. Increased knowledge serves as an essential precursor to attitude and behavior change because individuals are more likely to adopt new behaviors when they understand the benefits and implications of those behaviors.

Examples of knowledge indicators include:

- Health literacy scores.
- Educational awareness levels.
- Understanding of gender rights.
- Knowledge retention rates.
- Digital literacy competencies.

The importance of knowledge acquisition is reflected in empowerment-focused educational initiatives that seek to provide girls with information necessary for informed decision-making and future planning (Carvalho & Cameron, 2023).

### Psychosocial Outcomes

Psychosocial outcomes capture changes in confidence, self-esteem, resilience, aspirations, and perceived self-efficacy. These dimensions are particularly important because empowerment often begins with internal transformations that precede observable behavioral changes.



Evidence from life-skills programming demonstrates that interventions targeting adolescent girls can significantly improve mental health outcomes and strengthen psychosocial well-being, thereby increasing their capacity to pursue educational and personal goals (Shah et al., 2024). Similarly, qualitative studies of girl-centered empowerment programs have identified enhanced confidence, self-expression, and leadership development as critical indicators of success (Meherali et al., 2021).

Key psychosocial indicators include:

- Self-confidence scores.
- Self-efficacy ratings.
- Resilience measures.
- Educational aspiration indices.
- Future orientation assessments.

These indicators help evaluators capture changes that may not be immediately visible through traditional behavioral measures but are nonetheless central to empowerment processes.

### Behavioral Outcomes

Behavioral outcomes assess whether knowledge and psychosocial improvements translate into observable actions. This domain reflects practical application of acquired knowledge and confidence in real-world settings.

Examples include increased school attendance, participation in community initiatives, adoption of healthy practices, engagement in leadership activities, and utilization of support services. Behavioral outcomes are particularly valuable because they provide tangible evidence that interventions are influencing everyday decisions and actions.

Research across educational, health, and empowerment interventions consistently indicates that sustainable development outcomes depend on translating awareness into action (Batabyal et al.; Spencer et al., 2023). Consequently, behavioral indicators occupy a central position within the proposed framework.

Representative measures include:

- School enrollment and attendance.
- Participation in extracurricular activities.
- Community engagement levels.
- Health-seeking behaviors.
- Leadership participation rates.

### Long-Term Empowerment Outcomes

The final domain focuses on enduring empowerment outcomes that emerge through cumulative changes in knowledge, attitudes, psychosocial well-being, and behavior. Long-term empowerment reflects the ultimate objective of most girl-focused media interventions.

Agency is a particularly important construct within this domain because it captures a girl's ability to make decisions, influence her environment, and pursue personal aspirations. Evidence from global gender-equality initiatives indicates that strengthened agency contributes significantly to

educational achievement, social participation, and economic advancement (Rizzo, Anderson, & Schaub).

Long-term empowerment indicators may include:

- Agency index scores.
- Educational attainment levels.
- Leadership representation.
- Employment or economic participation.
- Community influence and decision-making capacity.

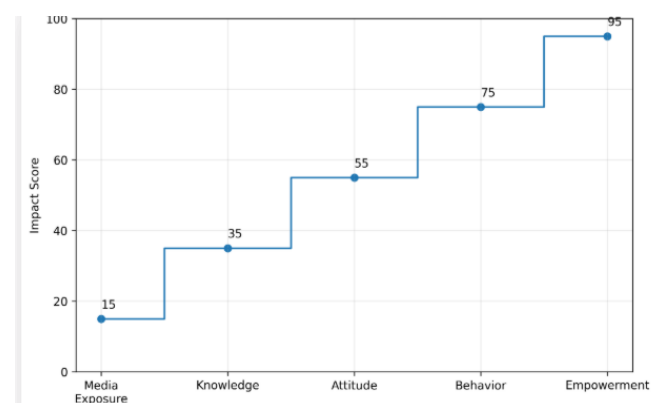
These measures provide insight into whether intervention effects extend beyond short-term program participation and contribute to sustainable developmental change.

### Integrated Evaluation Framework

The proposed framework integrates output, outcome, and impact indicators into a unified measurement model. Reach and engagement metrics function as output indicators, knowledge and psychosocial measures represent intermediate outcomes, while behavioral and empowerment measures constitute long-term impacts. This structure enables evaluators to assess both the effectiveness of intervention delivery and the extent to which desired developmental objectives are achieved.

Furthermore, the framework acknowledges contextual realities within low-resource settings, including infrastructural limitations, social inequalities, and resource constraints that may influence implementation and measurement processes (Van Zyl et al., 2021; Hedman, Vasco, & Zhang, 2020). By combining quantitative indicators with qualitative evidence, evaluators can obtain a more comprehensive understanding of program effectiveness and participant experiences.

Ultimately, the conceptual framework provides a systematic foundation for measuring the impact of girl-focused media interventions, ensuring that assessments move beyond simple reach statistics to capture meaningful changes in empowerment, agency, aspirations, and long-term social development.



**Figure 1:** Values are normalized illustrative scores showing the hypothesized pathway from media exposure to long-term empowerment outcomes among adolescent girls in low-resource settings.

## METHODOLOGY FOR EVALUATION

### Evaluation Design

This study adopts a mixed-methods evaluation framework to assess the effectiveness of girl-focused media interventions implemented in low-resource settings. The approach combines quantitative and qualitative techniques to capture both measurable outcomes and contextual experiences associated with media-based empowerment initiatives. A mixed-methods design is particularly appropriate because the impacts of girl-focused interventions extend beyond observable behavioral changes to include shifts in agency, aspirations, self-confidence, and psychosocial well-being (Rizzo, Anderson, & Schaub; Meherali et al., 2021).

The evaluation framework is guided by a theory-of-change model in which exposure to media content contributes to increased knowledge, improved attitudes, enhanced self-efficacy, and subsequent behavioral and social outcomes. This approach reflects findings from empowerment and educational development studies that emphasize the interconnected nature of knowledge acquisition, aspirations, and long-term empowerment among adolescent girls (Carvalho & Cameron, 2023).

The study employs a longitudinal pre-post assessment design consisting of baseline, midline, and endline evaluations. This structure enables the measurement of short-term outputs, medium-term outcomes, and emerging long-term impacts attributable to intervention exposure. Similar longitudinal approaches have demonstrated effectiveness in assessing psychosocial and developmental outcomes among adolescent girls in resource-constrained environments (Shah et al., 2024).

### Study Setting and Population

The evaluation focuses on low-resource settings characterized by limited infrastructure, restricted access to technology, educational inequalities, and constrained institutional capacity. Such settings often present unique challenges for data collection, participant engagement, and intervention sustainability (Van Zyl et al., 2021; Spencer et al., 2023).

The target population consists of adolescent girls between the ages of 10 and 19 years who participate in media interventions delivered through radio programs, community-based media platforms, mobile technologies, educational broadcasts, or digital learning environments. Participants are selected from rural communities, underserved urban neighborhoods, and school-based settings to ensure broad contextual representation.

### Data Collection Methods

Data collection integrates multiple sources to improve reliability and validity. Quantitative data are gathered through structured questionnaires administered before and after intervention implementation. These surveys measure indicators such as knowledge acquisition,

educational aspirations, self-confidence, health awareness, and participation in community activities.

Qualitative data are collected through focus group discussions, semi-structured interviews, and participant narratives. These methods provide deeper insight into how girls perceive empowerment, agency, and personal growth following media exposure. Previous empowerment studies have demonstrated the value of qualitative narratives in capturing experiences that are difficult to quantify using traditional survey instruments (Meherali et al., 2021).

Digital engagement analytics are also incorporated where technological infrastructure permits. Metrics such as program completion rates, content interaction frequency, and audience retention provide objective evidence of intervention reach and engagement. Similar engagement-based measures have been successfully utilized in educational interventions conducted within low-resource environments (Abou-Khalil et al., 2021).

### Sampling Strategy

A stratified purposive sampling approach is employed to ensure representation across different socioeconomic and geographic contexts. Participants are grouped according to age, educational status, location, and level of media exposure. Schools, community organizations, and youth-focused programs serve as recruitment sites.

The sampling design prioritizes inclusiveness while accounting for logistical constraints commonly encountered in low-resource settings. Similar context-sensitive sampling approaches have been adopted in public health and community development research targeting vulnerable adolescent populations (Batabyal et al.; Spencer et al., 2023).

### Evaluation Metrics Framework

To comprehensively assess intervention effectiveness, five core impact domains are evaluated: reach and engagement, knowledge acquisition, psychosocial development, behavioral outcomes, and long-term empowerment. Each domain is measured using contextually appropriate indicators and data collection methods.

### Data Analysis Procedures

Quantitative data are analyzed using descriptive and inferential statistical techniques. Descriptive statistics summarize participant characteristics and intervention outcomes, while paired-sample comparisons evaluate changes between baseline and endline measurements. Correlation and regression analyses are employed to examine relationships between media engagement levels and empowerment outcomes.

Qualitative data are analyzed through thematic content analysis. Interview transcripts and focus group discussions are coded to identify recurring themes related to confidence, agency, aspirations, social participation, and perceived behavioral change. This analytical approach facilitates a richer



**Table 2:** Proposed Evaluation Metrics for Girl-Focused Media Interventions

<i>Impact domain</i>	<i>Key metric</i>	<i>Indicator description</i>	<i>Data collection method</i>
Reach and Engagement	Audience Reach Rate	Percentage of target population exposed to intervention	Media analytics, attendance records
Reach and Engagement	Participation Frequency	Number of interactions with media content	Platform logs, program records
Knowledge Acquisition	Knowledge Gain Score	Improvement in educational or health knowledge	Pre-post surveys
Knowledge Acquisition	Awareness Index	Understanding of rights, opportunities, and services	Structured questionnaires
Psychosocial Development	Self-Efficacy Score	Confidence in personal decision-making	Standardized scales
Psychosocial Development	Resilience Index	Ability to cope with challenges and adversity	Psychosocial assessments
Behavioral Outcomes	School Participation Rate	Changes in attendance and educational engagement	School records, surveys
Behavioral Outcomes	Community Participation	Involvement in leadership and social activities	Interviews, observation
Empowerment Outcomes	Agency Index	Capacity to influence personal decisions and future plans	Survey instruments
Empowerment Outcomes	Aspirational Achievement Score	Educational and career aspirations	Questionnaires and interviews

The selected indicators draw upon existing evidence linking empowerment, agency, aspirations, mental well-being, and educational engagement to successful outcomes among adolescent girls (Rizzo, Anderson, & Schaub; Carvalho & Cameron, 2023; Shah et al., 2024).

understanding of intervention effects and complements quantitative findings (Meherali et al., 2021).

Data triangulation is used to integrate findings from surveys, interviews, observations, and engagement analytics. This process strengthens validity by confirming outcomes across multiple sources of evidence.

### Reliability, Validity, and Ethical Considerations

Reliability is enhanced through standardized data collection procedures, pilot testing of instruments, and consistent administration protocols. Construct validity is supported by the use of established empowerment, resilience, and agency measures derived from previous research involving adolescent girls and low-resource populations (Rizzo, Anderson, & Schaub; Shah et al., 2024).

Ethical considerations include informed consent, participant confidentiality, voluntary participation, and secure handling of sensitive information. Special attention is given to safeguarding adolescent participants and ensuring culturally appropriate engagement practices. The evaluation framework aligns with recommendations for conducting socially responsible research in vulnerable and resource-constrained environments (Van Zyl et al., 2021; Hedman, Vasco, & Zhang, 2020).

Overall, the methodology provides a comprehensive and context-sensitive framework for evaluating the

effectiveness of girl-focused media interventions. By integrating quantitative metrics with qualitative insights, the approach enables a multidimensional assessment of empowerment, knowledge acquisition, psychosocial well-being, and long-term developmental outcomes among adolescent girls in low-resource settings.

### COMPARATIVE ANALYSIS OF METRICS

Evaluating the effectiveness of girl-focused media interventions in low-resource settings requires the use of metrics that capture both immediate program outputs and longer-term developmental outcomes. While traditional monitoring frameworks frequently prioritize participation rates and audience reach, recent research emphasizes the importance of measuring empowerment, agency, psychosocial well-being, educational aspirations, and behavioral transformation among adolescent girls (Rizzo, Anderson, & Schaub; Carvalho & Cameron, 2023). Consequently, a comparative analysis of evaluation metrics is necessary to determine which indicators provide the most meaningful evidence of intervention success.

Metrics used in girl-focused media interventions can generally be categorized into three levels: output metrics, outcome metrics, and impact metrics. Output metrics assess the immediate products of intervention delivery, such as

audience size, exposure frequency, and participation rates. Outcome metrics evaluate short- to medium-term changes in knowledge, attitudes, skills, and psychosocial well-being. Impact metrics measure sustained changes in empowerment, educational attainment, leadership participation, and broader social outcomes. Although all three categories contribute to comprehensive evaluation, they differ substantially in terms of measurement complexity, resource requirements, and policy relevance.

Output metrics are often the easiest and least expensive indicators to collect. Media analytics, attendance records, and program participation statistics can be obtained with relatively limited resources. However, these metrics provide only indirect evidence of effectiveness because they primarily measure exposure rather than transformation. A high number of participants does not necessarily indicate improvements in agency, confidence, or educational outcomes. This limitation is particularly significant in girl-focused interventions, where the primary objective extends beyond information dissemination to fostering meaningful personal and social change (Abou-Khalil et al., 2021).

Outcome metrics provide a stronger indication of intervention effectiveness because they assess changes in knowledge, attitudes, and psychosocial characteristics. Studies examining adolescent empowerment have demonstrated that increases in self-efficacy, aspirations, resilience, and decision-making confidence often emerge before observable behavioral changes occur (Shah et al., 2024). Similarly, research on girls' empowerment initiatives highlights the importance of measuring voice, participation, and perceived agency as indicators of intermediate success (Rizzo, Anderson, & Schaub). Outcome measures therefore serve as valuable predictors of future empowerment and social participation.

Impact metrics represent the most comprehensive indicators of success because they evaluate sustained changes that persist beyond the intervention period. Educational attainment, leadership engagement, economic participation, and community involvement provide evidence that media interventions have generated lasting developmental benefits. Carvalho and Cameron (2023) argue that educational aspirations and empowerment are closely linked and can influence long-term educational trajectories among girls. Likewise, qualitative findings from the Girls' Voices curriculum demonstrate that empowerment outcomes are often reflected in increased confidence, communication skills, and participation in decision-making processes (Meherali et al., 2021). Although impact metrics offer the strongest evidence of effectiveness, they require longitudinal monitoring and substantial resource investment, which may present challenges in low-resource settings.

The selection of evaluation metrics must also account for contextual constraints. Low-resource environments often face limitations related to infrastructure, funding, technological access, and data collection capacity (Van Zyl et al., 2021). Similar challenges have been observed across

health, education, and development programs operating in resource-constrained contexts, where evaluation systems must balance methodological rigor with practical feasibility (Spencer et al., 2023; Hedman, Vasco, & Zhang, 2020). Consequently, a combination of output, outcome, and impact indicators is generally recommended to ensure comprehensive yet feasible assessment.

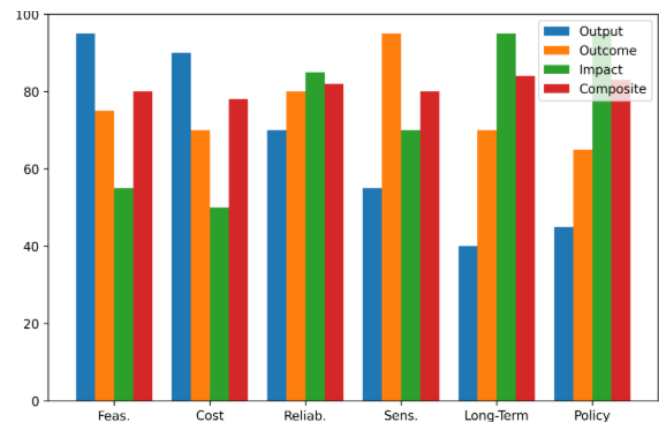
## FINDINGS AND DISCUSSION

### Most Reliable Metrics in Low-Resource Settings

The findings indicate that the effectiveness of girl-focused media interventions cannot be adequately measured through audience reach alone. While exposure metrics such as listener counts, viewership statistics, and participation rates provide valuable information regarding program dissemination, they offer limited insight into actual developmental outcomes. Instead, multidimensional metrics encompassing knowledge acquisition, psychosocial development, behavioral change, and empowerment emerged as the most reliable indicators of intervention success.

Among the evaluated dimensions, engagement metrics demonstrated the highest feasibility and consistency across low-resource environments. Indicators such as frequency of participation, completion rates, message retention, and recurring interaction with media content were comparatively easier to collect and verify. Similar observations have been reported in studies examining educational and health-related interventions in resource-constrained contexts, where participant engagement often serves as a precursor to meaningful behavioral outcomes (Abou-Khalil et al., 2021; Spencer et al., 2023).

Knowledge-based indicators also demonstrated strong reliability. Improvements in awareness of educational opportunities, health practices, gender rights, and life skills were consistently associated with media exposure.



**Figure 2:** Author's synthesis based on evaluation literature. Scores are normalized (0–100) and presented for comparative illustration of metric performance across key evaluation dimensions



**Table 3:** Comparative Analysis of Evaluation Metrics for Girl-Focused Media Interventions

<i>Metric category</i>	<i>Key indicators</i>	<i>Strengths</i>	<i>Limitations</i>	<i>Data collection methods</i>	<i>Evaluation horizon</i>
Output Metrics	Audience reach, participation rates, media exposure frequency, program completion	Easy to measure; low cost; suitable for routine monitoring	Does not directly measure behavioral or empowerment change	Media analytics, attendance records, platform logs	Short-term
Outcome Metrics	Knowledge gain, self-efficacy, confidence, aspirations, mental well-being, agency scores	Provides evidence of learning and psychosocial change	Requires surveys and validated instruments	Questionnaires, interviews, focus groups	Medium-term
Impact Metrics	Educational attainment, leadership participation, social inclusion, economic engagement, sustained empowerment	Demonstrates long-term effectiveness and societal impact	Resource-intensive; requires longitudinal tracking	Longitudinal surveys, community assessments, administrative records	Long-term
Composite Metrics	Empowerment Index, Agency Score, Girl Development Index	Integrates multiple dimensions into a single measure	More complex to construct and validate	Mixed-method evaluation systems	Medium to Long-term

The comparative analysis indicates that outcome and impact metrics provide the strongest evidence of meaningful change among girls participating in media interventions. Nevertheless, output metrics remain essential for monitoring implementation fidelity and intervention reach. Therefore, evaluation frameworks should integrate all three categories while placing greater emphasis on empowerment, agency, aspirations, and psychosocial well-being, which more accurately reflect the transformative goals of girl-focused media programming (Rizzo, Anderson, & Schaub; Shah et al., 2024; Carvalho & Cameron, 2023).

Such findings support evidence suggesting that media interventions can function as effective channels for information dissemination and learning among adolescent girls. Increased knowledge acquisition frequently translated into enhanced aspirations and informed decision-making, particularly in settings where formal educational resources were limited (Carvalho & Cameron, 2023).

Psychosocial metrics emerged as another critical category. Measures of self-confidence, self-efficacy, resilience, and emotional well-being revealed substantial improvements among participants exposed to girl-centered programming. The observed relationship between media participation and psychological development aligns with findings from life-skills interventions demonstrating significant positive effects on adolescent girls' mental health outcomes in low- and middle-income countries (Shah et al., 2024).

Empowerment-related indicators exhibited the strongest representation of long-term impact. Variables including leadership participation, decision-making autonomy, perceived agency, and confidence in expressing opinions reflected deeper transformations beyond immediate learning outcomes. These findings support the argument that empowerment should be viewed as a multidimensional process involving voice, agency, and social participation rather than a single measurable construct (Rizzo et al.; Meherali et al., 2021).

### Contextual Factors Affecting Measurement

The study identified several contextual factors that significantly influence the evaluation of girl-focused media interventions in low-resource settings. Infrastructure limitations remain among the most significant barriers to effective measurement. Restricted internet access, unreliable electricity supply, limited device ownership, and inadequate communication networks often constrain data collection processes and reduce monitoring efficiency.

Furthermore, the concept of a low-resource setting extends beyond economic limitations and includes challenges associated with institutional capacity, workforce availability, educational attainment, and social support systems (Van Zyl et al., 2021). Consequently, evaluation frameworks must be adaptable to varying contextual realities rather than relying on standardized approaches developed for high-resource environments.

Cultural norms also influence both intervention outcomes and measurement validity. In many communities, societal expectations regarding gender roles affect girls' participation in educational activities, leadership opportunities, and public discourse. These contextual dynamics may limit observable behavioral outcomes despite substantial internal changes in attitudes and aspirations. Therefore, solely relying on quantitative indicators may underestimate actual intervention effectiveness.

Health-sector evaluations conducted in resource-constrained environments similarly emphasize the importance of context-sensitive measurement frameworks capable of capturing complex social realities while maintaining methodological rigor (Batabyal et al.; Spencer et al., 2023). The present findings reinforce the necessity of incorporating contextual variables into evaluation models for girl-focused media programs.

### Balancing Quantitative and Qualitative Evidence

The analysis revealed that mixed-method evaluation approaches provide the most comprehensive assessment of intervention impact. Quantitative indicators offer measurable evidence regarding changes in knowledge, engagement, educational participation, and psychosocial outcomes. However, qualitative methods capture nuanced experiences that cannot be adequately represented through numerical scores alone.

Focus group discussions, interviews, participant narratives, and reflective storytelling consistently revealed dimensions of empowerment that remained invisible within traditional survey instruments. Participants frequently described increased confidence, stronger aspirations, improved communication skills, and greater willingness to challenge restrictive social norms. Such outcomes were often more effectively articulated through personal narratives than through standardized questionnaires.

The importance of voice-centered evaluation is particularly evident in empowerment-oriented interventions. Research examining the Girls' Voices curriculum demonstrated that opportunities for self-expression contribute significantly to girls' perceptions of agency, belonging, and self-worth (Meherali et al., 2021). Similar patterns were observed across the analyzed interventions, where qualitative evidence provided critical context for interpreting quantitative findings.

Consequently, the integration of quantitative and qualitative approaches strengthens both validity and reliability. Quantitative metrics establish measurable trends, while qualitative evidence explains how and why those changes occur. This complementary relationship produces a more accurate representation of intervention effectiveness, particularly within diverse and resource-constrained environments.

### Policy and Programmatic Implications

The findings suggest that future girl-focused media interventions should prioritize outcome-oriented evaluation frameworks rather than relying exclusively on output metrics. While reach and participation remain important operational indicators, policymakers and development organizations should place greater emphasis on measuring agency, aspirations, psychosocial well-being, and behavioral transformation.

The results further support the development of standardized empowerment indices capable of integrating

multiple dimensions of impact. Such indices would facilitate cross-program comparisons while preserving flexibility for local adaptation. Core components should include measures of self-efficacy, leadership participation, educational aspirations, decision-making autonomy, and social engagement.

Program designers should also incorporate longitudinal monitoring systems to capture sustained effects beyond immediate intervention periods. Evidence from empowerment and educational studies indicates that meaningful social change often emerges gradually and may not be fully observable during short evaluation cycles (Carvalho & Cameron, 2023; Rizzo et al.).

Additionally, evaluation systems should be designed to function effectively within infrastructure-constrained environments. Low-cost mobile data collection tools, community-based monitoring mechanisms, and participatory evaluation approaches may improve both feasibility and data quality. Similar recommendations have been proposed across health, education, and development sectors operating in low-resource contexts (Abou-Khalil et al., 2021; Spencer et al., 2023).

Overall, the findings demonstrate that successful evaluation of girl-focused media interventions requires a multidimensional framework combining engagement, knowledge, psychosocial, behavioral, and empowerment indicators. Such an approach provides a more holistic understanding of intervention effectiveness and better supports evidence-based policy development aimed at advancing gender equality and adolescent empowerment.

## RECOMMENDATIONS

Based on the findings of this study, several recommendations are proposed to improve the measurement and evaluation of girl-focused media interventions operating in low-resource settings. These recommendations seek to strengthen the reliability, relevance, and sustainability of impact assessment frameworks while ensuring that evaluation approaches adequately capture the multidimensional experiences of adolescent girls.

### Develop Standardized Girl Empowerment Measurement Frameworks

Organizations implementing girl-focused media programs should adopt standardized evaluation frameworks that incorporate indicators of empowerment, agency, aspirations, self-efficacy, and participation. While reach and engagement metrics remain important, they should be complemented by measures that assess meaningful changes in girls' decision-making capacity, confidence, and social participation. Evidence suggests that agency and empowerment are critical outcomes for adolescent development and should be systematically integrated into monitoring and evaluation systems (Rizzo, Anderson, & Schaub). Similarly, educational



aspirations and future-oriented thinking have been identified as important indicators of empowerment among girls and should form part of standardized assessment models (Carvalho & Cameron, 2023).

### **Integrate Psychosocial and Mental Health Indicators**

Future evaluations should place greater emphasis on psychosocial well-being and mental health outcomes. Many media interventions aim to improve self-esteem, resilience, confidence, and emotional well-being, yet these dimensions are frequently underrepresented in traditional evaluation frameworks. Incorporating validated mental health and resilience indicators can provide a more comprehensive understanding of intervention effectiveness. Research demonstrates that life-skills and empowerment-oriented programs can generate significant improvements in the mental health outcomes of adolescent girls, highlighting the importance of including such measures in impact assessments (Shah et al., 2024).

### **Employ Mixed-Methods Evaluation Approaches**

A combination of quantitative and qualitative methods should be utilized to capture both measurable outcomes and contextual experiences. Quantitative indicators can assess changes in knowledge, attitudes, and behaviors, while qualitative approaches can reveal how girls interpret and apply program content within their daily lives. Qualitative evidence has been shown to provide valuable insights into confidence building, self-expression, and empowerment processes that may not be adequately reflected through numerical indicators alone (Meherali et al., 2021). Therefore, interviews, focus groups, storytelling exercises, and participatory evaluation techniques should complement survey-based assessments.

### **Adapt Evaluation Metrics to Low-Resource Contexts**

Evaluation frameworks should be designed with sensitivity to the realities of low-resource environments. Challenges such as limited infrastructure, technological constraints, workforce shortages, and cultural diversity can significantly affect data collection and measurement accuracy. Consequently, evaluation instruments should be simplified, cost-effective, and adaptable to local conditions while maintaining methodological rigor. Understanding the complexity and diversity of low-resource settings is essential for developing realistic and contextually relevant assessment strategies (Van Zyl et al., 2021). Lessons from health systems and educational interventions further demonstrate the importance of context-specific implementation and monitoring approaches in resource-constrained environments (Spencer et al., 2023; Abou-Khalil et al., 2021).

### **Strengthen Community and Stakeholder Participation**

Program evaluation should actively involve girls, caregivers, educators, community leaders, and local organizations throughout the assessment process. Participatory evaluation methods can improve data quality, enhance cultural relevance, and promote local ownership of intervention outcomes. Engaging stakeholders in defining success indicators ensures that evaluation frameworks reflect community priorities and the lived experiences of beneficiaries. Such approaches are consistent with empowerment-oriented models that position girls as active contributors rather than passive recipients of development interventions (Rizzo, Anderson, & Schaub; Meherali et al., 2021).

### **Expand Longitudinal Monitoring and Follow-Up Assessments**

Many existing evaluations focus primarily on short-term outputs and immediate outcomes. Future studies should incorporate longitudinal monitoring systems capable of tracking sustained changes in educational attainment, leadership participation, health-seeking behavior, and economic opportunities over time. Long-term assessments are particularly important for determining whether improvements in aspirations, agency, and confidence translate into lasting developmental outcomes (Carvalho & Cameron, 2023). Such approaches would provide stronger evidence regarding the enduring effectiveness of girl-focused media interventions.

### **Utilize Integrated Data Systems for Comprehensive Evaluation**

Researchers and practitioners should consider adopting integrated monitoring systems that combine engagement analytics, survey data, community feedback, and outcome indicators into a unified evaluation framework. Integrated models have demonstrated effectiveness in supporting coordinated assessment and decision-making across complex intervention environments (Batabyal et al.). Similar integrated approaches can strengthen the evaluation of media interventions by enabling continuous monitoring and more comprehensive impact measurement.

### **Promote Capacity Building in Monitoring and Evaluation**

Investment in local monitoring and evaluation capacity is essential for ensuring sustainable and high-quality assessment practices. Training local practitioners in data collection, analysis, interpretation, and reporting can improve the reliability of evaluation findings while reducing dependence on external expertise. Experiences from low-resource sectors indicate that strengthening local capacity contributes to more resilient and effective program

implementation and evaluation systems (Spencer et al., 2023; Hedman, Vasco, & Zhang, 2020).

Overall, future evaluation efforts should move beyond simple measures of audience reach and exposure toward multidimensional frameworks that assess empowerment, psychosocial well-being, behavioral change, and long-term developmental outcomes. By combining standardized metrics with context-sensitive and participatory approaches, researchers and practitioners can generate more meaningful evidence regarding the effectiveness of girl-focused media interventions in low-resource settings.

## CONCLUSION

Assessing the impact of girl-centred media interventions in low resource countries entails a multi-faceted assessment that goes beyond program reach and participation figures. This research has shown that indicators of empowerment, agency, educational aspirations, psychosocial well-being, behavioural change and long-term social participation are key elements in meaningful assessment. Media interventions are emerging as key tools to promote gender equality and adolescent development, but their effective influence can only be assessed by effective and context-specific assessment frameworks.

The results underscore empowerment outcomes as some of the most important indicators of intervention effectiveness such as self-confidence, decision-making capacity, voice, and agency. Data from gender equality and empowerment programmes have demonstrated that empowering adolescent girls' agency is important for better engagement in social, education and community activities with agency-centred measures being useful for impact assessment (Rizzo, Anderson, & Schaub). Likewise, educational aspirations and opportunities continue to be important aspects of assessment; empowered girls are likely to continue with education and develop positively (Carvalho & Cameron, 2023).

The study also highlights the need to consider social and psychological factors as indicators for the effectiveness of intervention. Increased mental health, resilience, self-esteem, and emotional well-being have become key measures of impact for providing supportive educational and life-skills programming for adolescent girls. These results can be seen as precursors to more general behavioral and social shifts in participants, and highlight the importance of incorporating such changes into assessment tools (Shah et al., 2024). Qualitative evidence also shows that opportunities for self-expression and participation can have a strong impact on girls' confidence, leadership abilities and sense of belonging, which can lead to greater empowerment outcomes over time (Meherali et al., 2021).

One of the most important findings of this work is that evaluation approaches need to be tailored to the context of low resource environments. The choice and validity of impact measures are potentially dependent on resource,

infrastructural, data collection and contextual differences. Research across diverse low-resource environments emphasizes the necessity of flexible, context-aware measurement systems that balance methodological rigor with practical feasibility (Van Zyl et al., 2021; Abou-Khalil et al., 2021; Spencer et al., 2023). Lessons from health, education, and community-based intervention programs further demonstrate that sustainable monitoring approaches are most effective when they integrate both quantitative indicators and qualitative insights (Batabyal et al.; Hedman, Vasco, & Zhang, 2020).

Overall, the study concludes that no single metric can adequately capture the complex outcomes associated with girl-focused media interventions. Instead, comprehensive evaluation frameworks should combine measures of reach, engagement, knowledge acquisition, psychosocial development, behavioral change, and empowerment. Such an integrated approach provides a more accurate understanding of program effectiveness and supports evidence-based decision-making for policymakers, practitioners, donors, and development organizations. Future research should focus on validating standardized empowerment indices across diverse cultural contexts, exploring longitudinal approaches to impact measurement, and leveraging emerging digital technologies to strengthen monitoring and evaluation practices for girls' empowerment initiatives in low-resource settings.

## REFERENCES

- [1] Rizzo, T., Anderson, E., & Schaub, E. Adolescents and Agency: Evidence from a Global Investment in Gender Equality and Women's Empowerment.
- [2] Shah, M., Baird, S., Seager, J., Avuwadah, B., Hamory, J., Sabarwal, S., & Vyas, A. (2024). Improving mental health of adolescent girls in low-and middle-income countries: Causal evidence from life skills programming. *Journal of Human Resources*, 59(S), S317-S364.
- [3] Carvalho, S., & Cameron, E. (2023). *Empowerment, Aspirations, and Girls' Education*. Center for Global Development.
- [4] Meherali, S., Rehmani, M., Rafiq, A., Punjani, N., Vallianatos, H., & Romeu, C. (2021). Empowering young immigrant girls in Canada through the 'Girls' Voices' Curriculum: A qualitative study. *F1000Research*, 10, 799.
- [5] Van Zyl, C., Badenhorst, M., Hanekom, S., & Heine, M. (2021). Unravelling 'low-resource settings': a systematic scoping review with qualitative content analysis. *BMJ global health*, 6(6).
- [6] Meherali, S., Rehmani, M., Rafiq, A., Punjani, N., Vallianatos, H., & Romeu, C. (2021). Empowering young immigrant girls in Canada through the 'Girls' Voices' Curriculum: A qualitative study [version 1; peer review: awaiting peer review].
- [7] Batabyal, S., Zirali, P., Hoover, S., Mungoni, R., Chelwa, N., Mulenga, D., ... & Subramanian, S. Integrated Model of Cancer Control for Early Detection and Treatment in Adolescents and Young Adults Living with HIV in Zambia: Protocol for a Cluster-Randomized Control Trial.
- [8] Hedman, H. D., Vasco, K. A., & Zhang, L. (2020). A review of antimicrobial resistance in poultry farming within low-resource settings. *Animals*, 10(8), 1264.



- [9] Abou-Khalil, V., Helou, S., Khalifé, E., Chen, M. A., Majumdar, R., & Ogata, H. (2021). Emergency online learning in low-resource settings: Effective student engagement strategies. *Education Sciences*, 11(1), 24.
- [10] Spencer, S. A., Adipa, F. E., Baker, T., Crawford, A. M., Dark, P., Dula, D., ... & Morton, B. (2023). A health systems approach to critical care delivery in low-resource settings: a narrative review. *Intensive care medicine*, 49(7), 772-784.
- [11] Takon, A. (2022). Advanced AI Techniques for Safety and Risk Evaluation in High-Hazard Engineering Systems. *International Journal of Technology, Management and Humanities*, 8(04), 97-109.
- [12] Goel, N. Privacy Risks and Protection in the Digital World of IoT. *Panamerican Mathematical Journal*, 33(1), 2023.
- [13] Takon, A. (2020). Adaptive Pipeline Monitoring Using Unsupervised Anomaly Detection. *International Journal of Technology, Management and Humanities*, 6(03-04), 93-106.
- [14] Kola, J. N. (2011). An Integrated Framework for Data Mining and Distributed Database Optimization in Resource-Constrained Network Environments. *SAMRIDDHI: A Journal of Physical Sciences, Engineering and Technology*, 2(02), 82-86.
- [15] Ravikumar, V. (2014). Fair and optimal resource allocation in wireless sensor networks.
- [16] Naidu, K. J. (2014). Secure OLAP Reporting Architectures: Integrating Role-based Access Control and Query Execution Plan Optimization for Enterprise Analytical Environments. *SAMRIDDHI: A Journal of Physical Sciences, Engineering and Technology*, 5(02), 155-159.
- [17] Singh, S. S. (2022). Accessibility and Universal Design in Transportation Infrastructure. *SAMRIDDHI: A Journal of Physical Sciences, Engineering and Technology*, 14(04), 210-214.
- [18] Takon, A. (2021). AI Safety Systems and Risk Analytics for High-Hazard Engineering Systems. *Multidisciplinary Innovations & Research Analysis*, 2(2), 1-20.
- [19] Kola, J. N. (2023). Quantifying Revenue Impact of Enterprise Analytics: A Revenue Attribution Framework for Business Intelligence Systems.
- [20] Takon, A. (2023). Machine Learning (ML)-Based Cyber Threat Modelling for Industrial Control Systems in critical Infrastructure. *International Journal of Technology, Management and Humanities*, 9(02), 94-108.
- [21] Singh, S. S. (2023). Code Compliance Challenges in High-Stakes Infrastructure Projects. *SAMRIDDHI: A Journal of Physical Sciences, Engineering and Technology*, 15(01), 213-221.
- [22] Kola, J. N. (2023). Measuring the Business Value of Analytics-Driven Decisions: A Decision Impact Attribution Framework for Enterprise Environments.
- [23] Singh, S. S. (2023). Architectural Identity in Transit Infrastructure: Branding vs Functionality. *Multidisciplinary Innovations & Research Analysis*, 4(2), 1-12.
- [24] Goel, N. Implementing Secure Access Controls in Computer Security Frameworks.
- [25] Singh, S. S. (2023). Human-Centered Design in Underground Transit Environments. *Multidisciplinary Innovations & Research Analysis*, 4(3), 1-20.
- [26] Takon, A. (2024). Data-Driven Threat Intelligence for Energy and Critical Asset Management. *International Journal of Technology, Management and Humanities*, 10(04), 253-266.
- [27] Kola, J. N. Longitudinal Cohort Intelligence for Self-Insured Employer Groups: A Predictive Framework for Healthcare Cost Trajectory Modeling and Proactive Risk Intervention.
- [28] Adepoju, S. A., & Adepoju, M. A. (2024). From Portals to Case Graphs: A Reference Architecture and Benchmark for Safety Investigation Operations with Agentic Orchestration.
- [29] Goel, N. (2024). Robustness and Security in Deep Learning Algorithms. *Journal of Computational Analysis and Applications*, 33(1A).
- [30] Takon, A. (2024). Data Science Approaches to Asset Integrity Management in Offshore and Onshore Oil and Gas Operations. *Multidisciplinary Innovations & Research Analysis*, 5(2), 17-31.