*informatics*

MDPI

*Article*

# Marketing a Banned Remedy: A Topic Model Analysis of Health Misinformation in Thai E-Commerce

**Kanitsorn Suriyapaiboonwattana [1], Yuttana Jaroenruen [1,*], Saiphit Satjawisate [1], Kate Hone [2], Panupong Puttarak [3], Nattapong Kaewboonma [4], Puriwat Lertkrai [4] and Siwanath Nantapichai [1]**

[1] Informatics Innovation Center of Excellence, School of Informatics, Walailak University, Nakhon Si Thammarat 80160, Thailand; kanitsorn.su@wu.ac.th (K.S.); saiphit.sa@wu.ac.th (S.S.); ndecha@wu.ac.th (S.N.)
[2] Computer Science, Brunel University of London, Uxbridge UB8 3PH, UK; kate.hone@brunel.ac.uk
[3] Department of Pharmacognosy and Pharmaceutical Botany, Faculty of Pharmaceutical Sciences, Prince of Songkla University, Hatyai, Songkhla 90110, Thailand; panupong.p@psu.ac.th
[4] Faculty of Management Technology, Rajamangala University of Technology Srivijaya, Nakhon Si Thammarat 80110, Thailand; nattapong.k@rmutsv.ac.th (N.K.); puriwat.l@rmutsv.ac.th (P.L.)
* Correspondence: jyuttana@wu.ac.th

## Abstract

Unregulated herbal products marketed via digital platforms present escalating risks to consumer safety and regulatory effectiveness worldwide. This study positions the case of Jindamanee herbal powder—a banned substance under Thai law—as a lens through which to examine broader challenges in digital health governance. Drawing on a dataset of 1546 product listings across major platforms (Facebook, TikTok, Shopee, and Lazada), we applied Latent Dirichlet Allocation (LDA) to identify prevailing promotional themes and compliance gaps. Despite explicit platform policies, 87.6% of listings appeared on Facebook. Medical claims, particularly for pain relief, featured in 77.6% of posts, while only 18.4% included any risk disclosure. These findings suggest a systematic exploitation of regulatory blind spots and consumer health anxieties, facilitated by templated cross-platform messaging. Anchored in Information Manipulation Theory and the Health Belief Model, the analysis offers theoretical insight into how misinformation is structured and sustained within digital commerce ecosystems. The Thai case highlights urgent implications for platform accountability, policy harmonization, and the design of algorithmic surveillance systems in global health product regulation.

**Keywords:** health misinformation; regulatory compliance; topic modeling; digital platforms; Thailand



Academic Editor: Remo Pareschi

Received: 29 June 2025
Revised: 26 July 2025
Accepted: 8 August 2025
Published: 18 August 2025

**Citation:** Suriyapaiboonwattana, K.; Jaroenruen, Y.; Satjawisate, S.; Hone, K.; Puttarak, P.; Kaewboonma, N.; Lertkrai, P.; Nantapichai, S. Marketing a Banned Remedy: A Topic Model Analysis of Health Misinformation in Thai E-Commerce. *Informatics* **2025**, *12*, 84. https://doi.org/10.3390/informatics12030084



## 1. Introduction

The rise of digital platforms has transformed the global distribution of health-related products, offering convenience while simultaneously complicating regulatory oversight. Social commerce and e-marketplace environments—such as Facebook, TikTok, Shopee, and Lazada—have become dominant channels for marketing herbal remedies. These platforms often enable rapid dissemination of health claims with limited institutional verification, posing risks to public health through the circulation of unregulated or falsely marketed substances [1]. The intersection of consumer trust in traditional medicine and the affordances of algorithm-driven visibility has intensified concern over how health misinformation can evade formal checks and propagate across digital systems.

Thailand exemplifies this tension. Herbal products have long been part of the alternative healthcare landscape, valued for their natural origins and cultural legitimacy. However, these products are frequently marketed online with exaggerated claims—ranging from alleviating bodily discomfort to immune enhancement—often lacking transparency in origin and safety disclosures [2,3]. While perceived as safe, studies have increasingly reported health complications linked to adulterated herbal remedies [1].

This tension is exemplified by the case of Jindamanee powder, a product occupying a complex space between cultural remedy and regulatory hazard. While marketed as a traditional herbal formula for alleviating chronic pain and inflammation, its legal status shifted dramatically after a patient in Phayao Province experienced a severe allergic reaction in 2017. Subsequent investigation revealed systematic adulteration, with authorities finding it contained undeclared pharmaceutical substances like dexamethasone and piroxicam—controlled drugs associated with potentially severe side effects [4]. Consequently, the product was officially banned. Despite a formal crackdown by Thailand's Food and Drug Administration (FDA) and the Royal Thai Police in 2018, Jindamanee continues to be sold covertly online, where sellers use fraudulent registration numbers and misrepresent ingredients in a systemic attempt to bypass regulation. This persistence raises profound questions about the governance of digital health platforms and the effectiveness of current enforcement actions [5].

According to the Electronic Transactions Development Agency (ETDA), Thai consumers overwhelmingly rely on online platforms to purchase health products—with 75.99% using e-marketplaces and 66.76% using social media platforms such as Facebook [6]. Features like intuitive navigation, real-time chat, and automated logistics make these platforms attractive sales venues [7]. However, these same affordances, paired with algorithmic opacity and limited vetting of vendors, have allowed prohibited products like Jindamanee powder to re-emerge after being delisted.

Thai regulatory bodies have responded by increasing surveillance and public warnings. For instance, over 200,000 health-related advertisements have been removed since 2019, yet the circulation of unregistered herbal remedies persists [4]. This challenge is compounded by the evolving nature of digital health commerce and platform-specific enforcement gaps. One Thai government body—the Centre for Complaint Management and Suppression of Illegal Activities Related to Health Products—has played a key role in tracking and addressing such violations, although it operates within a national rather than international jurisdiction.

To examine how prohibited health products continue to circulate in these loosely governed spaces, this study analyzes the digital marketing of Jindamanee powder across Facebook, TikTok, Shopee, Lazada, Instagram, and X (formerly Twitter). Using Latent Dirichlet Allocation (LDA) topic modeling, we extracted patterns from 1546 product listings and interpreted the findings through the lens of Information Manipulation Theory and the Health Belief Model. Our analysis provides new insights into the rhetorical strategies sellers use to exploit consumer anxieties and regulatory loopholes. In doing so, we contribute to broader discussions on digital health governance, misinformation resilience, and platform accountability in online health product ecosystems.

## 2. Literature Review

### *2.1. Hazardous Herbal Products and Consumer Risk*

The proliferation of falsified, adulterated, and prohibited herbal products represents a mounting public health concern, particularly within unregulated digital marketplaces. Herbal remedies are often promoted as natural and culturally rooted alternatives to conventional pharmaceuticals, which contributes to widespread consumer trust. However,

evidence increasingly reveals that many of these products—including Thailand's Jindamanee powder—contain banned or undisclosed pharmaceutical substances such as dexamethasone and piroxicam [4,8]. These substances are associated with serious health risks, including immunosuppression and gastrointestinal bleeding, especially when consumed without medical supervision [9].

Despite regulatory prohibitions, Jindamanee powder continues to circulate across major digital platforms. Thailand's Food and Drug Administration (FDA) has issued warnings and conducted raids, but enforcement outcomes remain limited. This persistence reflects the broader difficulty of curbing health misinformation in decentralized digital environments. Online marketplaces—unlike traditional pharmacies—lack uniform mechanisms for screening vendors or verifying product claims, allowing prohibited sellers to flourish.

The dangers of such unregulated marketing are magnified by persuasive health claims that exaggerate therapeutic efficacy. Many consumers in Southeast Asia, particularly those in rural or low-income communities, may rely on such products due to cost, accessibility, or cultural preferences, making them especially vulnerable to misleading or incomplete information. Sun, et al. [10] noted that even after regulatory actions were taken against misleading claims for Cordyceps sinensis, the product continued to appear online, highlighting systemic enforcement gaps and the resilience of digital misinformation networks.

### *2.2. Regulatory Gaps in Thailand's Digital Health Ecosystem*

Thailand's e-commerce and social commerce sectors have expanded rapidly, with platforms such as Facebook, TikTok, Shopee, and Lazada emerging as primary channels for health product distribution. According to the Electronic Transactions Development Agency [6], these platforms collectively dominate the online purchase landscape, with Facebook leading in social commerce transactions. However, the regulatory framework overseeing digital health product sales remains fragmented and inconsistently enforced.

Prior studies highlight that consumer-to-consumer (C2C) and business-to-consumer (B2C) platforms differ significantly in their regulatory dynamics, influencing platform governance, user trust, and compliance practices [11]. C2C platforms such as Facebook and TikTok typically enable informal transactions with minimal oversight, whereas B2C platforms like Shopee and Lazada impose stricter vendor requirements, including FDA registration and automated moderation systems. These structural differences contribute to inconsistent risk environments and complicate efforts to establish unified regulatory standards.

Most platforms rely on self-regulatory tools—such as community guidelines and algorithmic moderation—to identify violations. Yet these mechanisms often fall short, particularly in contexts involving non-standard language use, euphemisms, or culturally specific terminology. As noted in previous research note, effective digital regulation requires both institutional capacity and adaptive monitoring technologies tailored to local linguistic nuances [12].

Cross-border operations and jurisdictional gaps further hinder enforcement. While some platforms mandate regulatory documentation, others do not, allowing vendors to circumvent restrictions by migrating across platforms. This inconsistency facilitates the persistent circulation of prohibited products like Jindamanee powder despite prior enforcement actions.

In sum, Thailand's digital health commerce landscape is marked by regulatory fragmentation, platform asymmetries, and enforcement loopholes—conditions that collectively enable regulatory evasion and undermine consumer safety.

### *2.3. Topic Modeling in Health Product Surveillance*

In response to the growing complexity of online health misinformation, researchers have turned to machine learning techniques—particularly topic modeling—to identify patterns in unstructured textual data. LDA has emerged as a leading method for this purpose due to its scalability and capacity to extract coherent themes from large datasets. It has been successfully applied in domains ranging from patient health forums [13] to pharmaceutical surveillance [14].

In the context of herbal product marketing, topic modeling can reveal both overt and covert promotional strategies, such as euphemistic phrasing, strategic ambiguity, or emphasis on culturally resonant terminology. These insights are particularly valuable for regulators and platform operators seeking to enhance algorithmic detection mechanisms and develop targeted interventions.

While previous studies have primarily focused on the identification of adverse reactions or misinformation in English-language contexts, few have applied LDA to the Thai digital commerce environment. This gap underscores the need for culturally and linguistically tailored surveillance tools that can capture the specific strategies used to market unregistered products in Thailand and other Southeast Asian countries.

### *2.4. Theoretical Grounding and Analytical Framework*

MOOCs have garnered substantial attention due to their potential to democratize education by providing learners worldwide with access to high-quality educational content, irrespective of their geographic location or financial resources [15,16]. However, it is imperative to extend our examination beyond the initial stages of MOOC participation and delve into the post-course phase, which involves the analysis of continued MOOC usage. This investigation is crucial for several compelling reasons.

This study is underpinned by two complementary theoretical frameworks that provide insight into the persuasive strategies embedded in the digital marketing of Jindamanee powder: Information Manipulation Theory (IMT) and the Health Belief Model (HBM).

Information Manipulation Theory [17] offers a lens through which to examine how online advertisements distort, omit, or strategically present information to influence consumer perception. This is particularly salient in the context of unregulated herbal product marketing, where sellers may obscure risks, exaggerate benefits, or use vague language to imply therapeutic efficacy while avoiding explicit medical claims. IMT facilitates a systematic analysis of how such tactics exploit regulatory blind spots and manipulate health messaging to shape purchase behavior.

Complementing this, the Health Belief Model [18] provides a behavioral framework for interpreting how advertisements influence consumers' health-related decisions. According to HBM, individuals' willingness to adopt health interventions depends on their perceived susceptibility to illness, perceived severity of symptoms, expected benefits, and perceived barriers to action. Within this study, the HBM is especially relevant in understanding how Jindamanee advertisements appeal to consumer anxieties—such as chronic pain or nerve-related issues—and position the product as a culturally legitimate, low-risk alternative to conventional medicine.

Together, these frameworks guide both the interpretation and computational modeling of online listings. They inform the categorization of promotional content, shape the coding schema for compliance assessment, and influence the interpretation of latent topics uncovered through unsupervised learning. The integration of IMT and HBM allows this study to move beyond surface-level classification and toward a deeper understanding of the psychological and strategic mechanisms driving consumer deception.

A visual summary of the theoretical and methodological flow is provided in Figure 1, illustrating the connections between data sources, preprocessing steps, modeling procedures, and visualization outcomes.

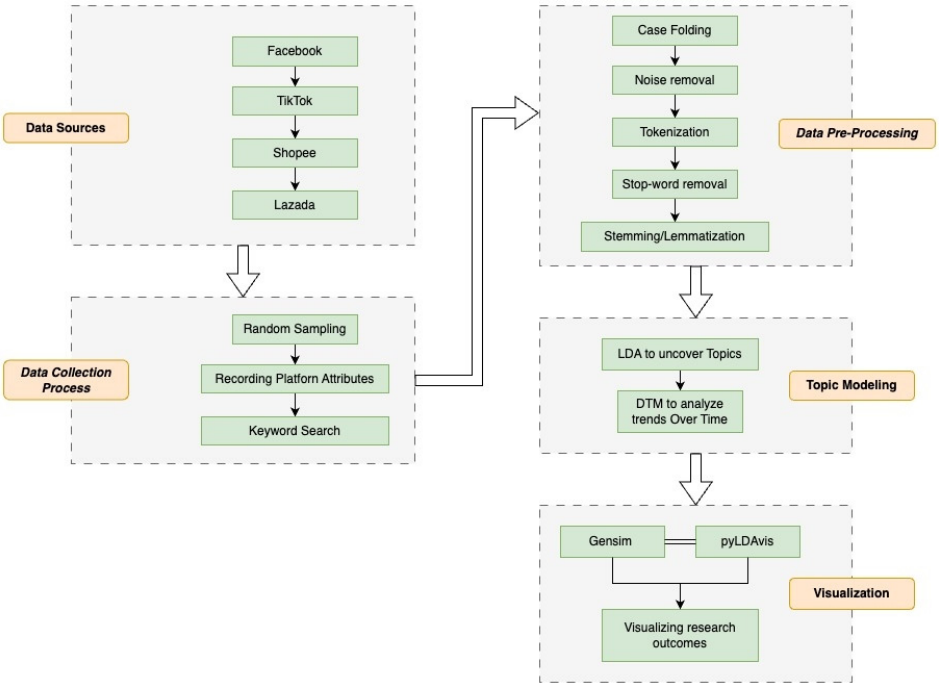


**Figure 1.** Research Methodology.

## 3. Methodology

### *3.1. Research Design*

This study employed a mixed-methods approach that integrates both quantitative and qualitative methodologies to comprehensively examine the advertising and sale of Jindamanee herbal powder across Thailand's major digital commerce platforms. The chosen design reflects the multifaceted nature of online health product promotion, enabling a holistic investigation that aligns with the study's objectives and the complex structure of e-marketplace ecosystems.

### *3.2. Mixed-Methods Framework*

The research design combined descriptive statistical analysis with unsupervised text mining techniques to investigate patterns of regulatory compliance and the linguistic features embedded in marketing content. The quantitative component provided measurable insights into platform-level behavior, commercial strategies, and the frequency of compliance violations. Prior studies have demonstrated that LDA can offer qualitative interpretive depth beyond mere statistical clustering, enabling the identification of rhetorical and thematic structures in digital marketing contexts [19,20]. Building on this approach, we examine the online discourse surrounding Jindamanee powder.

This methodological integration allowed for the triangulation of findings across different data types and analytic layers, thereby enhancing the overall validity and interpretability of the results. The hybrid approach was particularly well-suited to studying online health misinformation, where behavioral patterns, regulatory oversight, and persuasive content intersect in dynamic digital environments. By leveraging the complementary strengths of quantitative precision and qualitative nuance, the study delivers a robust evidence base for understanding the mechanisms by which prohibited health products are promoted in Thailand's evolving e-commerce landscape.

### *3.3. Platform and Sample Selection*

A total of 1547 listings were collected between November and December 2024 from six platforms: Facebook, TikTok, Shopee, Lazada, Instagram, and X (formerly Twitter). Platform selection was informed by national digital commerce analytics [6], which consistently identified these channels as primary conduits for health product transactions in Thailand's evolving online marketplace.

Facebook, Shopee, Lazada, and TikTok contributed the majority of listings, consistent with their dominant positions in both formal e-commerce and informal health product distribution. Instagram and X, while accounting for a smaller share (5.9% combined), were purposefully retained to ensure representational breadth and to capture marginal marketing activity—particularly listings that may migrate to less-regulated platforms in response to enforcement pressure. This inclusion strategy reflects a purposive sampling logic aligned with best practices in exploratory digital health surveillance research.

### *3.4. Data Collection and Preprocessing*

Listings were scraped using Python 3.12 scripts with customized keyword filters (e.g., "ยาผีบอก", "Jindamanee powder", "สมุนไพรแก้ปวด ") and manually verified for relevance. Non-product posts, reposts, and irrelevant content were excluded based on a dual-review protocol. Two independent reviewers assessed listing eligibility, with disagreements resolved via consensus.

An inter-rater reliability check on a 10% random sample yielded a Cohen's Kappa of 0.81, indicating strong agreement. This strengthens the validity of the screening protocol and exclusion criteria applied across the full dataset.

### *3.5. Analytical Procedures*

The analysis proceeded in four stages:

1. Platform Feature Mapping: A comparative audit of regulatory and interface features was conducted across all six platforms, evaluating elements such as FDA registration fields and automated moderation tools.
2. Compliance Assessment: Listings were manually reviewed for regulatory indicators, including medical claims, presence of FDA numbers, and disclosure of side effects, in line with Thai FDA guidelines for herbal product advertising.
3. Topic Modeling: LDA was performed using the Gensim Python package (version 4.3.3). After testing coherence scores across multiple topic configurations, a 10-topic model (coherence = 0.5565) was chosen over the 3-topic model (coherence = 0.6484) to capture greater thematic detail. Topics were interpreted using top keywords, representative listings, and semantic clustering.

   To ensure labeling was systematic and reliable, a multi-step interpretive process was followed. First, two researchers independently reviewed the top 30 keywords and the 10 most representative documents for each of the ten topics. Each researcher then independently proposed a concise, descriptive label for each topic. In the final step, the researchers convened to compare their proposed labels, discuss any discrepancies, and collaboratively reach a consensus on the final label that best captured the core theme of each topic. This consensus-based approach ensures the topic labels are not the product of a single interpretation but are instead a validated reflection of the underlying data.
4. Quantitative Characterization: Descriptive statistics were calculated for claim frequencies, pricing strategies, dosage information, and platform-specific patterns. Cross-tabulations examined distributional trends and regulatory implications.

### *3.6. Ethical Considerations*

This study received approval from the Phatthalung Provincial Health Office Human Research Ethics Committee (Approval No. PPHOREC/2567 COA NO. 36) on 24 April 2024. The approval is valid until 24 April 2025. The research exclusively relied on publicly accessible data from social media and e-commerce platforms. No personally identifiable information (PII) was collected, stored, or analyzed. All methods adhered to ethical guidelines for online and digital media research, including data minimization, informed use of public content, and anonymization [21].

## 4. Research Results

This section presents the empirical findings from the investigation of Jindamanee herbal powder advertisements across major Thai e-marketplaces. The results are structured into five subsections: platform compliance and features, topic modeling outcomes, regulatory violation patterns, consumer risk factors, and visual analysis of thematic distributions.

### *4.1. Platform Compliance and Feature Analysis*

Digital platforms serve as both distribution channels and regulatory frontiers for health-related products. This subsection evaluates the compliance architecture of Thailand's most prominent e-marketplaces—Facebook, TikTok, Shopee, and Lazada—with specific attention to how platform features enable or hinder the enforcement of prohibitions on Jindamanee powder sales.

Although all four platforms maintain community standards that nominally restrict the marketing of prohibited substances, the design and enforcement mechanisms differ markedly. As summarized in Table 1, Shopee and Lazada implement structural controls more aligned with regulatory expectations, such as required fields for FDA registration numbers and content moderation workflows. By contrast, Facebook and TikTok—despite their popularity and reach—lack these formalized compliance features, particularly in user-generated commerce, creating systemic blind spots in oversight.

**Table 1.** Comparison of Website Features by Platform.

| Website Features | Facebook | TikTok | Shopee | Lazada | Instagram | X |
|---|---|---|---|---|---|---|
| Product Information Display | ✗ | ✗ | ✓ | ✓ | ✓ | ✗ |
| Product Search Engine | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ |
| Product Image Display | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Product Description Text Display | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Consumer Complaint Mechanism | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ |
| Cumulative Sales Volume Display | ✗ | ✓ | ✓ | ✓ | ✓ | ✗ |
| Store/Product Rating System | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ |
| Consumer Reviews Section | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ |
| Vendor Information Display | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ |
| Vendor Name and Address Display | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ |
| Consumer-Vendor Communication Tools | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Mandatory Policies for Vendors | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Prohibition of Illegal Drug Sales Policy | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Mandatory Health Product Registration Display | ✗ | ✗ | ✓ | ✓ | ✗ | ✗ |
| Mandatory Advertisement Permission Number | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ |

A critical weakness across all platforms is the absence of vendor identity verification protocols. None require sellers to disclose their full names or physical business addresses, impeding traceability and undermining the capacity of regulators to enforce accountabil-

ity. This governance gap permits the anonymous circulation of high-risk products and complicates consumer recourse mechanisms.

The impact of these structural disparities is evident in the dataset. Of the 1546 analyzed listings, 87.58% originated from Facebook (Table 2), despite its policy prohibiting such content. This dominance illustrates Facebook's role as the central node in the online distribution of Jindamanee powder. It also reflects broader digital commerce trends in Thailand, where peer-to-peer and social commerce models—favored for their minimal entry barriers and informal networks—have overtaken formal B2C models in the health product circulation [1].

**Table 2.** Number and Percentage of Entries by Platform.

| Platform | Number of Entries | Percentage |
|---|---|---|
| Facebook | 1354 | 87.58 |
| TikTok | 68 | 4.4 |
| Instagram | 61 | 3.95 |
| X (formerly Twitter) | 32 | 2.07 |
| Lazada | 31 | 2 |
| Total | 1546 | 100 |

By presenting these platform-level contrasts upfront, this analysis highlights how compliance architecture, or the lack thereof, structurally conditions the likelihood of regulatory evasion. Understanding these differences is essential for interpreting the patterns of violation and misinformation explored in subsequent sections.

Despite platform-level policies prohibiting the sale of narcotics and prohibited medicines, enforcement varies by specificity:

- Facebook uses broad language prohibiting narcotics and illegal substances.
- TikTok explicitly bans herbal products, medicines, and related medical devices.
- Shopee and Lazada extend restrictions to nutritional supplements and controlled herbal formulations.

Importantly, no platform enforces the legal requirement to display advertisement permission numbers, which are essential for monitoring health-related claims. The failure to implement this requirement represents a significant regulatory blind spot, especially considering the health risks posed by adulterated herbal products.

#### 4.1.1. Data Distribution by Platform

As shown in Table 2, the distribution of the 1546 analyzed listings reflects a heavy skew toward Facebook:

This dominance highlights Facebook's function not just as a social platform, but as a quasi-e-commerce environment where regulatory evasion is relatively easier. Its algorithmic reach, minimal listing friction, and informal vendor networks make it particularly susceptible to misuse by illicit sellers [1].

#### 4.1.2. General Characteristics of the Dataset

The dataset comprises 1546 product listings collected across major e-marketplace platforms, offering insights into the marketing practices and consumer engagement surrounding Jindamanee herbal powder. Notably, 79.88% of entries explicitly referenced one or more designated Thai-language keywords—"จินดามณี " (Jindamanee), "ยาผงจินดามณี " (Jindamanee powder), or "สมุนไพรจินดามณี " (Jindamanee herb)—indicating deliberate efforts by vendors to capitalize on brand recognition and search optimization. This suggests

a high degree of intentional branding, likely aimed at enhancing discoverability within algorithm-driven platform environments.

Vendor reach varied considerably, with follower counts ranging from 1 to 47,000 across the 1317 listings that reported this metric. The mean follower count was 1502, reflecting a heterogeneous seller landscape that includes both small-scale actors and prominent influencers. This variation complicates regulatory enforcement, as it necessitates simultaneous monitoring of both long-tail sellers and high-reach accounts.

User engagement data further substantiates the visibility and traction of these listings. A total of 1386 entries reported likes, averaging 69.2 per post, with a maximum of 10,000. Shares were reported in 416 listings, averaging 15.51 per post and peaking at 983. Comment sections were observed in 878 listings, with the most engaged post attracting 66,131 comments. These metrics highlight not only widespread consumer interaction but also the viral potential of such content, particularly on social media platforms with embedded sharing mechanisms.

Overall, the general characteristics of the dataset reveal a dynamic, interactive, and brand-aware marketing environment. The combination of high-volume micro-vendors and influential macro-sellers, coupled with high levels of user engagement, underscores the challenge for regulatory agencies tasked with managing illegal herbal product dissemination in a digitally fragmented and algorithmically amplified marketplace [4].

### *4.2. Topic Modeling Analysis Results*

#### 4.2.1. Data Preprocessing

Before conducting topic modeling, the dataset underwent a rigorous preprocessing pipeline designed to enhance textual consistency and semantic clarity. The inherently unstructured nature of e-marketplace content required multiple layers of cleaning. A total of 13,977 emojis were removed from 1202 entries, indicating the frequent use of visual-emotive cues in promotional messages. Additionally, 104,357 special characters were eliminated from 2879 listings, primarily composed of punctuation artifacts, decorative symbols, and non-standard formatting often used to bypass content filters. To ensure semantic coherence, Thai-language content was translated into standard English using a hybrid approach combining machine translation and manual validation. CamelCase tokens were normalized across 2490 records, producing 8299 transformations. Collectively, these steps enabled the development of a linguistically coherent corpus suitable for downstream topic modeling using LDA.

To optimize the model, multiple iterations were run with varying numbers of topics, evaluated through coherence scores and interpretability assessments. While the 3-topic model achieved the highest coherence score (0.65), the 10-topic model was selected to allow for finer-grained thematic differentiation while still maintaining an acceptable coherence level (0.55). The Gensim library was used for implementation, with pyLDAvis employed for interactive visualization and validation of semantic clustering. This approach facilitated a more nuanced exploration of advertising discourses across platforms.

#### 4.2.2. Topic Model Development and Optimization

The LDA model was optimized through iterative testing of multiple topic numbers, with selection guided by coherence score evaluation and interpretability. Among the models tested, the 3-topic configuration yielded the highest coherence score (0.6484), followed by the 9-topic model (0.5933), both indicating strong internal semantic consistency. However, despite its slightly lower coherence score of 0.5565, the 10-topic model was ultimately selected. This decision reflects a deliberate trade-off between statistical coherence and thematic granularity, prioritizing analytical richness over strict metric optimization. As illus-

trated in Figure 2, coherence scores varied non-linearly across topic counts, reinforcing the need to balance model fit with interpretive utility when dealing with heterogeneous, user-generated text data.

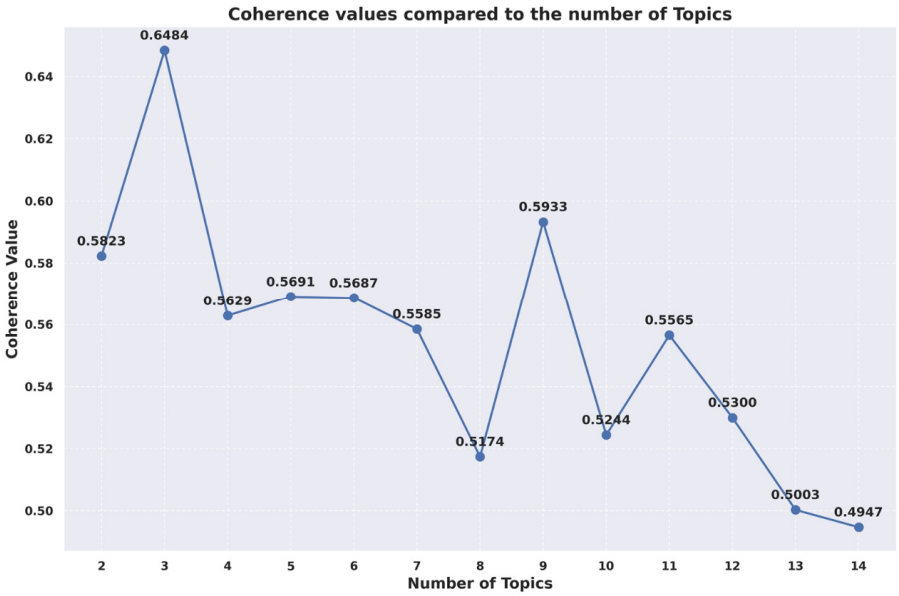


**Figure 2.** Coherence values for LDA topic models.

#### 4.2.3. Identified Topics and Key Terminology

The LDA model extracted ten distinct thematic topics from the 1547 product listings, each representing a recurring semantic cluster associated with the online marketing of Jindamanee powder. Table 3 summarizes these topics, along with their top keywords, illustrative listing excerpts, and percentage contribution to the overall corpus.

**Table 3.** Summary of Topics with Frequency Contributions.

| Topic ID | Top Keywords | Label | Sample Phrase (Translated) | Frequency (%) |
|---|---|---|---|---|
| T1 | free, baht, get, plus, order | Discount Offers | "Buy 2, get 1 free, shipping included!" | 14.8 |
| T2 | pain, relieve, inflammation, numbness | Pain Management | "Relieves chronic joint pain and inflammation." | 13.7 |
| T3 | herb, traditional, ancient, Thai, formula | Traditional Legitimacy | "Ancient Thai formula used for over 100 years." | 11.2 |
| T4 | price, sale, limited, offer, today | Urgency and Pricing Tactics | "Only today! Discounted price 199 baht." | 10.4 |
| T5 | nerve, spine, back, stiff, recover | Nerve & Spine Treatment | "Effective for nerve pain and spinal stiffness." | 9.9 |
| T6 | review, user, share, real, effect | User Testimonials | "My father walked again after 2 weeks!" | 9.3 |
| T7 | 100%, guaranteed, original, cure, real | Exaggerated Efficacy Claims | "100% cure guarantee, real result from day 1." | 8.7 |
| T8 | dizzy, intoxicated, warning, allergic | Adverse Effects (rare) | "May cause dizziness if overdosed." | 3.1 |
| T9 | no chemical, natural, pure, safe | Natural Ingredient Appeal | "No chemicals, only pure herbal extracts." | 11.4 |
| T10 | chronic, elderly, body, healing, balance | Holistic Health Appeal | "Improves body balance for elderly users." | 7.5 |

The topic structure reflects a bifurcation between marketing incentives and therapeutic claims. Topics such as T1, T4, and T6 center on consumer engagement tactics—emphasizing affordability, urgency, and social proof. These resonate with the psychological appeal of quick deals and peer influence, typical of informal digital commerce. Conversely, Topics T2, T5, T7, and T10 focus on health-related messaging, specifically addressing chronic pain, nerve dysfunction, and general wellness.

Critically, Topic T8 is the only one to reference potential adverse effects, contributing just 3.1% to the dataset. This stark underrepresentation of risk information—coupled with an overwhelming presence of unverified health claims (T2 and T7, 22.4% combined)—suggests systematic omission rather than accidental oversight. These findings support the premise of Information Manipulation Theory (IMT), indicating that vendors selectively

present favorable information while suppressing risk disclosures to manipulate consumer decision-making.

Cultural marketing norms may further exacerbate this imbalance. Thai health communications often foreground benefits and rely on implicit trust in traditional medicine, limiting the visibility of cautionary messaging. Moreover, euphemistic expressions, such as "monk formula" or "ancient remedy" (T3), substitute cultural credibility for scientific validation—thus exploiting regulatory ambiguity while evading platform moderation filters.

In sum, the 10-topic model provides critical insight into the rhetorical architecture of prohibited health product promotion in Thailand's digital marketplaces. The dominance of exaggerated claims, coupled with minimal risk acknowledgment, reveals a calculated marketing ecosystem that leverages linguistic framing, health anxieties, and algorithmic blind spots. These insights point to an urgent need for targeted regulatory interventions, including risk-labeling mandates, culturally sensitive moderation tools, and platform accountability in preventing health misinformation.

#### 4.2.4. Inter-Topic Distance Analysis

To further explore the semantic relationships among the discovered topics, an inter-topic distance map was generated using multidimensional scaling, as shown in Figure 3. This visualization plots the topics in a two-dimensional space, where spatial proximity reflects lexical similarity. The size of each circle indicates the relative prevalence of the topic within the corpus, with larger circles representing topics that appeared more frequently in the dataset.

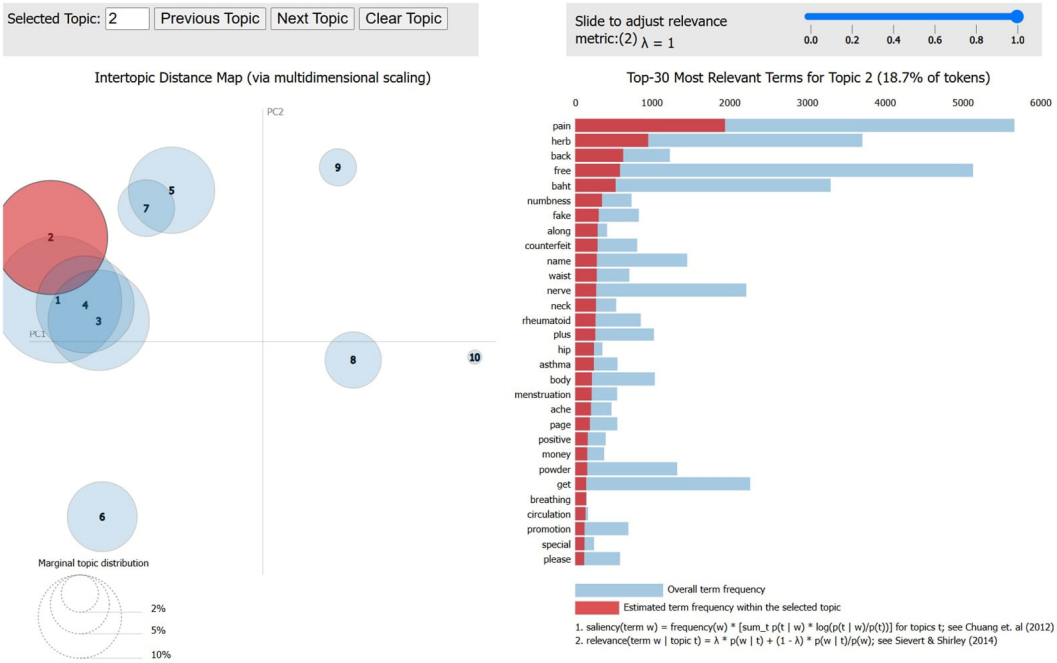


**Figure 3.** Inter-topic distance map generated via multidimensional scaling [22,23].

The spatial arrangement reveals two major thematic clusters. The first cluster, comprising Topics 1, 4, and 6, centers around promotional strategies, including discount-based messaging, product packaging, and sensory appeals. These topics demonstrate strong internal cohesion and are positioned close together, reflecting a shared linguistic emphasis on affordability, product characteristics, and consumer incentives.

The second cluster, encompassing Topics 2, 3, 5, 7, and 8, is oriented around health-related claims and symptom relief narratives. These topics contain language as-

sociated with pain alleviation, nerve disorders, musculoskeletal issues, and back pain treatment—terms that align with the Health Belief Model's emphasis on perceived severity and susceptibility. Notably, Topics 6, 7, 9, and 10 exhibit overlap at the intersection of these clusters, suggesting hybrid content that merges therapeutic language with product formulation details, side effect mentions, and usage guidance.

The position of Topic 9, which includes references to adverse effects such as "intoxicated" and "dizzy", is especially revealing. Its proximity to usage-related and counterfeit-warning topics (e.g., Topics 6 and 7) implies that when adverse effects are mentioned, they tend to appear in listings that also attempt to establish product legitimacy or guide consumer behavior—potentially as a reputational safeguard strategy.

This clustering pattern underscores the dual communicative strategy observed in Jindamanee marketing: one that aggressively promotes sales through price-driven messaging and another that legitimizes the product via quasi-medical language, despite its unregistered and prohibited status. The overlap between promotional and medicinal claims is emblematic of information blending tactics, which strategically combine marketing with health messaging to exploit regulatory grey zones. These findings substantiate earlier topic model results and align with Information Manipulation Theory, suggesting that vendors selectively emphasize persuasive content while minimizing or compartmentalizing risk-related disclosures.

#### 4.2.5. Word Frequency and Visualizations

To complement the topic modeling analysis, a corpus-wide word frequency analysis was conducted to identify dominant lexical patterns in the advertisement content. As illustrated in Figure 4, the most frequently occurring terms include "package" (5817 instances), "pain" (5798), "free" (5270), "herb" (3803), and "baht" (3414). These high-frequency tokens provide compelling evidence of two dominant communicative themes: pricing strategies and health-related claims. The prominence of "package", "free", and "baht" suggests that promotional framing is a core tactic used to attract consumers, particularly through bundled offers and affordability messaging. Simultaneously, the recurrence of medically oriented terms such as "pain" and "nerve" reflects an effort to position the product as a solution to specific health concerns.

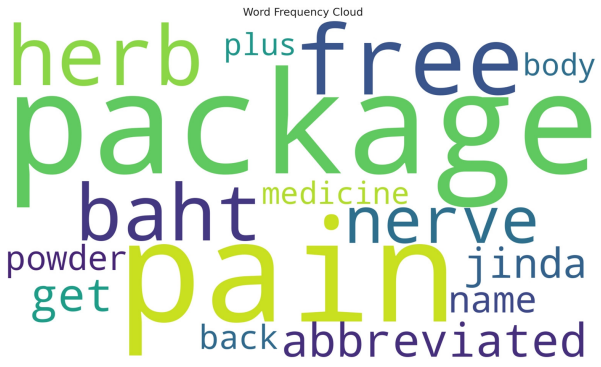


**Figure 4.** Overall Word Frequency Distribution.

The word cloud visualization in Figure 4 offers an intuitive representation of term salience within the corpus, with font size corresponding to frequency and color gradients used for visual emphasis. This visualization reveals not only the lexical density of marketing terms but also the dual narrative strategy that blends economic appeal with therapeutic language—a pattern previously observed in the topic modeling results.

To further explore topic-specific linguistic structures, word clouds were generated for each of the ten modeled topics. These visualizations enable direct comparison across

thematic areas and highlight distinctive vocabulary patterns associated with different marketing strategies. As shown in Figure 5, certain topics demonstrate strong internal cohesion around specialized vocabularies. For instance, Topic 1 is dominated by transactional and pricing-related terms, reinforcing its commercial orientation. Topic 6 highlights terminology associated with bodily references and product formulation, suggesting emphasis on tangible, physical product attributes. Topic 7 reveals a convergence of anatomical references and authenticity cues, including body-specific terms and warnings about counterfeit products. Topic 10, by contrast, is defined by a focus on medicinal efficacy, as seen in its prevalence of terms like "relieve", "medicine", and "nerve."


**Figure 5.** Multi-Topic Word Cloud Visualization.

Taken together, these visualizations not only support the topic model findings but also enhance interpretability by illustrating the textual ecosystem in which promotional and pseudo-medical narratives coexist. The lexical convergence between economic and therapeutic terminology underscores the strategic ambiguity embedded in Jindamanee advertisements—a phenomenon that warrants further scrutiny in light of regulatory concerns and consumer risk.

### *4.3. Regulatory Compliance Analysis*

#### 4.3.1. Medical Claim Patterns

The topic modeling results revealed a widespread presence of unsubstantiated medical claims across multiple themes, indicating a substantial pattern of non-compliance with Thailand's regulatory framework for herbal products. These claims, appearing explicitly or implicitly, align with pharmacological assertions that are legally restricted to registered pharmaceuticals under the oversight of the Thai Food and Drug Administration (FDA).

Specifically, Topics 3, 7, 8, and 10 were consistently associated with health-related claims. These included therapeutic assertions concerning pain management—particularly for nerve and musculoskeletal conditions—as well as anti-inflammatory properties, circulatory enhancement, and treatment of symptoms such as numbness and paralysis. Given Jindamanee powder's classification as an unregistered product, such language constitutes a direct violation of Thai FDA advertising regulations.

Quantitative analysis further underscores the extent of this regulatory breach. As shown in Table 4, 81.54% of Facebook listings and 18.46% of TikTok listings contained explicit medical claims, highlighting the pervasive nature of this issue across social commerce platforms. These patterns suggest that product promoters strategically use medicalized language to enhance perceived efficacy, likely in an effort to appeal to consumers seeking alternative treatments for chronic conditions.

**Table 4.** Distribution of Medical Claims by Platform.

| Medical Claim Type | Facebook (%) | TikTok (%) | Total Sample (%) |
|---|---|---|---|
| Pain relief | 78.4 | 71.2 | 77.6 |
| Nerve disorders | 54.2 | 48.7 | 53.6 |
| Muscle/tendon issues | 42.1 | 38.4 | 41.7 |
| Inflammation | 36.9 | 32.5 | 36.4 |
| Numbness | 35.7 | 31.2 | 35.2 |
| Circulation improvement | 28.5 | 25.1 | 28.1 |
| Paralysis | 12.3 | 9.6 | 12 |
| Other medical conditions | 18.7 | 15.3 | 18.3 |

Notably, the consistency in claim patterns across platforms points to more than incidental non-compliance. The similarities in content suggest a degree of coordination, possibly reflecting organized distribution or templated promotional scripts circulated among sellers. This raises concerns not only about consumer misinformation but also about the systemic evasion of regulatory scrutiny.

#### 4.3.2. Marketing Strategies

Beyond overt medical claims, the analysis also identified several marketing strategies that raise compliance and ethical concerns. These strategies reflect deliberate linguistic and rhetorical choices designed to amplify product appeal while minimizing perceived risks—thereby constructing an information asymmetry that may mislead consumers.

First, price-centric promotions were widespread. Topics 1 and 4 revealed frequent use of terms such as “free” and “baht”, reflecting the strategic emphasis on affordability and perceived value. Quantitative review indicated that 89.7% of listings included discount schemes or bundled offers, underscoring the commercial imperative driving consumer engagement.

Second, authentication cues emerged as a salient marketing technique. In Topic 7, keywords like “fake” and “counterfeit” appeared prominently, suggesting that sellers seek to distinguish their products from substandard imitations. Ironically, this tactic both acknowledges the saturated counterfeit market and attempts to build consumer trust in a product that itself lacks legal authorization.

Third, product differentiation based on formulation was evident in Topics 6 and 9. Approximately 72.3% of listings emphasized unique product characteristics—such as “ancient” or “traditional” recipes—or focused on physical features like texture or scent. These references function as soft persuasive devices, enhancing product legitimacy through cultural framing and sensory appeal.

Finally, the analysis revealed a systematic minimization of risk disclosures. While Topic 9 included references to side effects—such as “dizzy” and “intoxicated”—these terms were markedly infrequent. Only 18.4% of all listings mentioned any adverse effects, and even those that did tended to offer vague, non-technical language. This rhetorical imbalance between benefit amplification and risk suppression aligns with the principles of Information Manipulation Theory, which explains how communicators selectively curate content to influence decision-making while concealing critical information.

Taken together, these marketing strategies illustrate a multi-layered promotional ecosystem that not only violates regulatory norms but also exploits consumer trust. The combination of persuasive discounting, health claims, authenticity appeals, and risk omission positions Jindamanee powder as a deceptively legitimate remedy—despite its unregistered and potentially harmful status.

#### 4.3.3. Cross-Platform Patterns

The analysis revealed a notable consistency in thematic content across platforms, despite minor variations in topic prevalence. This pattern suggests a level of strategic alignment in marketing discourse, possibly driven by shared promotional templates or seller networks that operate across multiple digital environments. For instance, product authenticity warnings (Topic 7) appeared more frequently on Facebook, constituting 23.4% of all Facebook listings, compared to 16.7% on TikTok. This difference may reflect Facebook's positioning as a more community-oriented platform where brand legitimacy and trust-building are central to consumer persuasion.

In contrast, usage instructions (Topic 10) were more commonly emphasized on TikTok, comprising 28.9% of listings on the platform versus 19.3% on Facebook. This discrepancy may be attributed to TikTok's video-based interface, which allows for visually engaging content that includes product demonstrations and dosage guidance. Regardless of these nuances, price-focused promotions (Topics 1 and 4) remained dominant across all platforms, accounting for 37.2% of the overall content, reinforcing the role of economic accessibility as a unifying marketing appeal.

These findings indicate that, while platforms exhibit unique affordances that shape the expression of content, the underlying marketing strategies are highly consistent. Such cross-platform uniformity suggests either the deliberate replication of promotional narratives or the dissemination of pre-formatted advertising scripts. In both cases, the results present a regulatory challenge, as enforcement efforts targeting a single platform may fail to capture the broader, coordinated ecosystem of prohibited product promotion.

### *4.4. Visualization Results*

To facilitate interpretation of the latent semantic structures identified through topic modeling, several data visualizations were employed. These graphical tools not only enhance transparency in model outputs but also allow for intuitive pattern recognition across complex, high-dimensional text data. Visualization plays a critical role in confirming topic coherence, assessing term dominance, and enabling readers to engage with the findings beyond textual summaries.

#### 4.4.1. Topic-Term Distribution Visualization

Figure 6 presents a horizontal bar chart displaying the top ten weighted terms for Topic 1, offering insight into the vocabulary that most strongly characterizes this particular theme. Term weights represent each word's contribution to the topic's semantic profile, with higher values indicating stronger associations.

In this case, "get" emerges as the most salient term, with a weight of 0.504, followed by "back" (0.240) and "body" (0.197). These terms suggest that Topic 1 is oriented around both transactional language (e.g., "get", "price") and physical symptom references (e.g., "back", "body", "numbness"). The presence of terms such as "fake" and "counterfeit" also points to a layer of authenticity signaling, indicating that sellers may combine bodily benefit claims with assurances of product legitimacy.

The co-occurrence of commercial, anatomical, and legitimacy-oriented vocabulary illustrates the hybrid rhetorical strategies found throughout Jindamanee advertisements. This mixed thematic structure aligns with previous findings on cross-topic blending and

underscores the complexity of consumer-facing messaging in the herbal supplement market. Topic-term visualizations like this offer a critical layer of interpretability for unsupervised machine learning outputs and are particularly useful in identifying subtle or overlapping discursive patterns.

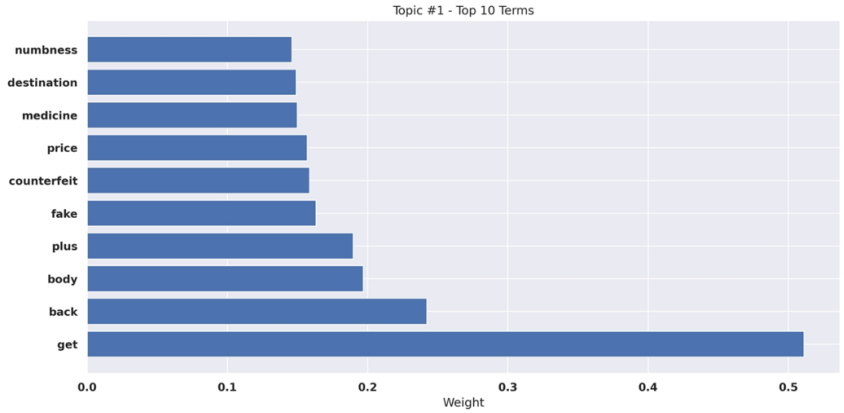


**Figure 6.** Topic-Term Distribution.

#### 4.4.2. Topic Correlation Matrix

To assess the degree of thematic overlap among the identified topics, a topic correlation matrix was constructed and visualized using a heat map, as shown in Figure 7. This matrix displays the pairwise correlation coefficients between topic vectors, calculated from their distribution across documents. The color gradient ranges from blue (indicating negative or weak correlation) to red (indicating strong correlation), enabling quick visual identification of potential co-occurrence patterns. The analysis revealed that most correlation coefficients were clustered near zero, indicating minimal interdependence among the topics. This statistical outcome reinforces the semantic distinctiveness observed in earlier stages of the modeling process. In other words, the topics identified by the LDA model largely capture discrete and independent dimensions of the marketing discourse, rather than overlapping or redundant themes.

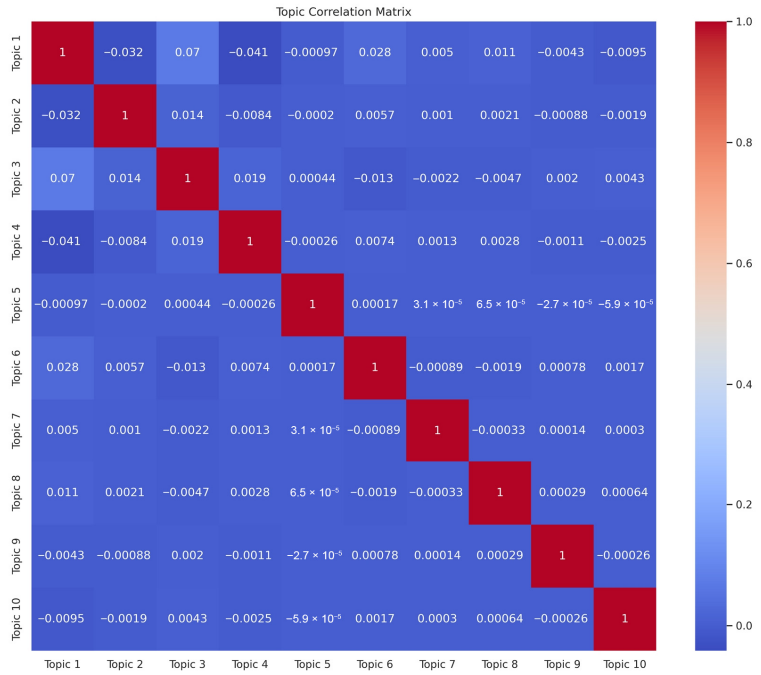


**Figure 7.** Topic Correlation Matrix.

This finding is particularly relevant in the context of regulatory analysis, as it suggests that multiple non-overlapping strategies are being employed in parallel to promote Jindamanee powder—ranging from pricing appeals to therapeutic claims and authenticity signaling—each of which may require distinct regulatory responses.

The correlation analysis revealed minimal interdependence between most topics, with correlation coefficients predominantly near zero. This suggests that the identified themes represent distinct and relatively independent aspects of herbal product marketing strategies, with limited overlap in their thematic content.

#### 4.4.3. Interactive LDA Visualization

To support an in-depth examination of topic structure and improve interpretability, an interactive LDAvis visualization was employed (see Figure 3). This tool enables dynamic adjustment of term relevance metrics, offering a nuanced view of topic-term relationships and the semantic proximity between topics. By allowing researchers to explore both high-frequency and topic-specific terms interactively, LDAvis provides a transparent interface for validating and interpreting unsupervised model outputs.

Through iterative exploration, it was determined that setting the relevance parameter $\lambda$ between 0.6 and 0.7 yielded the most meaningful differentiation among topics. At this range, the visualization maintained semantic coherence while minimizing topic overlap—thus confirming that each of the ten topics captured distinct thematic domains. The spatial distribution of topics remained stable across this $\lambda$ interval, reinforcing the model's robustness and interpretive clarity.

This interactive diagnostic approach not only affirms the internal consistency of the LDA model but also enhances analytical rigor by enabling visual validation of thematic separation, an essential step when interpreting complex, high-dimensional text data. The tool proved particularly valuable in detecting subtle topic overlaps and guiding qualitative analysis in later stages of the study.

## 5. Discussion

By thoroughly examining the marketing and distribution of the banned Jindamanee herbal powder on Thailand's e-marketplaces, this study provides significant insights with implications for digital commerce governance, public health, and regulatory enforcement. Utilizing topic modeling, our analysis revealed persistent promotional narratives and sales strategies characterized by continued regulatory violations. The prevalence of illicit products, therefore, exposes consumers to substantial health risks within these online platforms [24,25]. Importantly, this research goes beyond mere identification of illegal products; it explores the dynamics that allow such products to thrive in digital marketplaces.

### *5.1. Platform Governance and Regulatory Compliance*

The examination of e-marketplace infrastructures reveals a pronounced and persistent gap between platform policy declarations and their practical enforcement—particularly regarding health-related products. Despite explicit prohibitions by major platforms such as Facebook, TikTok, Shopee, and Lazada on the sale of prohibited health items, enforcement remains fragmented and largely reactive. This challenge is especially pronounced across social media platforms, where governance mechanisms lag behind those of structured e-commerce environments. For instance, Facebook explicitly bans "narcotics, prescription drugs, and illegal substances", while TikTok extends this to "medicines, vitamins, herbal products, and medical equipment." Nonetheless, our findings confirm that both platforms continue to host active listings for Jindamanee powder [8]. These observa-

tions reinforce that policy statements, in the absence of robust, proactive, and consistently enforced mechanisms, are insufficient to deter illicit activity at scale.

Facebook's dominance in hosting such listings—accounting for 87.58% of observed entries—underscores the need to prioritize regulatory interventions within social media ecosystems. A contributing factor is the absence of mandatory, machine-readable fields for regulatory verification, such as FDA registration numbers, on platforms like Facebook and TikTok. This design limitation enables sellers to obscure compliance and impairs consumers' ability to authenticate product legitimacy, ultimately weakening regulatory oversight [26].

The persistence of these enforcement gaps can be attributed to a complex interplay of factors, including the overwhelming volume of user content, the difficulty of identifying nuanced violations within natural language or visual formats, the adaptive strategies of sellers, and perhaps the platforms' own business incentives. Economic motivations to maximize content diversity and user engagement may conflict with the substantial investment required to maintain robust compliance infrastructure and enforcement personnel.

### *5.2. Thematic Patterns in Marketing Claims*

Applying LDA to the marketing content uncovered distinct themes—broadly falling into either promotional strategies or medical claims—that indicate the sophisticated marketing tactics employed by sellers to both avoid regulation and appeal to consumer preferences [27,28]. A striking aspect of our findings is the widespread use of specific therapeutic claims in product listings, raising substantial regulatory concerns. Listings frequently claimed to treat various conditions, directly violating Thai FDA regulations regarding the marketing of unregistered products [24,28].

The alarming presence of banned substances, such as dexamethasone and piroxicam, as adulterants in Jindamanee powder further complicates the risk landscape for consumers [25,29]. This intertwining of exaggerated health benefits and undisclosed harmful ingredients presents a significant health threat, reinforcing the call for stringent regulatory measures in online marketplaces.

#### 5.2.1. Medical Claims and Regulatory Violations

The widespread use of therapeutic claims in product listings represents a significant regulatory concern. Listings on Facebook (81.54%) and TikTok (18.46%) prominently featured assertions related to the treatment or relief of conditions such as pain (77.6%), nerve disorders (53.6%), and musculoskeletal issues (41.7%). Such claims, made for an unregistered product, directly contravene Thai FDA regulations [4]. These advertisements appear strategically crafted to target consumer anxieties about chronic health issues, aligning with motivational constructs in the Health Belief Model [18].

Particularly alarming is the documented adulteration of Jindamanee powder with banned pharmaceutical substances such as dexamethasone and piroxicam. This combination of exaggerated health claims and undisclosed, potentially harmful ingredients presents a compound threat to consumer safety and public health [30].

#### 5.2.2. Strategic Information Management

In alignment with Information Manipulation Theory, the evidence strongly suggests that sellers deliberately underreport the risks associated with Jindamanee powder. Only 18.4% of listings mentioned potential adverse effects, and these disclosures were predominantly associated with Topic 9. This selective omission fosters an informational asymmetry that undermines consumers' ability to make informed decisions [31,32]. Topic 7 frequently incorporated terms such as "fake" and "counterfeit." While ostensibly aimed at building trust by distinguishing listings from imitations, these authenticity claims often

serve to legitimize prohibited and potentially dangerous products [33]. This paradoxical strategy compounds the broader problem of misinformation within online health product markets [34,35].

### *5.3. Cross-Platform Marketing Coordination*

The thematic consistency observed across platforms suggests that sellers engage in coordinated marketing strategies rather than isolated behaviors, despite some platform-specific variations in emphasis (e.g., greater emphasis on authenticity on Facebook, usage instructions on TikTok). Furthermore, the analysis revealed a substantial use of visual cues, including a large volume of emojis (13,977 instances) and non-standard characters (104,357 instances). However, the specific role and impact of these particular visual tactics within the context of digital marketplaces for illicit products are not well-addressed by the current literature. For instance, while Kim, et al. [36] discuss sensory marketing, their focus is on a specific hospitality context and does not directly correlate with the use of these character types in our observed domain.

These findings align with research by Miller, Wafula, Onoka, Saligram, Musiega, Ogira, Okpani, Ejughemre, Murthy and Garimella [14], who identified similar cross-platform coordination in the marketing of prohibited health products in other contexts. The sophisticated nature of these multi-platform strategies underscores the need for coordinated regulatory responses that transcend individual platform policies and address the broader ecosystem of online health product marketing.

### *5.4. Consumer Vulnerabilities and Safety Risks*

This study reveals multiple dimensions of consumer vulnerability in Thailand's online herbal product ecosystem. Foremost among them is the imbalance between exaggerated health claims and insufficient risk disclosure. A total of 77.6% of listings promised definitive pain relief, while only 18.4% disclosed potential adverse effects—typically vague mentions like "dizzy" or "intoxicated." This asymmetry undermines informed decision-making, echoing findings from prior research that misleading efficacy framing can distort consumer risk-benefit perceptions [37].

A second critical dimension is the heterogeneity of vendors, which complicates regulatory oversight. Jindamanee powder was marketed by both micro-scale sellers and high-reach influencers, with follower counts ranging from 1 to 47,000. This diversity reflects a decentralized commercial ecosystem in which platform affordances vary and policy enforcement remains uneven. Regulatory strategies must adapt to this multiplicity of actors and sales tactics, particularly as social commerce continues to outpace traditional e-commerce models [38].

Notably, 32.3% of listings explicitly warned about counterfeit versions of Jindamanee powder. While such claims aim to reassure buyers, they simultaneously expose systemic concerns around product adulteration and authenticity, further complicating consumer safety assessments.

Lastly, although 68.4% of listings provided some usage instructions, these were inconsistent and lacked standardization, ranging from ambiguous dosage references to conflicting claims. Without clear administration guidance, self-medication becomes riskier—especially among medically vulnerable populations—exacerbating the likelihood of harm [39].

Together, these findings highlight a need for platform-embedded consumer protection tools, including mandatory risk disclosures, algorithmic flagging of medical claims, and traceable seller verification systems. These interventions should be culturally contex-

tualized to account for the informal norms and rhetorical strategies prevalent in Thai digital commerce.

### *5.5. Theoretical Implications*

This study's findings lend strong empirical support to the theoretical frameworks guiding the analysis. Information Manipulation Theory [17] offers a valuable perspective on how sellers strategically manage information to downplay risks while emphasizing perceived benefits—a pattern corroborated by recent studies on digital misinformation in health marketing [40]. This is particularly evident in the selective disclosure of product information, where potential adverse effects are routinely omitted, and therapeutic claims are overstated. Such tactics exemplify classic manipulation strategies that exploit knowledge asymmetries between sellers and consumers in unregulated digital marketplaces.

Complementing this, the Health Belief Model (HBM) [18] helps elucidate the psychological mechanisms driving consumer engagement. Our findings show how sellers systematically leverage HBM constructs. They amplify perceived susceptibility and severity by focusing on chronic conditions like pain and numbness (Topics 2, 5, 10), making health threats feel immediate. Against this, the product is framed with high perceived benefits, using claims of being an 'ancient' or '100% cure' (Topics 3, 7) to signal efficacy and cultural legitimacy. Concurrently, sellers lower perceived barriers by stressing affordability and offering discounts (Topics 1, 4), removing financial hurdles associated with formal medical treatments. The advertisements themselves, with their urgency tactics and user testimonials (Topic 6), serve as powerful cues to action, prompting purchase. This strategic manipulation of consumer health beliefs highlights how digital marketing can exploit established psychological models of decision-making.

The integration of these two frameworks yields a more comprehensive theoretical understanding of how prohibited herbal products are rhetorically constructed and promoted in digital environments. This synthesis advances the growing body of research on health communication by illuminating how information management and belief-based appeals operate synergistically—particularly in informal e-commerce ecosystems common in Southeast Asia and other emerging markets.

### *5.6. Methodological Reflections*

The application of LDA topic modeling to analyze the marketing content of prohibited herbal products underscores the utility of unsupervised machine learning techniques in regulatory and public health research [41]. The ability to successfully identify distinct thematic patterns across 1546 listings affirms the methodological suitability of LDA for uncovering latent discursive structures within unstructured digital data [42]. Nonetheless, this approach is not without limitations. A significant proportion of the dataset—over 75%—required extensive preprocessing due to noise, inconsistent formatting, and the presence of non-standard textual elements typical of user-generated e-marketplace content [43]. This preprocessing burden reflects a broader challenge in applying computational methods to real-world digital environments, where data quality is often heterogeneous and context-dependent.

Furthermore, the decision to adopt a 10-topic model, despite the higher coherence score of the 3-topic alternative (0.65 vs. 0.55), reflects a deliberate trade-off between statistical optimization and thematic granularity. While the 3-topic solution may offer clearer topic separation, the 10-topic model provided a more nuanced understanding aligned with the exploratory objectives of this study [44].

Similarly, while newer deep learning-based topic models offer powerful alternatives, LDA was deliberately chosen for its alignment with this study's mixed-methods design.

A key objective was not merely to identify topics, but to interpret them through the theoretical lenses of the Health Belief Model and Information Manipulation Theory. LDA's high degree of interpretability, which produces clear, human-readable topic-word distributions, is exceptionally well-suited for this type of qualitative and theoretical analysis. Its robustness and proven utility in analyzing digital health discourse provided a solid and transparent foundation for bridging our computational findings with health communication theories.

Such methodological choices highlight the importance of transparent documentation and theoretical alignment in the implementation of topic modeling in social science research [45].

### *5.7. Policy and Regulatory Implications*

The findings of this study carry several critical implications for policy development and regulatory reform in the domain of digital health product governance. First, the pronounced gap between platform policies and real-world enforcement highlights the urgent need for strengthened coordination between digital platform governance mechanisms and national regulatory authorities [46]. The continued availability of Jindamanee listings—despite clear policy prohibitions—demonstrates that self-regulation, in isolation, lacks the enforcement capacity necessary to address illicit online health product marketing at scale [47].

Second, the observed consistency in promotional strategies across platforms suggests that regulatory responses must transcend platform-specific approaches and instead address the broader structural dynamics of the digital marketplace [48]. Legislative frameworks should aim to establish standardized compliance requirements across all digital sales environments. Failure to do so risks merely shifting illicit activity from more strictly regulated platforms to those with weaker oversight [49].

Third, the sophisticated information manipulation strategies identified—such as implicit therapeutic claims, euphemistic language, and strategic omission of risk information—indicate that traditional content moderation approaches based on explicit keyword detection are no longer adequate [50]. Effective regulatory frameworks must incorporate more nuanced detection systems capable of identifying indirect or concealed forms of regulatory noncompliance [51]. This may necessitate the deployment of advanced AI-based monitoring tools capable of analyzing semantic context and intent.

Finally, the pervasive absence of risk disclosures across listings underscores the need for mandatory safety information requirements for all online health product advertisements, irrespective of regulatory status [52]. Even in cases where products are unregistered or prohibited, ensuring that consumers have access to accurate and transparent risk information remains a fundamental public health imperative [49]. Current regulatory structures appear ill-equipped to guarantee this level of consumer protection, pointing to an urgent need for reform.

### *5.8. Limitations and Future Research Directions*

While this study contributes meaningful insights, its limitations define clear pathways for future inquiry. First, although the dataset was substantial—comprising 1546 listings—it reflects only a snapshot in time within a rapidly evolving digital marketplace. Online marketing is highly responsive to regulatory changes, thus, longitudinal studies are needed to examine how sellers adapt their strategies over time [53].

Second, the analysis was confined to textual content, excluding visual and multimodal elements such as imagery and video content, which likely play a critical role in shaping consumer perception and engagement [54]. Future research incorporating multimodal con-

tent analysis would offer a more holistic understanding of the communicative strategies employed. A related methodological constraint is the machine translation process, which, despite verification, may introduce subtle linguistic inaccuracies.

Third, the theoretical frameworks used, while valuable, do not fully account for the socio-cultural dimensions that influence consumer trust in herbal remedies [55]. In the Thai context, cultural beliefs may shape receptiveness to online health claims in ways that quantitative approaches cannot fully capture. Future studies employing ethnographic fieldwork or in-depth interviews would enrich our understanding of consumer motivations and belief systems.

Finally, this study did not assess the actual chemical composition or safety of the Jindamanee products promoted online. While previous research documents adulteration with pharmacologically active substances [56], systematic laboratory testing of products sourced from these platforms would allow for a direct correlation between digital marketing practices and public health risks, significantly strengthening the evidence base for regulatory interventions.

## 6. Conclusions

This study investigated the marketing and distribution practices surrounding prohibited Jindamanee herbal powder across Thailand's digital marketplaces by applying LDA to analyze 1546 product listings. The findings reveal a substantial disconnect between platform policy declarations and enforcement practices, with Facebook accounting for 87.58% of identified listings despite its formal prohibitions. Topic modeling uncovered systematic marketing strategies designed to circumvent regulatory oversight. Notably, 77.6% of listings included therapeutic claims related to pain relief, while only 18.4% disclosed potential side effects. The thematic consistency observed across multiple platforms suggests the existence of coordinated distribution networks, presenting significant challenges for effective regulatory intervention.

Beyond its specific findings, this study offers several distinct scientific contributions. Methodologically, it demonstrates the viability of LDA as a regulatory surveillance tool in a non-English context, addressing a significant gap in digital health research that has predominantly focused on English-language platforms. Theoretically, our work provides a novel synthesis by empirically connecting Information Manipulation Theory with the Health Belief Model; we show how manipulative communication tactics prey on established psychological health triggers within real-world digital markets. Finally, our study makes a crucial empirical contribution by providing the first large-scale, data-driven analysis of the marketing ecosystem surrounding this prohibited product. The specific patterns uncovered—such as the dominance of Facebook in hosting illicit listings and the stark imbalance between therapeutic claims and risk disclosures—provide an actionable evidence base for policymakers and platform governors in Thailand and other nations facing similar challenges.

The policy implications that stem from this analysis are clear and urgent. Our findings affirm the practical value of unsupervised machine learning for public health regulation and confirm the utility of integrating IMT and HBM to interpret illicit marketing. Addressing these issues requires stronger coordination between digital platform operators and national regulatory authorities, the establishment of harmonized cross-platform compliance standards, and the deployment of advanced content moderation systems capable of detecting nuanced forms of information manipulation.

These measures are essential to mitigate the considerable risks faced by consumers. Future research should build on these findings by examining the temporal evolution of marketing strategies, incorporating multimodal analysis of visual content, and exploring

consumer beliefs through qualitative methods. Ultimately, ensuring safer digital marketplaces will require sustained, collaborative engagement among regulatory agencies, platform providers, and public health stakeholders in Thailand and beyond.

**Author Contributions:** Conceptualization, Y.J., K.S. and P.P.; methodology, K.S. and Y.J.; software, Y.J.; validation, S.S., S.N. and P.P.; formal analysis, K.S. and Y.J.; investigation, K.S. and Y.J.; resources, K.S. and S.S.; data curation, N.K. and S.S.; writing—original draft preparation, K.S. and Y.J.; writing—review and editing, K.H., K.S. and P.P.; visualization, K.S. and Y.J.; supervision, K.H.; project administration, P.L. and S.S.; funding acquisition, P.P. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research was funded by the Thai Health Promotion Foundation (ThaiHealth), Thailand, under Grant No. 67-00463.

**Institutional Review Board Statement:** This study received approval from the Phatthalung Provincial Health Office Human Research Ethics Committee (Approval No. PPHOREC/2567 COA NO. 36) on 24 April 2024. The approval is valid until 24 April 2025. The research utilized only publicly available data from social media and e-commerce platforms. No personally identifiable information (PII) was collected, stored, or analyzed. All procedures complied with ethical standards for online and digital media research, including principles of data minimization, responsible use of public content, and anonymization.

**Informed Consent Statement:** Informed consent was not required for this study, as it utilized publicly available data from advertisements on social media and e-commerce platforms, and did not involve the collection of personally identifiable information or direct interaction with individuals.

**Data Availability Statement:** The data used in this study consist of publicly available advertisements collected from social media and e-commerce platforms. No proprietary or personal data was collected. Relevant data or details about the data collection process are available from the corresponding author upon reasonable request.

**Acknowledgments:** The authors gratefully acknowledge the Phatthalung Provincial Public Health Office, Ministry of Public Health, for their valuable support and collaboration in relation to the research context. The authors also wish to thank Thitima Tongsang for her assistance in securing ethics approval for the overarching research project.

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

1. Santhosh Kumar, J.U.; Chayapol, T.; Suchada, S. Mitigating the impact of admixtures in thai herbal products. *Front. Pharmacol.* **2019**, *10*, 1205. [CrossRef]
2. Jordan, C.R.; Harris, C.M.; Miranda, M.I.; Kim, D.Y.; Hellberg, R.S. Labeling compliance and online claims for Ayurvedic herbal supplements on the US market associated with the purported treatment of COVID-19. *Food Control* **2023**, *148*, 109673. [CrossRef]
3. Bourgon, R. Herbal Medicine: Friend or Foe? *J. Adv. Pract. Oncol.* **2022**, *13*, 260–264. [CrossRef]
4. Sornchaithawatwong, C.; Tadtong, S.; Tangkiatkumjai, M. The prevalence of acceptable quality herbal products in Thailand. *J. Herb. Med.* **2020**, *24*, 100391. [CrossRef]
5. Food and Drug Administration of Thailand; Royal Thai Police. FDA Announce the Results of the Crackdown on Jindamani Herbal Powder (Ya Phee Bok) in 5 Provinces, with a Total Value of over 15 Million Baht. Available online: https://oryor.com/media/newsUpdate/media_news/1890 (accessed on 9 November 2024).
6. ETDA. Thailand Internet User Behavior. 2022. Available online: https://www.etda.or.th/th/Useful-Resource/publications/iub2022.aspx (accessed on 10 December 2024).
7. Ayob, A.H. E-commerce adoption in ASEAN: Who and where? *Future Bus. J.* **2021**, *7*, 4. [CrossRef]
8. Sachiko, O.; Daniel, R.E.; Sophia, B.; Deson, H.; Tatenda, T.Y.; Sarah, L.; James, E.H. Prevalence and estimated economic burden of substandard and falsified medicines in low- and middle-income countries. *Jama Network Open* **2018**, *1*, e181662.
9. Raynor, D.K.; Dickinson, R.; Knapp, P.; Long, A.; Nicolson, D. Buyer Beware? Does the Information Provided With Herbal Products Available Over the Counter Enable Safe Use? *BMC Med.* **2011**, *9*, 94. [CrossRef] [PubMed]

10. Sun, J.; Li, L.; Li, H.; Liu, T.; Deng, J.; Zhang, T.; Li, J.; You, J.; Zhang, L. Governance of the business environment based on food safety disputes: Empirical analysis based on the case of "*Cordyceps sinensis*". *Front. Sustain. Food Syst.* **2023**, *7*, 1273468. [CrossRef]
11. Cui, L.; Ying, H.; Yang, L.; Zhang, L. Text mining to explore the influencing factors of sharing economy driven digital platforms to promote social and economic development. *Inf. Technol. Dev.* **2021**, *27*, 779–801. [CrossRef]
12. Adina-Loredana, N.; Elizabeth, P.; Maarten, K. Why falsified medicines reach patients: An analysis of political and economic factors in romania. *BMJ Global Health* **2023**, *6* (Suppl. S3), e009918.
13. Damian, Ś.; Szymon, Z.; Piotr, M.; Miłosz, J. Falsified drugs in the opinion of patients diagnosed with cardiovascular Diseases—Nationwide and cross-sectional study on the example of EU-Member country. *Int. J. Environ. Res. Public Health* **2021**, *18*, 3823.
14. Miller, R.; Wafula, F.; Onoka, C.A.; Saligram, P.; Musiega, A.; Ogira, D.; Okpani, I.; Ejughemre, U.; Murthy, S.; Garimella, S.; et al. When technology precedes regulation: The challenges and opportunities of e-pharmacy in low-income and middle-income countries. *BMJ Glob. Health* **2021**, *6*, e005405. [CrossRef] [PubMed]
15. Kennedy, J. Characteristics of massive open online courses (MOOCS): A research review, 2009–2012. *J. Interact. Online Learn.* **2014**, *13*, 1–16.
16. Fröberg, A.; Lundvall, S. Sustainable Development Perspectives in Physical Education Teacher Education Course Syllabi: An Analysis of Learning Outcomes. *Sustainability* **2022**, *14*, 5955. [CrossRef]
17. McCornack, S.A. Information manipulation theory. *Commun. Monogr.* **1992**, *59*, 1–16. [CrossRef]
18. Rosenstock, I.M. Historical origins of the health belief model. *Health Educ. Monogr.* **1974**, *2*, 328–335. [CrossRef]
19. Williams, L.; Burnap, P. The Emotional Landscape of Technological Innovation: A Data-Driven Case Study of ChatGPT's Launch. *Informatics* **2025**, *12*, 58. [CrossRef]
20. Gomez-Adorno, H.; Bel-Enguix, G.; Sierra, G.; Barajas, J.-C.; Álvarez, W. Machine learning and deep learning sentiment analysis models: Case study on the sent-covid corpus of tweets in mexican spanish. *Informatics* **2024**, *11*, 24. [CrossRef]
21. Afolabi, O.; Edet, O.; Kayode, O.; John, S. Malaria endemicity: A survey of antimalarial herbal products in ijebu ode, nigeria. *Dutse J. Pure Appl. Sci.* **2023**, *9*, 1–9. [CrossRef]
22. Chuang, J.; Manning, C.D.; Heer, J. Termite: Visualization Techniques for Assessing Textual Topic Models. In Proceedings of the International Working Conference on Advanced Visual Interfaces, Naples, Italy, 22–25 May 2012; ACM Press: New York, NY, USA, 2012; pp. 74–77.
23. Sievert, C.; Shirley, K. LDAvis: A Method for Visualizing and Interpreting Topics. In Proceedings of the Workshop on Interactive Language Learning, Visualization, and Interfaces, Baltimore, MD, USA, 27 June 2014; Association for Computational Linguistics: Baltimore, MD, USA, 2014; pp. 63–70.
24. Ramirez, L.I.; Kanwugu, O.N.; Ivantsova, M.H. Impact of Herbal Supplements Nowadays: An Overview. *Chim. Technol. Acta* **2022**, *9*, 202292-4. [CrossRef]
25. Pauzi, N.A.M.; Cheema, M.S.; Ismail, A.; Ghazali, A.R.; Abdullah, R. Safety Assessment of Natural Products in Malaysia: Current Practices, Challenges, and New Strategies. *Rev. Environ. Health* **2021**, *37*, 169–179. [CrossRef]
26. Elizabeth, P.; Adina-Loredana, N.; Amalia, H.; Koray, P.; Jingying, X.; Maarten, K. Identifying market risk for substandard and falsified medicines: An analytic framework based on qualitative research in china, indonesia, turkey and romania. *Wellcome Open Res.* **2019**, *4*, 70. [CrossRef]
27. Kilay, A.L.; Simamora, B.H.; Putra, D.P. The Influence of E-Payment and E-Commerce Services on Supply Chain Performance: Implications of Open Innovation and Solutions for the Digitalization of Micro, Small, and Medium Enterprises (MSMEs) in Indonesia. *J. Open Innov. Technol. Mark. Complex.* **2022**, *8*, 119. [CrossRef]
28. Wongves, K.; Chongcharoen, W.; Chandrachai, A. Development of Herbal Topical Anesthetic Mucoadhesive Spray for Oral Cavity Using Customer-Centric Approach. *J. Hum. Earth Future* **2023**, *4*, 274–289. [CrossRef]
29. Chinakwe, E.C.; Ngumah, J.C.; Kenechukwudozie, O.Q.; Nwogwugwu, N.U.; Ihejirika, O.C.; Mike-Anosike, E.E.; Iwuji, J.C.; Onyeka, C.A. Microbial Quality and Public Health Risks of Selected Herbal Remedies Sold in Open Markets in Owerri Metropolis, South Eastern, Nigeria. *Microbiol. Res. J. Int.* **2023**, *33*, 24–31. [CrossRef]
30. Mary Catherine, C.; Katharine, C.; Chuyin, F.; Romero-Sandoval, E.A. Mapping cannabis potency in medical and recreational programs in the United States. *PLoS ONE* **2020**, *15*, e0230167.
31. Ekor, M. The Growing Use of Herbal Medicines: Issues Relating to Adverse Reactions and Challenges in Monitoring Safety. *Front. Pharmacol.* **2014**, *4*, 177. [CrossRef]
32. Rashrash, M.; Schommer, J.C.; Brown, L.M. Prevalence and Predictors of Herbal Medicine Use Among Adults in the United States. *J. Patient Exp.* **2017**, *4*, 108–113. [CrossRef]
33. Hunsel, F.v.; Kooi, D.v.d.; Koppel, S.v.d.; Kroes, B.H.; Woerdenbag, H.J. Analysis of Reports on Adverse Drug Reactions Related to Herbal Medicinal Products and Herbal Supplements in the Netherlands Received by the National Pharmacovigilance Centre Lareb. *Drug Saf.* **2022**, *45*, 651–661. [CrossRef]

34. Tsai, D.H.; Lin, H.W.; Pickard, A.S.; Tsai, H.-Y.; Mahady, G.B. Evaluation of Documented Drug Interactions and Contraindications Associated with Herbs and Dietary Supplements: A Systematic Literature Review. *Int. J. Clin. Pract.* **2012**, *66*, 1056–1078. [CrossRef]
35. Pittler, M.H.; Schmidt, K.; Ernst, E. Adverse Events of Herbal Food Supplements for Body Weight Reduction: Systematic Review. *Obes. Rev.* **2005**, *6*, 93–111. [CrossRef] [PubMed]
36. Kim, M.G.; Yang, H.; Mattila, A.S. Effects of Visual Cues and Social Density on Beverage Consumption: A Field Experiment in a Bar. *Cornell Hosp. Q.* **2021**, *63*, 182–194. [CrossRef]
37. Aikin, K.J.; Betts, K.R.; Keisler, A.; Ziemer, K.S. Market Claims and Efficacy Information in Direct-to-consumer Prescription Drug Print Advertisements. *Psychol. Mark.* **2019**, *36*, 747–757. [CrossRef]
38. Means, B.; Toyama, Y.; Murphy, R.; Bakia, M.; Jones, K. *Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies*; U.S. Department of Education: Washington, DC, USA, 2009.
39. Korenstein, D.; Keyhani, S.; Mendelson, A.; Ross, J.S. Adherence of Pharmaceutical Advertisements in Medical Journals to FDA Guidelines and Content for Safe Prescribing. *PLoS ONE* **2011**, *6*, e23336. [CrossRef]
40. Wang, X.; Ashraf, A.R.; Thongpapanl, N.; Wang, K. Perceived Deception and Online Repurchase Intention: The Moderating Effect of Product Type and Consumer Regulatory Orientation. *J. Consum. Behav.* **2022**, *21*, 1522–1539. [CrossRef]
41. Liu, Y.; Tang, X. The Effects of Online Trust-Building Mechanisms on Trust and Repurchase Intentions. *Inf. Technol. People* **2018**, *31*, 666–687. [CrossRef]
42. Robinson, A.C.; Demšar, U.; Moore, A.; Buckley, A.; Jiang, B.; Field, K.; Kraak, M.J.; Camboim, S.P.; Sluter, C.R. Geospatial Big Data and Cartography: Research Challenges and Opportunities for Making Maps That Matter. *Int. J. Cartogr.* **2017**, *3*, 32–60. [CrossRef]
43. Li, H.; Fang, Y.; Wang, Y.; Lim, K.H.; Liang, L. Are All Signals Equal? Investigating the Differential Effects of Online Signals on the Sales Performance of E-Marketplace Sellers. *Inf. Technol. People* **2015**, *28*, 699–723. [CrossRef]
44. Haeder, S.F.; Weimer, D.L.; Mukamel, D.B. California Hospital Networks Are Narrower in Marketplace Than in Commercial Plans, but Access and Quality Are Similar. *Health Aff.* **2015**, *34*, 741–748. [CrossRef]
45. Svatošová, V. The Importance of Online Shopping Behavior in the Strategic Management of E-Commerce Competitiveness. *J. Compet.* **2020**, *12*, 143–160. [CrossRef]
46. Dijck, J.v. Seeing the Forest for the Trees: Visualizing Platformization and Its Governance. *New Media Soc.* **2020**, *23*, 2801–2819. [CrossRef]
47. Laestadius, L.; Wang, Y. Youth Access to JUUL Online: eBay Sales of JUUL Prior to and Following FDA Action. *Tob. Control* **2018**, *28*, 617–622. [CrossRef] [PubMed]
48. Jackler, R.K.; Li, V.Y.; Cardiff, R.; Ramamurthi, D. Promotion of Tobacco Products on Facebook: Policy Versus Practice. *Tobacco Control* **2018**, *28*, 67–73. [CrossRef]
49. Sacks, G.; Looi, E.S.Y. The Advertising Policies of Major Social Media Platforms Overlook the Imperative to Restrict the Exposure of Children and Adolescents to the Promotion of Unhealthy Foods and Beverages. *Int. J. Environ. Res. Public Health* **2020**, *17*, 4172. [CrossRef]
50. Vargas, E.D.; Sánchez, G.R.; Juárez, M. Fear by Association: Perceptions of Anti-Immigrant Policy and Health Outcomes. *J. Health Politics Policy Law* **2017**, *42*, 459–483. [CrossRef] [PubMed]
51. Hooley, C.; Baumann, A.A.; Mutabazi, V.; Brown, A.; Reeds, D.; Cade, W.T.; Fuentes, L.d.l.; Proctor, E.K.; Karengera, S.; Schechthman, K.; et al. The TDR MOOC training in implementation research: Evaluation of feasibility and lessons learned in Rwanda. *Pilot Feasibility Stud.* **2020**, *6*, 66. [CrossRef]
52. Perreira, K.M.; Pedroza, J.M. Policies of Exclusion: Implications for the Health of Immigrants and Their Children. *Annu. Rev. Public Health* **2019**, *40*, 147–166. [CrossRef]
53. Culpepper, P.D.; Thelen, K. Are We All Amazon Primed? Consumers and the Politics of Platform Power. *Comp. Political Stud.* **2019**, *53*, 288–318. [CrossRef]
54. Bhuian, S.N.; Sharma, S.K.; Butt, I.; Ahmed, Z.U. Antecedents and Pro-Environmental Consumer Behavior (PECB): The Moderating Role of Religiosity. *J. Consum. Mark.* **2018**, *35*, 287–299. [CrossRef]
55. Ramaswamy, M.P. Regulation of Online Platforms, Intermediaries, and Markets in the European Union and China. *People Int. J. Soc. Sci.* **2023**, *9*, 108–132. [CrossRef]
56. Herweg, N.; Wurster, S.; Dümig, K. The European Natural Gas Market Reforms Revisited: Differentiating Between Regulatory Output and Outcome. *Soc. Sci.* **2018**, *7*, 57. [CrossRef]