Predicting and Preventing gender-based violence: A strategic framework for long-term change

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Abstract Gender-based violence (GBV) remains a critical global issue, requiring proactive prevention strategies to mitigate its long-term impact. This study examines the evolving landscape of GBV prevention, highlighting a shift from reactive interventions to forward-looking strategies. Using the futures cone and three horizons framework, we developed a sustainable model for GBV mitigation. Through Natural Language Processing analysis of survivor narratives, we identified linguistic and semantic patterns that reveal resilience and opportunities for early intervention. Our data-driven approach provides policymakers and advocates with actionable insights to drive systemic change and reduce GBV prevalence.
Keywords: gender-based violence, NLP, preventive strategies, futures cone

1. Introduction

Gender-based violence (GBV) refers to any act of violence directed at an individual based on their gender, causing or potentially causing physical, sexual, or psychological harm, as well as the threat of such acts, coercion, or deprivation of liberty. Although it predominantly affects individuals who do not conform to traditional gender stereotypes can also be victims. GBV manifests in various forms, such as domestic violence, stalking, sexual violence, female genital mutilation, human trafficking, and discrimination. GBV remains a pervasive global issue, yet despite various interventions and increasing public discourse, it continues to be underreported, thus limiting the effectiveness of current prevention policies. Traditional approaches typically focus on reactive measures, addressing the relationships or motivations. However, the prevention aspect is often underexplored in the literature, which this contribution seeks to address by developing a sustainable model based on patterns of resilience. This study integrates methodologies from social sciences, computational linguistics, and future scenario planning to construct a comprehensive framework for long-term GBV prevention. By utilizing Natural Language Processing techniques to analyze survivor testimonies, the research identifies linguistic patterns indicative of resilience and early warning signs of violence. Through this multidisciplinary approach, a strategic framework for long-term GBV prevention was proposed, emphasizing policy development and public awareness.

2. Methodology

2.1 Data

The dataset consists of a collection of Italian narratives from the RAI television program Sopravvissute (archived from 2018 to 2023). It comprises a textual corpus of 55 stories shared by women who have survived violence. The overall corpus contains 145,535 tokens of varying lengths and associated metadata. The use of metadata has enabled both the

reconstruction of survivors' journeys and the identification of the most significant attributes of these women.

2.2 Methods

This study adopts a multidisciplinary approach, integrating Natural Language Processing (NLP) to analyze television discourse on the survival of gender minorities and to outline potential future scenarios. The innovative aspect lies in the use of a specific lexicon for gender-based violence (GBV) and its application, which has been employed to capture future horizons

The analysis is based on three main phases:

1. Identification of the main themes in television communication through specific lexicon and *Structural Topic Modeling*-STM;

2. Detection of syntactic, semantic, and emotional patterns using *word embedding models and LLM for emotions classification*;

3. Development of a future scenario horizon based on the previous results.

STEP1 To model latent themes the STM was performed. As well known, it is a Bayesian probabilistic model that identifies latent topics in a textual corpus by incorporating structural metadata that influence topic distribution [1]. STM extends *Latent Dirichlet Allocation* by introducing document-level covariates that modify the prior probability of topic distributions, allowing for the analysis of thematic variations based on external factors. Formally, the STM model assumes that each document d is represented as a distribution over latent topics $\boldsymbol{\theta}_d$, which in turn are distributions over a vocabulary of words $\boldsymbol{\phi}_k$. The document generation process follows these steps: 1) For each document d, a topic distribution is drawn: $\boldsymbol{\theta}_d \sim \text{LogisticNormal}(\boldsymbol{\mu}, \boldsymbol{\Sigma})$, where $\boldsymbol{\mu}$ and $\boldsymbol{\Sigma}$ depend on document metadata. 2) For each word w_{dn} in the document, a topic is chosen: $z_{dn} \sim \text{Multinomial}(\boldsymbol{\theta}_d)$. 3) The word w_{dn} is then generated from the distribution $w_{dn} \sim \boldsymbol{\phi}_{z_{dn}}$, associated with the selected topic. Inference in STM is performed using the Bayesian sampling method *Gibbs*. The model was estimated optimizing the number of topics K based on semantic coherence and log-likelihood probability criteria.

STEP 2 - preliminary word embedding and LLM comparison To detect syntactic and semantic patterns related to coping strategies, a *word embedding* technique based on *GloVe* (*Global Vectors for Word Representation*) was adopted. The model developed by [2] is a distributional representation method that constructs dense word vectors by leveraging the global information of the co-occurrence matrix X of the corpus. The model is based on the factorization of the co-occurrence matrix, solving the following log-linear equation $\boldsymbol{w}_i^T \tilde{\boldsymbol{w}}_j + b_i + \tilde{b}_j = \log X_{ij}$, where $\boldsymbol{w}_i$ and $\tilde{\boldsymbol{w}}_j$ are the word and context vectors, b_i and $\tilde{b}_j$ are additive biases, and X_{ij} represents the frequency with which word i co-occurs with word j in the corpus. Its optimization is based on *Stochastic Gradient Descent* which minimizes the weighted cost function $J = \sum_{i,j} f(X_{ij}) \left(\boldsymbol{w}_i^T \tilde{\boldsymbol{w}}_j + b_i + \tilde{b}_j - \log X_{ij} \right)^2$, where $f(X_{ij})$ is a

weighting function that reduces the influence of word pairs with low co-occurrence frequency. Pre-trained embeddings on a corpus of television transcripts was used. The obtained vectors were analyzed using *cosine similarity* and *hierarchical clustering* to identify groups of semantically related words associated with the concepts of survival and coping strategies. Subsequentely a supervised approach using transformer models such as BERT (Bidirectional En- coder Representations from Transformers) was used [3]. Initially, a lexicon specifically designed for gender-based violence was introduced to support the classification process. Subsequently, an ensemble learning approach was adopted, combining predictions from multiple models (BERT and XLM-RoBERTa) to enhance the robustness and accuracy of the final classification. The construction of the future scenario will be based on the most effective results obtained through the comparative evaluation of different methods and the integration of the proposed lexicon.

STEP 3 Futures cone & horizons framework

The three horizons are a framework as dialogue structure between change and uncertainty. It describes Horizon 1 as the predominant but decaying system, Horizon 3 as the future landscape and Horizon 2 as the bridging transitional innovations between the two. It promotes future-oriented decision-making and helps differentiate between incremental and transformational change [4]. In the same way, the futures cone and three horizons framework emerged from our NLP-based methodological asset, for envisioning the evolution of GBV prevention strategies. STM uncovers how the themes in GBV discussions change, revealing emerging trends and shifts in cultural narratives. GloVe tracks the evolution of language and terminology, highlighting the adoption of new concepts in the discourses. Together, these techniques provide valuable data-driven insights that can guide the progressive steps. **Horizon 1 ($\mathbf{H}_1$)** represents the present state of GBV prevention, encompassing existing policies, interventions, and societal attitudes. **Horizon 2 ($\mathbf{H}_2$)** captures emerging innovations, shifting cultural narratives. **Horizon 3 ($\mathbf{H}_3$)** illustrates a long-term transformative vision where systemic change has minimized GBV occurrence. By mapping data-driven insights onto these horizons, we can outline progressive steps towards a society that effectively prevents GBV.

3. Results

Figure 1 shows the results of the STM. For the sake of brevity, only "Topic 17" (red) and "Topic 18" (blue) are presented, where two distinct themes emerge with keywords associated with relevant semantic differences. "Topic 17" focuses on violence dynamics, psychological manipulation, warning signs, and the psychological dependence that characterizes unhealthy relationship dynamics. "Topic 18" suggests an emphasis on physical violence and the difficulties in escaping abusive situations, with implications related to the victims' vulnerability. The courage to speak out emerges, along with the necessity of seeking support.The spatial distance between the terms reflects a difference between the themes, highlighting the minimal overlap between the concepts addressed. This result provides a foundation for further explorations of thematic narratives beyond this contribution.

The analysis of semantic representations derived from GloVe (Table 1) presents the se-

Figure 1: STM

mantic relationships between keywords, linguistic structures (substructure), and association probabilities. It highlights several thematic trajectories that reflect a journey from vulnerability to resilience, both individual and collective. Conscious resilience represents the first step in breaking free from submission. This transitions into a process of strengthened autonomy, characterized by the emergence of trust, freedom, and decision-making independence, often culminating in empowerment, which manifests through self-determination, self-esteem, and the assertion of one's rights.The concepts range from awareness and self-defense to transformation and overcoming difficulties. The initial results for the depiction of future horizons (Table 2) have been obtained using only a newly customized lexicon based on gender-based violence (GBV). Furthermore, the thematic distinctions highlighted by STM, which differentiate between narratives centered on violence dynamics and those emphasizing escape and support-seeking, indicate distinct linguistic terrains that can be targeted for tailored interventions. By amplifying this "future core" of resilience language, policymakers and advocates can proactively shape the discourse around GBV, fostering a societal shift towards prevention and empowerment, rather than solely focusing on reactive measures.

The three horizons framework contextualizes this strategy, positioning the current emphasis on awareness and justice, here's a more detailed application of the findings within each horizon:

1. H_1: Current State: The STM results, particularly the identification of themes related to "violence dynamics, psychological manipulation," and "difficulties in escaping abusive situations," fall within H1. This horizon is characterized by the language of the problem: fear, control, and victimhood. Current interventions often focus on legal frameworks and immediate crisis response, reflecting this H1 language. The NLP findings here highlight the limitations of this language for long-term change.

2. H_2: Emerging Innovations: The GloVe analysis, which reveals the semantic shift towards "autonomy, empowerment, and breaking the silence," aligns with H_2. This horizon represents the transition. The language is shifting towards resilience, agency, and self-determination. Emerging interventions might include:

   - programs that build self-esteem and assertiveness;
   - community initiatives that promote survivor leadership;

- educational campaigns that emphasize healthy relationship models.

3. H_3: Transformative Vision: The long-term vision where the future core of resilience language has become the dominant paradigm. In this horizon:
   - GBV is rare because of pervasive gender equality education;
   - social norms support help-seeking and challenge power imbalances;
   - language reinforces equality and respect in all relationships.

   By strategically focusing on amplifying the H2 language and working to embed it within H3, we can accelerate the shift away from H1 and its associated problems.

word representations	substructures	prob.	semantic label
dignity + decision - manipulation	self-determination	0.48	empowerment
	rights	0.47	
	self-esteem	0.45	
justice + change - silence	reform	0.53	social change
	law	0.48	
	activism	0.47	
courage + self-defense - victim	reaction	0.52	self-defense
	inner strength	0.48	
	survival	0.48	
mother + protection - fear	children	0.53	love
	reaction	0.52	
	future	0.51	

Table 1: Glove results

4. Further developments

This preliminary study applies the three horizons framework to gender-based violence (GBV) prevention, identifying current trends and potential future transformations. The initial findings highlight a shift toward empowerment and early prevention. However, the use of the GloVe model has limitations in semantic accuracy, which will be addressed in future research by incorporating large language models (LLMs), enhancing both the precision and depth of the analysis.

Horizon	Key Insights
H1	**Current State of GBV Prevention:** Predominant negative emotions: fear, anger, sadness to underline the drama of violence. Focus on awareness, justice, personal change. Semantic structures: maltreatment, domestic violence, escalation violence, emerging containment measures such as laws and reforms.
H2	**Emerging Innovations and Cultural Shifts:** Increasing awareness, awareness on dynamics related to psychological manipulation, cases or narrative of survivors and new life. New perspective of autonomy, empowerment, and breaking the silence. Shift towards healthy relationships and empowerment, escape from psychological and economic manipulative relationships.
H3	**Long-Term Transformative Vision:** Shift in emotional narrative: pressing representation of the negative outcomes of violent dynamics to emphasize their danger. Negative polarity related to opportunity of resilience for a better future, for freedom. Focus on gender equality education in couple dynamics, early prevention. Language evolving towards gender equality, healthy relationships, balanced relationships not based on power dynamics, trust in response and reforms, the end of shame or fear, and the ability to ask for help to save oneself.

Table 2: GBV Prevention:Three Horizons

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