

HeaLing 2026

**The 1st Workshop on Linguistic Analysis for Health**

**Proceedings of the Workshop**

March 28, 2026

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**Scented AI? Integrating olfaction into Large Language Models (VR 2024-01506)**



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## Introduction

Welcome to the inaugural edition of **HeaLing: The 1st Workshop on Linguistic Analysis for Health!** We are thrilled to welcome you to Rabat, Morocco, for this first-of-its-kind gathering co-located with *EACL 2026*. This workshop was born from a simple but profound observation: language in medicine is never neutral. It shapes how we understand illness, how clinicians interact with patients, and how public health policy is forged. As we open this forum, we aim to bridge the gap between the rich traditions of the humanities and the powerful, rapidly evolving tools of computational linguistics.

The program for this first year reflects the incredible diversity and urgency of health-related discourse. In line with global shifts in the field, a significant portion of our contributions focuses on the **capabilities and vulnerabilities of Large Language Models (LLMs)** in clinical contexts. We have papers exploring the impact of mixed-vendor multi-agent systems on diagnostic accuracy, the risks of sycophancy in multi-turn medical conversations, and the effectiveness of prompt optimization for detecting errors in clinical notes. These works don't just apply AI; they critically evaluate whether these models can truly maintain the rigor and reliability required for patient care.

A central contribution of this year's workshop lies in the **computational exploration of stigma, metaphors, and illness narratives**. By leveraging NLP to analyze large-scale datasets, our authors examine how diagnostic categories emerge and how the "naming and framing" of conditions affects societal perception. Significant studies in this edition track the longitudinal trends of autism stigma in media, the evolution of medical metaphors across scientific and public domains, and the way patient narratives on TikTok reveal interconnected health discourses. These papers demonstrate that quantitative methods can rigorously capture the subtle linguistic shifts that contribute to stigmatization or, conversely, to more inclusive health communication.

We also see a strong focus on the **computational analysis of patient experience**. From investigating the linguistic roots of loneliness in caregivers via Reddit to analyzing Norwegian patient feedback through aspect-based sentiment analysis, these studies highlight how digital platforms serve as mirrors for the human side of medicine. This work is complemented by research into **clinical assessment and inclusivity**, including multimodal frameworks for aphasia and wh-question development in children with hearing loss. Furthermore, several contributions provide critical case studies on the accessibility of cancer-related materials and the gender representation in vaccination campaigns.

Finally, our program highlights the **technical frontiers of health NLP**, particularly in resource-constrained or multilingual settings. These include innovative data augmentation for the "One Health" context, cross-lingual evaluations of LLMs for Arabic medical tasks, and neural embedding frameworks for normalizing health concepts across diverse text sources.

By bringing together researchers from ACL with scholars from medicine, social sciences, and the humanities, we hope to foster a "careful alignment" between computational methods and human-centered hypotheses. Whether you are here to discuss the ethics of AI empathy in clinical voice assistants or the technicalities of biomedical named entity recognition, we are certain you will find inspiration in these pages.

For more information, please visit our website at [healing-workshop.github.io](https://healing-workshop.github.io).

Our deepest gratitude goes to the authors for their high-quality submissions and to our dedicated program committee for their rigorous and thoughtful reviews. We also thank the EACL 2026 organizers for their support and for providing a platform to launch this important conversation. We look forward to engaging discussions, new collaborations, and the continued growth of this vibrant community in the years to come.

*Vera, Murathan, Ylva, Julia and Andrew*

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**Keynote Talk**  
**Narrative Medicine and Natural Language Processing: A  
Critical Juncture for Humanistic Health AI**

**Kirsten Ostherr**  
Rice University, USA



**Saturday, March 28, 2026 – Time: 14:15–15:00 – Room: SALLE Les Oudayas**

**Abstract:** Much health humanities work has focused on the ways that narratives and texts can illuminate silenced or marginalized aspects of health and illness experiences. Scholars have emphasized the importance of historicized, contextually-grounded details that can be understood through qualitative analysis to give meaning to quantitative health data. With the rapid adoption of large language models (LLMs), narratives have suddenly taken on an outsized role in data-driven healthcare, without critical frameworks to contextualize their meaning. This moment presents a new urgency and opportunity for research at the intersection of computational and humanities-based methods. NLP-based AI tool developers can learn from scholarship in the digital humanities that draws on the affordances of large-scale, distant data mining techniques, while also engaging practitioners of narrative medicine that utilize the analytic, interpretive, close and deep reading tools of the humanities. The challenges of bridging from the patient to the dataset - or from the large language model to the personal health narrative - require new interdisciplinary methods with substantive grounding in radically different epistemologies. This keynote will present a case for understanding digital health humanities as a timely and necessary response to the emergence of health AI.

**Bio:** *Kirsten Ostherr, PhD, MPH* is the Gladys Louise Fox Professor and Founding Director of the **Medical Humanities Research Institute** at Rice University in Houston, Texas. Kirsten is the author of *Medical Visions: Producing the Patient through Film, Television and Imaging Technologies* (2013), *Cinematic Prophylaxis: Globalization and Contagion in the Discourse of World Health* (2005), and editor of *Applied Media Studies* (Routledge, 2017). She is currently writing *Virtual Health* (under contract with MIT Press) and “The Visual History of Computational Health,” supported by a grant from the National Endowment for the Humanities. Her research on trust and privacy in digital health ecosystems has been featured in **Marketplace Tech**, **The Atlantic**, and **STAT**. Her work on humanistic AI and health equity includes, “**Artificial Intelligence and Medical Humanities**,” “**Patient Participation in AI for Health Curriculum**,” and “**Responsible AI for Health**” curriculum supported by the National Humanities Center. She is co-PI on the NEH-funded “Center for Humanities-based Health AI Innovation,” and her work has also been supported by the Andrew W. Mellon Foundation and the National Institutes of Health. She received the Health Humanities Visionary Award in 2024 from the International Health Humanities Consortium.

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# Program

## Saturday, March 28, 2026

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- 14:15 - 15:00     *Keynote Talk*
- 15:00 - 15:45     *Oral Presentations*
- 15:45 - 16:15     *Coffee Break & Poster Discussions*
- 16:15 - 17:15     *Oral Presentations*
- 17:15 - 17:30     *Closing Remarks*
- 17:30 - 18:00     *Poster Discussions*

# Discourses of Prevention: A Multimodal Study of HPV Vaccination Campaigns in Italy

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## Abstract

This study assesses the communicative effectiveness of Italian HPV vaccination campaign materials using a mixed-methods design that combines expert annotation and a public perception experiment. A corpus of 49 official documents was annotated by six experts (three Linguistics Ph.D. students and three Gynecology residents) across 56 variables capturing the appropriateness and efficiency of verbal and visual elements. The perception experiment, administered to a convenience sample of Italian general public, examined attitudes toward HPV vaccination and evaluations of communication effectiveness. Overall, both expert and public assessments converged in judging the HPV vaccination campaign materials as relatively weak, citing reduced informativeness in overly concise texts, inappropriate choice of colors, and recurring issues regarding gender representation, inclusivity, and diversity.

## 1 Introduction

When vaccines are available, a suboptimal vaccination coverage is caused by vaccine hesitancy (Kang et al., 2017). Studies on vaccine hesitancy mention safety concerns, the accelerated approval process, and misinformation as primary reasons of skepticism (Wouters et al., 2021). Vaccine hesitancy due to disinformation and/or misinformation represents a threat for the healthcare system, so it is necessary that policy makers develop health communication strategies able to contrast these situations by increasing public understanding of benefits of vaccination (see Combei, 2022, Clarke et al., 2026).

This study examines the suitability and communicative effectiveness of textual and visual content of Human Papillomavirus (HPV) vaccination campaigns in Italy. Communicative effectiveness is conceptualized here as the capacity of campaign materials to convey information accurately and to

promote understanding and the achievement of intended communication goals. Our aim is to establish a methodology that could pave the way for future studies on other healthcare campaigns. Furthermore, this study may contribute to the broader discussion on the development of vaccination materials capable of addressing vaccine hesitancy.

The remainder of this article is organized as follows. Section 2 situates the study by providing an epidemiological background (Section 2.1) and examining briefly the role of discourse strategies in vaccination framing (Section 2.2). Section 3 details the empirical approach, describing the data (Section 3.1) and the methodological components, namely the expert annotation (Section 3.2) and the perception experiment (Section 3.3). Section 4 reports the results, namely the findings from the expert survey (Section 4.1), the participants' vaccine stances (Section 4.2), and a qualitative examination of selected expert and general public participant responses (Section 4.3). Section 5 offers concluding remarks, Section 6 acknowledges the limitations of our study, and finally, ethical considerations are presented in Section 7.

## 2 Related work

### 2.1 Epidemiological Background

HPV is the most common sexually transmitted infection worldwide and persistent HPV infection is the primary risk factor for developing cervical cancer, responsible of approximately 350,000 deaths in 2022 (Zhu et al., 2024). Vaccination is the most effective preventive strategy for cervical cancer and other HPV-related cancers and diseases (see Luostarinen et al., 2018, Muñoz et al., 2010, Harder et al., 2018, Palefsky et al., 2011). The World Health Organization (WHO), within its global strategy to eliminate cervical cancer, has identified a

key objective: ensuring that 90% of girls are fully vaccinated against HPV by 15 years of age.<sup>1</sup>

In Italy, the HPV vaccine is recommended and offered free of charge to adolescents and young adults, both male and female, from 11–12 years of age up to 26 years as part of the National Immunization Program. Despite these recommendations, vaccination coverage remains below the national targets: in 2019, only 64.07% of 12-year-old females and 55.80% of 12-year-old males had completed the full vaccination series (Mascaro et al., 2019). A recent survey investigated knowledge, attitudes, and behaviors towards HPV preventive measures among Italian university students (Di Giuseppe et al., 2023). Out of the addressed university students, 41.7% knew about HPV infection and the main preventive measures and 39.1% have received at least one HPV vaccination dose, whereas 29.2% and 31.7% had not been vaccinated or did not remember. Female students enrolled in the field of health sciences, those who did not report a prior history of a sexually transmitted infection, and those with a higher knowledge about HPV infection and preventive measures were more willing to receive the HPV vaccination.

## 2.2 Narratives in Vaccination Campaigns

Previous research has highlighted the role of communication strategies in shaping attitudes toward vaccination, even if linguistic studies regarding HPV vaccination hesitancy are scanty and those on Italian data are completely lacking. A study on English (Semino et al., 2023), analyzing real-life discussions on the Mumsnet forum, showed that creating persuasive pro-vaccination narratives entails specific challenges of tellability: making the risks of HPV infection and the benefits of the HPV vaccine appear reportable, relatable, and worth narrating.

Other studies demonstrated that narrative forms may be particularly impactful in countering hesitancy. For example, one study (Cawkwell and Oshinsky, 2016) found that parents are often more influenced by vivid, emotionally charged stories of vaccine harms than by clinical evidence, suggesting that pediatricians should strategically use narratives to address concerns about childhood vaccinations. A controlled experiment with 341 college students (Nan and Madden, 2012) found that exposure to

blogs framing negatively HPV vaccine significantly increased perceived risk, worsened attitudes, and reduced vaccination intentions among participants, whereas positive blog content produced no measurable improvement compared with controls, suggesting that negative online narratives may exert a disproportionate influence relevant to vaccine hesitancy. In a subsequent study (Nan et al., 2015), it was demonstrated that combining narrative and statistical evidence produces the strongest effects on unvaccinated college students' perceptions of HPV-related risks, pointing to the value of multimodal communication approaches.

Taken together, these studies indicate that effective communication about HPV vaccination depends not only on informational and factual accuracy but also on how messages are framed, narrated, and rendered personally salient. These findings from the literature suggest the importance of audience segmentation and targeted messaging, whereby communication strategies are tailored to the distinct characteristics and needs of specific groups.

## 3 Data and Methods

Our study comprises two phases and was designed to highlight the value of the multidisciplinary team involved in the research: i) an expert survey consisting of an annotation task administered to linguists and gynecologists who were part of the team (Section 3.2); and ii) a perception questionnaire aimed at the wider public (Section 3.3), which draws on materials selected during phase i). Both phases were preceded by the collection of official materials related to HPV vaccination campaign (Section 3.1).

### 3.1 Corpus

This study draws on a dataset of official materials pertaining to HPV vaccination. First, we constructed a purpose-built corpus consisting of 49 official documents issued at regional and national levels, sampled for reasons of public availability, convenience, and proximity to the team members. Not all Italian regions made HPV vaccination campaign materials publicly available for download and dissemination. Among the materials we were able to collect, 66% originated from Northern Italy, 8% from Central Italy, 16% from Southern Italy and the islands, and the remaining 10% consisted of materials produced at the national (Ministry-level) scale. This initial corpus represented the dataset

<sup>1</sup>The detailed report is available at this webpage: <https://www.who.int/news-room/fact-sheets/detail/cervical-cancer> (accessed 17 December 2025).



Figure 1: Single page flier on HPV vaccination campaign issued by Lombardy region (low score).

for an expert annotation survey involving linguists and gynecologists. The documents ranged from 1 to 72 pages and contained more than 98,000 tokens overall. After the expert survey, we selected a subset of 12 documents from the full corpus as stimuli for a questionnaire administered to the general public in a perception experiment. Selection was guided by the experts' aggregated ratings produced during the annotation phase, with the aim of achieving a stratified set of stimuli representing materials evaluated as highly, moderately, and weakly effective in communicative terms (see Section 3.2 and Section 3.3). Illustrative examples of stimuli receiving different effectiveness ratings are provided in Figure 1, Figure 2, and Figure 3.

### 3.2 Expert Annotation

An expert annotation survey was conducted with the aim of (i) exploring linguistic features potentially relevant to assessing the communicative effectiveness of HPV vaccination materials and contributing to a preliminary benchmark for well-designed informative documents; and (ii) informing the development of the perception questionnaire for the general public by assisting in the selection of a balanced set of stimuli, pre-testing the clarity of selected questions, and collecting feedback.



Figure 2: Single page poster on HPV vaccination campaign issued by Sicily region (medium score).

This survey also enabled a qualitative comparison between expert judgments and the perceptions of the general public regarding the same materials.

Six annotators were recruited for the expert survey: three residents in Gynecology with expertise in HPV prevention and three Ph.D. students in Linguistics with expertise in pragmatics and multimodal analysis. Two annotators were men and four were women; ages ranged from 24 to 32 year. This combination of complementary disciplinary backgrounds broadens the conceptualization of expertise and ensures a diverse set of analytical perspectives. The annotation was conducted independently, with no exchange of information among annotators.

The annotation scheme was designed collaboratively by two senior linguists and one senior gynecologist. It consisted of an extensive and time-intensive multi-layer protocol including 56 variables, divided into 38 closed and 18 open questions. The scheme covered objective aspects of material design (e.g., presence of predominant colors), objective aspects of content (e.g., presence of references to external sources of information regarding HPV and/or the vaccine), subjective evaluations of design choices (e.g., assessment of typeface use), and subjective evaluations of informativeness, effectiveness, usefulness, credibility, diversity, inclu-



Figure 3: Front page of a 24-page multilingual brochure issued by Emilia Romagna region (high score).

sivity, and target audience. Additional questions elicited feedback specifically aimed at improving the structure and clarity of the questionnaire used in the subsequent public survey. The annotation form is available through the OSF repository.<sup>2</sup>

### 3.3 Perception Experiment

The general public perception experiment relied on a set of 12 stimuli selected during the expert assessment phase. Items were retained only if inter-annotator agreement among six experts was substantial or higher (Fleiss'  $\kappa \geq 0.61$ ), with the strongest items reaching almost perfect agreement ( $\kappa \geq 0.81$ ). These agreement levels were achieved consistently across all annotated variables. The selected stimuli were stratified into three effectiveness categories based on expert judgments: three high-ranking stimuli classified as highly effective, three mid-ranking stimuli considered sufficiently

<sup>2</sup>The annotation form used in the expert survey is stored as a .pdf file in the repository available at this webpage: <https://osf.io/9nwpe/overview> (accessed 31 January 2026).

effective, and three low-ranking stimuli judged to be minimally effective. To ensure balanced exposure, four questionnaire versions were constructed, each comprising three stimuli positioned according to the ranking scheme described above. The participants were redirected to one of the versions of the questionnaire based on their birth year and the initial letter of their last name. Overall, questionnaire completion rates were distributed as follows: 35% participants completed the first one, 22% the second one, 21% the third one, and 22% the fourth one.

At the beginning of the experiment, participants were provided with a general explanation of the study's aims and scope, along with information on data handling and storage procedures. They were then asked to answer seven socio-demographic questions regarding their gender, age, marital status, number of children, education, nationality, and region of residence. The experiment subsequently proceeded with 21 items assessing participants' perceptions of the stimuli across a set of variables derived from the expert annotation scheme. Of these, 19 items were closed-ended and two were open-ended; the latter were intentionally limited numerically to reduce questionnaire complexity. An additional set of seven items assessed respondents' vaccination history and attitudes, including HPV vaccination status and familiarity with individuals who had been vaccinated and were highly satisfied with their decision. The form used in the perception experiment is available through the OSF repository.<sup>3</sup>

The questionnaire was disseminated via a snowball sampling strategy, initially shared with personal contacts who were asked to circulate it further, and subsequently promoted through academic and private social media channels, professional mailing lists, and related networks. Thus, the sample is not specifically designed to be completely representative of the Italian population, but it is suitable for a preliminary experimental investigation. Regional and educational distributions may reflect recruitment-related biases. Overall, the questionnaire was completed by 132 participants, of whom 82 were women (62%) and 50 men (38%). The most represented age group was 21–29 years (28%), followed by participants aged 30–39 (25%),

<sup>3</sup>The questionnaire used in the perception experiment for the general public is stored as a .pdf file in the repository available at this webpage: <https://osf.io/9nwpe/overview> (accessed 31 January 2026).

resulting in an overall balanced age distribution. Most respondents reported being in a relationship (71%), and 40% indicated that they had children. The majority of participants held Italian citizenship (96%). Regional representation was skewed: Lombardy accounted for 45% of respondents, followed by Emilia-Romagna and Puglia (each 10%). In terms of educational background, 21% held a high school diploma, 54% had a university degree, 9% had a postgraduate specialization, and 16% held a Ph.D.

## 4 Results

In this section, we report the findings of the expert survey (Section 4.1), examine the public’s perceptions (Section 4.2), and present a qualitative examination of illustrative open responses that exemplify some key themes (Section 4.3).

### 4.1 The Experts

The expert survey combined quantitative and qualitative analyses to evaluate the characteristics and communicative effectiveness of our corpus of 49 collected materials.

Free-text annotations were pre-processed through text normalization, whereas annotations of other types were processed according to their respective typologies, including statistical scaling and centering to account for differences in rating scales.

Inter-annotator agreement was computed for each item and level of annotation using Cohen’s kappa for nominal variables, Fleiss’ kappa for ordinal variables and multiple annotators, and the Intraclass Correlation Coefficient (ICC, [Shrout and Fleiss, 1979](#)) for numerical variables. These metrics are widely used in linguistic annotation and content analysis to assess agreement beyond chance and the consistency of annotations by multiple annotators ([Artstein and Poesio, 2008](#)), as is the case with this study. Overall, agreement levels ranged from fair to almost perfect across most variables. As expected, items assessing the presence of structural features such as hashtags, slogans, images, or question–answer formats yielded almost perfect agreement ( $\kappa = 0.81\text{--}1.00$ ). Substantial agreement ( $\kappa = 0.61\text{--}0.80$ ) was observed for evaluations of informativeness regarding vaccine safety, side effects, and effectiveness, as well as for items related to image use. Moderate agreement ( $\kappa = 0.41\text{--}0.60$ ) emerged for the identifica-

tion of male and female representations, whereas fair agreement ( $\kappa = 0.21\text{--}0.40$ ) characterized judgments concerning credibility, usefulness, material length, perceived neutrality in the representation of men, and the identification of the intended target audience. Slight to poor agreement ( $\kappa = 0.00\text{--}0.20$ ) was found for assessments of institutional authority, neutrality in the representation of women, and the adequacy of typefaces and color schemes.

Mean scores and standard deviations were then computed for each material across all rating and annotation variables. A small subset of materials (predominantly originating from specific regions, particularly Emilia-Romagna) consistently achieved high scores ( $\geq 66$  on a 100-point scale), especially on the important items assessing informativeness with respect to vaccine safety, side effects, and effectiveness. These included a comprehensive 72-page booklet featuring 100 questions and answers on the HPV vaccine, a 25-page brochure on childhood and adolescent vaccinations, and a multilingual 24-page brochure designed for linguistically diverse audiences, most issued by the Emilia-Romagna region. Additional high-scoring materials comprised informed-consent forms and advisory notices from Emilia-Romagna, Lombardy, and Liguria, as well as a two-page informational flyer for parents produced in Friuli-Venezia Giulia. A leaflet from Puglia and a pediatric vaccination calendar from Emilia-Romagna received high scores for clarity and comprehensibility.

Materials receiving intermediate scores (50–65 on a 100-point scale) were comparatively few, including a 40-page booklet outlining Basilicata’s HPV vaccination strategy and an A3-format poster from Sicily. Finally, and somewhat surprisingly, the majority of materials in the HPV vaccination campaign corpus were rated low ( $< 50$  on a 100-point scale) by the experts across all variables considered.

The observations above align with findings noted in the literature in previous evaluations of HPV vaccination materials across various countries, such as Serbia, Kenya, India, Nigeria, and the USA. Positively assessed materials typically provide vaccine-specific information (e.g., its purpose, efficacy, logistical details) alongside evidence-based communication strategies ([Njogu et al., 2024](#)). Then, a study on the *HPV Vaccination NOW* social media campaign found that messages accompanied by photographs were rated more favorably than those using graphic illustrations when addressing

HPV-related misinformation online (Štrbac et al., 2025). Furthermore, other studies showed that higher-quality vaccination communication often incorporates demographic targeting and employs multiple media platforms to deliver consistent, scientifically accurate information (Cartmell et al., 2019).

## 4.2 The General Public

We begin the presentation of results from the general public with the final section of the experiment, which investigated the respondents' vaccination history and attitudes. Only 25% of participants reported having received the HPV vaccine, with a pronounced gender difference: 32% of women respondents versus 14% of men respondents. Among the vaccinated individuals, 94% were under 40 years old, highlighting low uptake in older age groups, particularly those aged 40–49, who also reported lower vaccination rates for their children. When asked whether their children had been vaccinated, only 12% responded affirmatively. It should be noted that the majority of respondents who selected “Prefer not to answer” did not have children, while the remaining 12% were primarily in the 40–49 age group.

A strong contrast emerged when comparing HPV vaccine uptake with participation in other vaccination campaigns: 94% of respondents reported having participated in at least one such campaign (e.g., influenza or COVID-19 vaccination). Yet, only 25% of the participants had received the HPV vaccine. Educational level did not account for this discrepancy, as most HPV-unvaccinated respondents who had adhered to other campaigns were university graduates (82%). This pattern may indicate a persistent lack of information or trust specifically concerning HPV vaccination.

Regarding perceptions of others' experiences, 54.5% of respondents reported knowing individuals who had been vaccinated against HPV and were satisfied with their decision. Interpretation of negative responses remains ambiguous, potentially reflecting either negative perceptions or simply the absence of discussion about HPV vaccination within peer networks. Then, 17% of participants indicated knowing someone who had experienced harm or problems following vaccination; however, the nature and severity of these events remain unclear, ranging from mild reactions to potentially more serious adverse events.

Importantly, belief in vaccine efficacy remained

overwhelmingly positive: 96% of respondents agreed that vaccines are important for reducing or eliminating serious diseases. Even among those aware of adverse events, only two respondents questioned the importance of vaccines.

Trust in healthcare providers and institutions was generally high, with 61% rating their trust as “Very high” and 36% as “Fair”. Only 3% of the respondents reported low trust; these individuals had never participated in any vaccination campaign, knew of people who had experienced vaccine-related problems, did not consider vaccines important, and had not vaccinated their children. They were evenly distributed across all age groups, were Italian citizens (two from Puglia and one from Veneto), and one held a college degree. By contrast, respondents reporting “Very high” trust exhibited strong adherence to vaccination campaigns, and 29% of them had received the HPV vaccine. Although 11% of this highly trusting group were aware of vaccine-related problems, all continued to view vaccines as important public health tools. This group was geographically diverse, including participants from most Italian regions as well as several living abroad, and 75% held a university degree.

Next, we present the results regarding how the general public perceived the various materials related to HPV vaccination campaigns. Among the surveyed dimensions, we prioritized the analysis of perceived informativeness regarding vaccine effectiveness (Noar et al., 2020). This was selected as the primary outcome variable because establishing the functional benefit of the vaccine is the central goal of these communicative campaigns, and thus the most relevant metric to assess against design variations. Then, given the breadth of variables considered in the experiment, we focus specifically on text length, structural organization, and the use of multimodal features such as color, and how these elements influence the perceived informativeness of the materials in conveying vaccine effectiveness.

An interesting relationship emerged between text length and perceived informativeness regarding effectiveness (see Figure 4). In over 75% of cases, respondents who rated materials as uninformative regarding vaccine effectiveness also indicated that the text was excessively short. This finding may suggest that overly condensed information could fail to provide sufficient context or detail, leading to a perception of inadequacy. Even among materials rated as only minimally informative, more

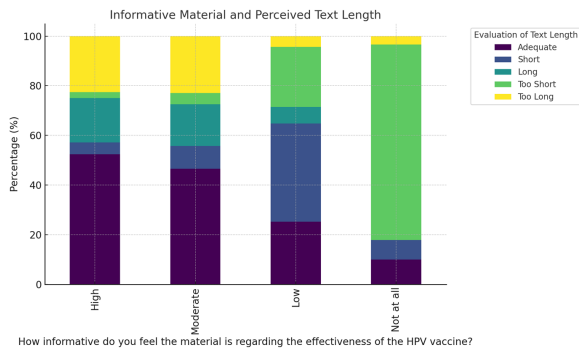


Figure 4: Informativeness of material vs. perceived text length.

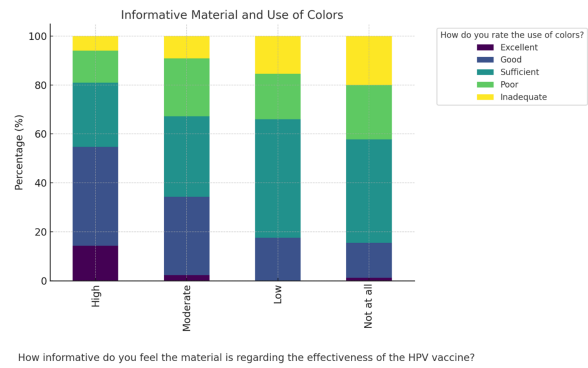


Figure 6: Informativeness of material vs. use of color.

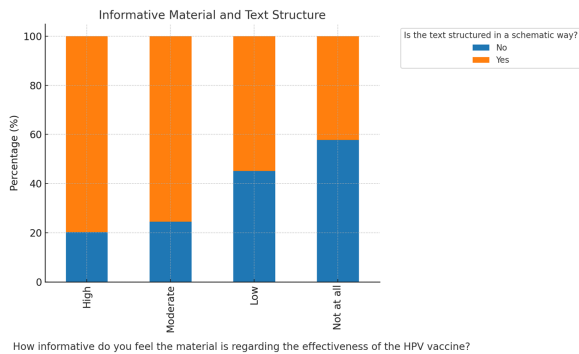


Figure 5: Informativeness of material vs. text structure.

than 60% of respondents associated shorter texts with lower levels of informativeness. Conversely, when materials were rated as highly or moderately informative, respondents (over 50% and 40%, respectively) generally considered the text length to be adequate. These results indicate that more comprehensive texts tend to be perceived as more credible and clearer in explaining infection risks and vaccine benefits. The pattern is consistent with previous research suggesting that messages providing greater detail and explanation tend to enhance acceptance and perceived autonomy, as they facilitate informed decision-making without seeming coercive (Zhao et al., 2022).

In addition to text length, the structure of the materials, including schematic organization, appeared as another relevant factor influencing perceived informativeness (see Figure 5). Over 75% of respondents who rated materials as highly informative described them as well-organized and schematic. This finding suggests that a clear, structured presentation facilitates understanding of complex topics such as vaccine effectiveness. When texts are logically organized with clear headings, bullet points, and concise sections, readers can process and retain important information more effectively. How-

ever, the difference between schematic and non-schematic evaluations decreased for materials rated as moderately or minimally informative, suggesting that structural organization enhances perceived educational value primarily when the underlying content is sufficiently informative.

Lastly, the role of multimodal elements, particularly the use of color, was examined in relation to perceived informativeness of effectiveness. (see Figure 6). Respondents exhibited considerable disagreement regarding whether color enhanced or detracted from clarity. Despite this divergence, the results indicate that graphic design features, including color schemes and images, can influence how audiences engage with and interpret information. Some respondents reported that color improved readability and helped highlight key points, whereas others perceived it as distracting or irrelevant. In general, positive evaluations were associated with uses of color that reinforced document structure or content, while negative evaluations were reported when color appeared ornamental or unrelated to the text.

The findings above show that design choices related to text length, structure, and graphical features may influence perceived informativeness in different ways, depending on the underlying quality of the content. In particular, the data at hand suggest that design enhancements should be used to support and clarify substantive information, rather than as a substitute for it, in efforts to improve public understanding of vaccine effectiveness.

### 4.3 Qualitative Exploration

In this section, we analyze several semiotically and linguistically salient aspects emerging from the responses of participants in the perception experiment and the expert survey. Our aim is to provide

a descriptive account of patterns in the vaccination materials at hand, identifying potential communicative strengths and limitations, and to inform exploratory insights for the development of guidelines on HPV informational resources.

A first observation is that slogans emphasizing parental responsibility for vaccinating their children are generally perceived as effective. However, one expert argued that awareness should also target younger audiences. What is notably absent from slogans such as those in the following quotes is an explicit focus on the agency of the individuals who are ultimately expected to undergo vaccination. This omission may contribute to de-responsibilization, which could influence attitudes toward potentially risky sexual behaviors. Interestingly, the slogan below includes verbs in the first person with a second person pronoun direct object.

Mi informo, ti proteggo, ti vaccino (*I inform myself, I protect you, I vaccinate you*).

Experts also criticized overly brief or elliptical slogans. This is because in contexts of medical and scientific relevance, individuals require sufficient information to make informed decisions and construct a common interpretive ground. Very short slogans, such as the example below, while potentially effective elsewhere, can appear superficial and fail to communicate relevant information.

Io, sì! (*I, say yes!*)

All experts agreed that slogans employing vivid and engaging textuality (Ferrari, 2014) are generally effective, highlighting the strategic impact of advertising and marketing language (Capozzi, 2008), as shown by this example:

Hai prenotato, vero? (*You booked an appointment, right?*)

However, forms of creative textuality are not uniformly appreciated. The following slogan was evaluated negatively by all experts:

Lunga vita alle signore! (*Long life to the ladies!*)

This slogan relies on a distortion of the idiom “long live the queen/king”. Reception of humor varies widely among individuals (Attardo, 2020), making it a challenging communicative strategy.

It also suffers from excessive focus on a female audience, implicitly framing HPV prevention as a female-only issue, and from low inclusivity.

Color usage patterns were similarly salient: purple, pink, lilac, and fuchsia (all typically associated with femininity) appeared frequently, whereas green, linked to regional institutional logos (in Lombardy, Emilia-Romagna), was interpreted as conveying implicit authoritativeness. Experts and general public inferred target audiences from explicit labels or indirect cues such as color schemes, references to medical evidence for specific groups, images of young females, youth-oriented stylistic elements (hashtags, bright colors, creative fonts, English terms), or, conversely, technical language and complex visuals suggesting medical professionals as the intended audience.

Broader issues of diversity and inclusivity were also reported by both experts and the general public. Female subjects were often depicted in highly stereotyped and unnatural ways, which could reduce engagement or even provoke negative reactions. Women were frequently shown as excessively cheerful or smiling, sometimes oversexualized, and largely represented as young and white. Male representation was similarly problematic, with frequent emphasis on homosexual male subjects, potentially implying that same-sex relations carry particular HPV risks. Positive examples of inclusivity included materials using multiple languages, ethnically diverse imagery, diversified color palettes, and intentionally generic representations to avoid excluding specific groups.

Some of these inclusivity issues were reflected in participant responses to the questionnaire. For example, the leaflet in Figure 7, published by the Lombardy region, received mixed evaluations. In particular, 50% of participants judged the material as non-inclusive, 48% as inclusive, and 2% was unable to take a position. Respondents identifying the material as non-inclusive cited reasons such as depicting only young people (17%), exclusively white individuals (30%), solely binary subjects (26%), only wealthy individuals (13%), and only non-disabled individuals (4%). Additionally, several respondents (30%) reported the absence of explicit textual references to diversity, and one respondent (4%) criticized the low comprehensibility of the pyramid diagram.

Among respondents judging the material as inclusive, highlighted factors included age inclusivity (5%), absence of gender discrimination (32%), tar-

getting non-wealthy individuals (9%), avoidance of heteronormative language (5%), and absence of explicit discrimination (23%). It should be noted that treating the absence of explicit discrimination as inclusivity is problematic. Other observations included the use of colors and images to enhance inclusivity (5%), and the general perception that the material was aimed at all audiences (5%). These findings appear partially contradictory to those reported in other rated dimensions.

Finally, as regards the open-ended questions, several participants provided contrastive or internally inconsistent responses. Preliminary inspection suggests that such patterns may relate to socio-demographic factors, including gender or age. Notably, some participants emphasized language comprehension and clarity as positive elements, indicating that language itself is perceived as a key component of inclusivity.

## 5 Conclusions

This study evaluated the communicative effectiveness of textual and visual content used in HPV vaccination campaigns, addressing a gap in linguistically oriented research on HPV vaccine hesitancy in Italy. The expert survey assessed features relevant to communication effectiveness through a multi-layer annotation scheme comprising 56 variables and achieved generally high inter-annotator agreement. Most materials received low effectiveness ratings, pointing to a need for substantial improvements in current communication strategies.

The perception experiment with the general public, implemented via a questionnaire using 12 stimuli, provided insights into how Italians appraise official HPV vaccination messages. It appears that overly concise texts tended to reduce perceived informativeness, whereas schematic layouts and clearly structured materials were more frequently associated with higher perceived informativeness regarding effectiveness, even as preferences regarding color use remained heterogeneous.

Across both expert and public evaluations, issues of gender representation and inclusivity emerged as recurrent concerns, with respondents noting problematic elements such as unnatural or sexualized depictions, stereotypical portrayals, and limited social and ethnic diversity. Even if some participants explicitly framed inclusive language as a primary vehicle for inclusion, others emphasized inclusivity more broadly in terms of social representation.

## 6 Limitations

This study has several limitations that are acknowledged here. Firstly, it is exploratory in nature and relies on descriptive statistics, without using inferential analyses or statistical modeling to examine relationships in the expert survey or the perception experiment. Then, even if the corpus includes materials from across Italy, northern regions are overrepresented, largely because health units in those regions seem to produce more publicly available online content. Another limitation regards the participants in the perception experiment that do not constitute a representative sample of the Italian population. The sample is skewed toward highly educated respondents, and certain regions (e.g., Lombardy) are overrepresented due to the dissemination method and the authors' professional networks. Future research should systematically test the relationship between the sociodemographics of the target audience (i.e., adults, adolescents, or parents of children) and perceived effectiveness of HPV vaccination campaign materials. Finally, the expert survey included only linguists and gynecologists. In fact, we believe that our findings would carry greater weight with the addition of perspectives from graphic designers and advertising experts.

## 7 Ethical Considerations

The study takes a descriptive approach and follows established ethical standards for research in health communication and linguistics. Our corpus comprises only institutional and public-awareness materials on HPV vaccination made publicly accessible. Materials were selected and evaluated through a multi-stage process involving medical experts and linguists to ensure methodological rigor and topic-appropriate expertise. Public perceptions were examined through anonymous questionnaires administered to a sample of the general public. An informed-consent statement was presented on the first page of the questionnaire and advancing to subsequent pages indicated agreement with the terms. The survey addressed several dimensions of HPV vaccination campaign effectiveness, vaccine knowledge and concerns, inclusivity, and trust in healthcare professionals. We acknowledge potential biases rooted in the source materials and in the methodology employed, and we address these throughout the paper and in detail in Section 6.

Figure 7: Leaflet distributed in the HPV vaccination campaign in Lombardy.

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