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Shifting Discourses on “Health Inequality” and Policy Frames in South Korea: A Text-Mining, Sentiment Analysis, and System Dynamics Approach

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ABSTRACT: This study empirically examines how discourses on “health inequality” have evolved over time in South Korean newspaper coverage, using articles collected with the query “health AND inequality” between January 1, 2000 and December 31, 2024 (N = 14,392). We distinguish responsibility attribution in the discourse by differentiating a public-responsibility frame (centered on government, institutions, and public services) from an individual-responsibility frame (centered on lifestyle and self-management). Using the “feature extraction (top 50 weighted terms)” text included in newspaper metadata as standardized analytical input, we construct indices for responsibility framing (keyword frequencies per 1,000 tokens), affect (anxiety, anger, and hope), and policy discourse (based on a policy-action lexicon). Period-based summaries show that language associated with the public-responsibility frame was relatively prominent during 2005–2014, and that both the public-responsibility index and the policy-action index increased again in 2020–2024. In terms of affect, anxiety and hope increased simultaneously in 2020–2024, suggesting that crisis recognition and solution-oriented narratives intensified in parallel. In addition, LDA topic modeling indicates that multiple sub-discourses—such as “national health insurance/medical costs/vulnerable groups,” “labor and employment,” and “infectious disease (COVID-19) and crisis”—shifted in prominence across periods. Fixed-effects regression models (controlling for year and media outlet) show that the public-responsibility index is positively associated with the policy-action index, whereas the individual-responsibility index is negatively associated. Finally, from a system dynamics perspective, we present a causal loop diagram (CLD) of the feedback structure linking framing, affect, and policy discourse, and discuss the potential coexistence of a balancing loop in which public-responsibility framing strengthens policy-alternative discourse and a reinforcing loop in which individual-responsibility framing weakens structural policy pressure.

1. INTRODUCTION

Health inequality/inequity refers to disparities in health outcomes that arise from unequal socioeconomic conditions, beyond individual biological differences. Internationally, policy approaches to the social determinants of health have become a central agenda for achieving health equity, and under the goal of reducing health gaps “within a generation,” the importance of governmental leadership and coherent policy packages has been emphasized (CSDH, 2008; Marmot, 2010). In South Korea, socioeconomic and regional gradients in health—by income, education, employment, and place—have been consistently documented, and health inequality has grown in importance both as a research topic and as a policy agenda (Kim & Kim, 2007; Khang & Lee, 2012). However, objective health indicators alone cannot fully explain how “health inequality” is socially understood, where responsibility is attributed, or which solutions are legitimized. Traditional media such as newspapers play a key role in constructing problem definitions, causal attributions, and perceived solution agents. Even when the underlying

health gap is similar, whether the media frames it as a “failure of individual self-management” or as “limitations of institutions and public services” can shape the legitimacy of policy prescriptions (e.g., campaign-centered approaches versus strengthened coverage and public healthcare). In this context, attribution of responsibility frames have been treated as an important analytic unit in policy communication research (Entman, 1993; Iyengar, 1991; Temmann et al., 2021). Drawing on a corpus of “health AND inequality” news articles from 2000 to 2024, this study (1) quantitatively documents long-term shifts in public- versus individual-responsibility framing; (2) analyzes how affect (anxiety, anger, hope) and policy-alternative discourse (policy action) move alongside framing; and (3) integrates the results through a system dynamics lens to explain the feedback structure (reinforcing/balancing loops). Rather than conducting full morphological analysis of entire article texts, we use the provider-generated “feature extraction (top 50 weighted terms)” as standardized analytical text, thereby reducing measurement noise driven by year-to-year changes in article volume, article length, and article-type differences, and improving comparability of long-run trends (Commission on Social Determinants of Health [CSDH], 2008; Marmot, 2010; Marmot et al., 2008; Whitehead, 1992; Braveman & Gruskin, 2003; Chong & Druckman, 2007; Semetko & Valkenburg, 2000).

1.1 Research questions and hypotheses This study addresses the following research questions.

RQ1. How do the public-responsibility and individual-responsibility frames in “health inequality” discourse change across periods and years?

RQ2. How does policy-alternative discourse (policy action) change across periods and years?

RQ3. How do affective tones (anxiety, anger, and hope) co-vary with shifts in framing?

RQ4. Does the relationship between responsibility framing (public/individual) and policy-alternative discourse remain after accounting for control variables (year and media outlet)?

RQ5. Based on these results, how can the dynamic structure linking framing, affect, and policy discourse be articulated from a system dynamics perspective? (Link & Phelan, 1995; Adler & Newman, 2002; Krieger, 2001; Sterman, 2000; Meadows, 2008; Luke & Stamatakis, 2012).

The expected directions guiding the analysis are as follows.

H1. Higher public-responsibility framing is associated with higher levels of policy-alternative (policy-action) discourse.

H2. Higher individual-responsibility framing is associated with lower (or weaker) levels of policy-alternative discourse.

H3. Hope is positively associated with policy-alternative discourse, and when combined with public-responsibility framing (interaction), it may strengthen policy-alternative discourse.

H4. During crisis phases such as infectious disease outbreaks, anxiety increases, and public-responsibility framing and policy-alternative discourse may intensify together. (Entman, 1993; Iyengar, 1991; Scheufele, 1999; Chong & Druckman, 2007; Druckman, 2001).

2. THEORETICAL BACKGROUND AND LITERATURE REVIEW

This section integrates four strands of scholarship: (1) the concept of health inequality and the Korean policy context; (2) media framing and attribution of responsibility; (3) the role of affect; and (4) complex systems perspectives, particularly system dynamics.

First, research on health inequality has emphasized the importance of the social determinants of health. The World Health Organization’s Commission on Social Determinants of Health (CSDH) argued that achieving health equity requires not only improving social conditions—such as education, employment, housing, and the environment—but also transforming the policy and power structures that shape those conditions (CSDH, 2008). The Marmot Review similarly conceptualized health disparities as a “social gradient” and called for policy interventions across the life course and multiple domains, including early childhood, education, employment, living conditions, and sustainable communities (Marmot, 2010). In the Korean context, prior studies documenting the status of health inequality have shown that both health indicators and health behaviors are strongly patterned by socioeconomic position, while public policy responses have remained relatively limited (Kim & Kim, 2007; Khang & Lee, 2012).

Second, media framing research suggests that the aspects selectively emphasized in news coverage shape how audiences define problems, diagnose causes, make moral evaluations, and consider solutions (Entman, 1993). In particular, attribution of responsibility frames construct whether the cause of a problem and the agent of its solution are located at the individual level

(behavior, character, choice) or at the societal/governmental level (institutions, policies, structures). Iyengar (1991) demonstrated that episodic framing, which focuses on individual cases, tends to strengthen individual attributions of responsibility, whereas thematic framing, which situates issues within broader social contexts, can strengthen structural attributions. These insights are highly relevant to health-related issues. A growing body of research has shown that responsibility framing can influence perceptions of obesity, diabetes, mental health, and other public health issues, including stigma and support for policy interventions; systematic reviews have synthesized the effects of responsibility frames in health contexts (Temmann et al., 2021).

Third, affect (emotion) may shape both the intensity and persistence of framing effects. Anxiety and anger can heighten risk perception and increase the visibility of social problems, yet prolonged crisis narratives may also generate fatigue or cynicism. By contrast, hope—defined as perceived possibility of resolution, improvement, or recovery—may strengthen the perceived feasibility of policy alternatives and mobilize collective action. This study focuses on three core affective categories—anxiety, anger, and hope—and explores their co-movement with framing and policy discourse over the long term.

Fourth, social problems such as health inequality are best understood as complex systems. Individual health behaviors, access to healthcare, policies and institutions, economic and employment structures, and social perceptions interact through feedback mechanisms. System dynamics provides methodological tools to represent such feedback structures through causal loop diagrams (CLDs) and stock-and-flow models, and to simulate their evolution over time (Sterman, 2000). In public health research, CLDs have been increasingly used to understand complex issues such as obesity, community health, and health disparities (Allender et al., 2015). Building on these traditions, this study interprets long-term changes in newspaper discourse from a system dynamics perspective and proposes feedback loops through which framing and affect mediate policy alternatives and social responses (CSDH, 2008; Marmot, 2010; Marmot et al., 2008; Solar & Irwin, 2010; Krieger, 2001; Goffman, 1974; Entman, 1993; Scheufele, 1999; Gamson & Modigliani, 1989; Semetko & Valkenburg, 2000; Sterman, 2000; Homer & Hirsch, 2006; Leischow & Milstein, 2006; Luke & Stamatakis, 2012).

The analytical framework of this study assumes a cyclical structure: attribution of responsibility in discourse (public versus individual) → affect (anxiety/anger/hope) → policy alternatives (policy-action language) → problem visibility/crisis perception → reproduction of discourse. Within this framework, the public-responsibility frame may legitimize structural policy alternatives (e.g., expanded coverage, public healthcare, financial support), whereas the individual-responsibility frame may legitimize behavior-centered prescriptions. Affect is interpreted as a moderating factor that can strengthen or weaken the linkage between framing and policy alternatives (Whitehead, 1992; Braveman & Gruskin, 2003; Iyengar, 1991; Iyengar, 1996; Druckman, 2001; Chong & Druckman, 2007; Tausczik & Pennebaker, 2010; Mohammad & Turney, 2013).

3. DATA AND METHODS

This study uses a corpus of newspaper articles with associated metadata. Articles were retrieved from BigKinds (<https://www.bigkinds.or.kr/>), a major Korean news portal that provides access to articles from 25 leading national newspapers. The database allows users to export articles in Excel format. Each article record includes an article identifier, publication date, media outlet, title, full text, URL, keywords, and “feature extraction (top 50 weighted terms)” text. The unit of analysis is a single news article.

The standardized analytical text used in this study is the “feature extraction (top 50 weighted terms).” This choice is motivated by three considerations. First, it reduces bias arising from increases in the number of articles and changes in article length over time, which would otherwise distort simple frequency comparisons. Second, lexicon-based index construction can more reliably normalize by document length when using standardized token lists. Third, this approach mitigates stylistic differences across media outlets and article types, thereby facilitating long-term trend comparisons. However, because this method does not fully capture the entire narrative context of each article, the resulting indices should be interpreted as signals at the level of core lexical patterns in discourse. Future research could extend the analysis through full morphological parsing of article texts or sentence-level frame classification (Grimmer & Stewart, 2013; Gentzkow et al., 2019; Tausczik & Pennebaker, 2010; Pennebaker et al., 2015).

3.1 Study Period and Sample

The study period spans from January 1, 2000 to December 31, 2024. A total of 14,392 articles were collected using the search query “health AND inequality.” To examine long-term changes, the period was divided into five intervals: 2000–2004, 2005–2009, 2010–2014, 2015–2019, and 2020–2024.

3.2 Construction of Responsibility Frame Indices

The public-responsibility frame is defined as language attributing the causes and solutions of health inequality to government, institutions, and public services. The individual-responsibility frame is defined as language attributing responsibility to lifestyle and self-management at the individual level. For each frame, a lexicon of 15 keywords (30 in total) was constructed. Within the “feature extraction” token list, tokens partially matching (including compound forms) the predefined keywords were counted.

The frame indices were calculated as follows:

Public responsibility index (public_idx) = (number of public-responsibility keywords / total tokens) $\times$ 1,000

Individual responsibility index (ind_idx) = (number of individual-responsibility keywords / total tokens) $\times$ 1,000

Dominance index (frame_dom) = $\text{public_idx} - \text{ind_idx}$

For qualitative comparison, articles with high dominance values (public-dominant) and low dominance values (individual-dominant) were selected for each period (top and bottom 10 articles, respectively).

3.3 Policy-Alternative (Policy-Action) and Affect Indices

The policy-alternative (policy-action) index is based on a lexicon of 15 terms indicating policy implementation (e.g., strengthen, expand, reform, introduce, invest, guarantee). Tokens matching these terms in the feature list were counted and converted into a per-1,000-token index (policy_action_idx).

Affect indices were constructed using separate lexicons for anxiety (e.g., crisis, concern, fear), anger (e.g., criticism, conflict, controversy), and hope (e.g., resolution, improvement, recovery). For each category, keyword frequencies were calculated and normalized per 1,000 tokens. These affect measures are preliminary lexicon-based indicators rather than substitutes for machine-learning sentiment models. Nonetheless, they are useful for exploring how framing and policy discourse co-move with affective signals over long-term trends (Blei et al., 2003; Blei, 2012; Forrester, 1961; Sterman, 2000; Meadows, 2008).

3.4 Text Mining: Topic Modeling

To identify sub-structures within the discourse, we conducted Latent Dirichlet Allocation (LDA) topic modeling. The input documents consisted of space-concatenated “feature extraction” tokens. After cleaning Korean tokens (removing non-Korean characters and low-frequency terms), a document–term matrix was constructed. The number of topics was set to ten. Each topic was labeled interpretively based on its top terms. In addition, topic prevalence (mean document–topic proportions) was calculated by period to examine shifts in sub-discourses over time (Roberts et al., 2019).

3.5 Statistical Analysis: Determinants of Policy-Alternative Discourse

To examine how policy-alternative discourse relates to responsibility framing and affect, we estimated OLS regression models. The dependent variable is the policy_action_idx . Key independent variables include the public-responsibility index (public_idx), the individual-responsibility index (ind_idx), and affect indices (anxiety, anger, hope). Year fixed effects and media outlet fixed effects (top 30 outlets plus others) were included to control for long-term trends and outlet-level heterogeneity. Heteroskedasticity-robust (HC1) standard errors were used (Pang & Lee, 2008; Liu, 2012; Mohammad & Turney, 2013).

4. RESULTS

4.1 Period-based summary: framing, affect, and policy-alternative indicators

Table 1 summarizes, for each of the five periods, the number of articles, the average standardized text length, the responsibility framing indices, affect indices, and policy-related discourse indicators. The mean public-responsibility index was relatively high in 2005–2009 (40.63) and 2010–2014 (37.86), declined in 2015–2019 (27.97), and then increased again in 2020–2024 (32.46). The mean individual-responsibility index was consistently lower than the public-responsibility index overall, but reached a comparatively higher level during 2010–2014 (11.16). The policy-alternative (policy-action) index was elevated during 2005–

2014 and remained high in 2020–2024. Regarding affect, the simultaneous increases in the anxiety index (4.20) and the hope index (11.23) in 2020–2024 suggest that crisis recognition and solution-oriented narratives intensified in parallel (Bambra et al., 2020; OECD, 2019; Rutter et al., 2017; Luke & Stamatakis, 2012).

Table 1. Summary of “Health Inequality” Discourse Indicators by Period (2000–2024)

Period	Articles (N)	Standardized text length (tokens, mean)	Public-responsibility index (mean)	Individual-responsibility index (mean)	Dominance index (Public – Individual, mean)	Policy discourse index (mean)	Anxiety index (mean)	Anger index (mean)	Hope index (mean)	Public frame share (%)	Individual frame share (%)	Mixed/Neutral share (%)
2000–2004	400	24.76	28.06	8.67	19.4	14.65	4.27	4.13	7.75	15.0	4.0	81.0
2005–2009	674	22.29	40.63	9.55	31.08	20.49	4.35	3.45	7.73	19.14	4.45	76.41
2010–2014	1730	21.41	37.86	11.16	26.7	19.1	3.85	2.98	7.68	17.11	4.57	78.32
2015–2019	3194	19.97	27.97	8.72	19.25	16.0	2.89	2.79	8.23	12.55	2.94	84.5
2020–2024	8394	18.8	32.46	9.26	23.2	18.15	4.2	2.67	11.23	13.41	2.85	83.74

Note: (1) The standardized text refers to the provider-generated “feature extraction (top 50 weighted terms)” token list; the standardized text length (tokens) is the mean length of this list. (2) Indices are computed as keyword frequencies per 1,000 tokens. (3) The public/individual/mixed–neutral shares are based on a rule-based classification (see Section 3.2).

4.2 Period-based word clouds of news articles

Table 2 presents period-specific word clouds for articles grouped by time interval and summarizes their main characteristics.

Table 2. Period-based word clouds (“health AND inequality” articles) and interpretive summary

Period	Word Cloud	Key interpretation (summary)
2000-2004		The discourse appears to have been centered on “Seoul,” suggesting a strong metropolitan focus in discussions of health inequality. Health inequality was more frequently framed in terms of disparities in access to and utilization of medical services rather than solely as differences in disease outcomes. The prominence of terms such as “women” and “households” indicates that vulnerability was discussed not only at the individual level but also in relation to gender and household-level living conditions. The frequent appearance of “United States” suggests that international comparisons were commonly used in framing health inequality during this period.
2005-2009		This period shows a strong convergence of the discourse around “medical care” and “public health.” In particular, the most prominent term is “medical care,” and it is closely surrounded by terms such as “government” and “policy.” This pattern suggests that health inequality was frequently framed not merely as an issue of individual health, but as a matter of the healthcare system, public health infrastructure, and policy intervention—consistent with a public-responsibility framing.
2010-2014		During this period, the discourse was organized around “health” as a central axis, while simultaneously intertwining themes related to policy and government (the public sector) with everyday life and social conditions (e.g., households and international comparisons such as the United States). At the same time, the prominence of terms such as “government,” “policy,” and “public” (as well as “citizens”) indicates that responsibility for addressing health inequality continued to be discussed in connection with policy and institutional intervention.
2015-2019		A notable feature of this period is that the focus of the discourse expanded beyond “Seoul” to more clearly encompass policy and government (public responsibility), as well as regional governance (local governments) and broader notions such as the welfare state or inclusive state. One of the most prominent terms is “local government,” accompanied by large occurrences of “government” and “policy.” This suggests that health inequality was actively discussed not only as an issue of central government institutions, but

		also as a matter of policies, programs, and services implemented by local governments.
2020-2024		Compared to earlier periods, the most salient feature of this phase is a stronger reconfiguration of the discourse around the axes of “medical care/public health (system),” “crisis (infectious disease),” and “government/policy (public responsibility).” The most prominent keyword is “medical care,” and it is closely accompanied by terms such as “public health,” “COVID-19” (or related crisis/infectious disease terms), as well as “government” and “policy.”.

Period-specific word clouds reveal the “surface structure” of the discourse. In the early 2000s, terms such as “Seoul,” “women/households,” and “utilization/access” were prominent, foregrounding language related to living conditions and access. During 2005–2014, the discourse converged more strongly around “medical care/public health,” with increasing co-occurrence of “government” and “policy” vocabulary. In 2015–2019, “local government” emerged as a salient term, indicating that health inequality expanded beyond a central government concern to become an agenda for local government policies and programs. In 2020–2024, coinciding with the infectious disease crisis, the discourse was reconfigured around the axes of the “medical/public health system” and “government/policy.” This pattern suggests that crisis contexts may reactivate a public-responsibility framing.

4.3 Yearly trends: framing, affect, and policy alternatives

Figures 1–4 display annual changes in the public and individual framing indices, the dominance index, the policy-action index, and affective indices. Overall, the public-responsibility framing index rises in the mid-to-late 2000s and early 2010s, and remains at a sustained level in the 2020s. The dominance index (public minus individual) indicates periods in which the public-responsibility frame is relatively more salient, maintaining positive values during 2020–2024. The policy-action index tends to move in tandem with changes in the public-responsibility index, while affective indicators show a marked increase in the hope index during the 2020s (Khang & Lee, 2012; CSDH, 2008; Marmot, 2010).

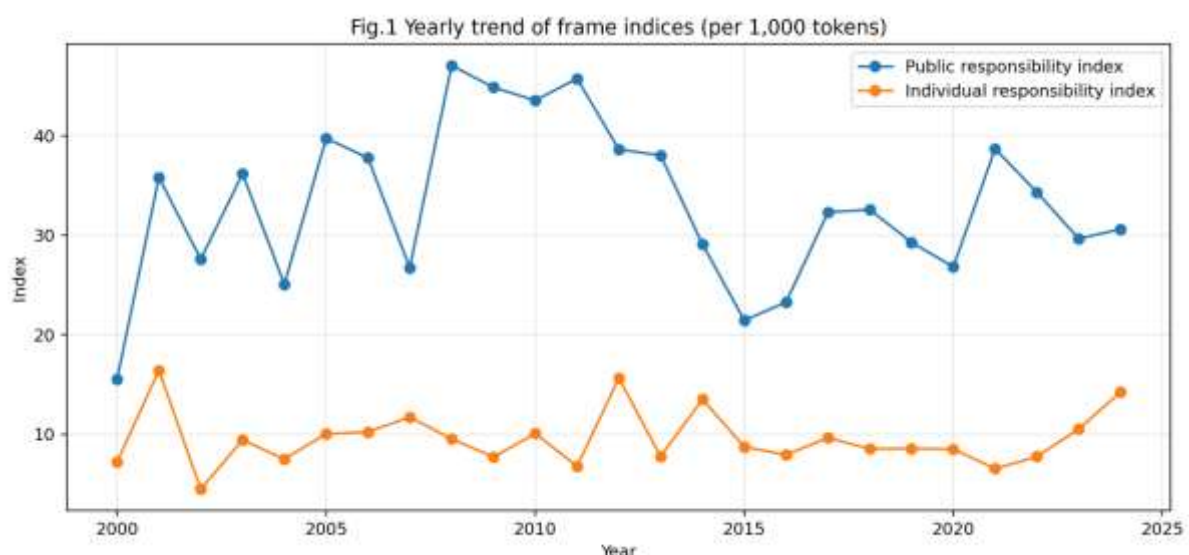


Figure 1. Yearly trends in public- and individual-responsibility framing indices (per 1,000 tokens)

Note: The public- and individual-responsibility indices are calculated by counting keyword occurrences in the “feature extraction (top 50 weighted terms)” token list and standardizing them per 1,000 tokens.

The public-responsibility index is relatively high in the mid-to-late 2000s and early 2010s, declines around 2015, and rises again in the 2020s. This pattern suggests that the public-responsibility frame tends to strengthen when “health inequality” becomes closely associated with policy and institutional debates or broader crisis contexts.

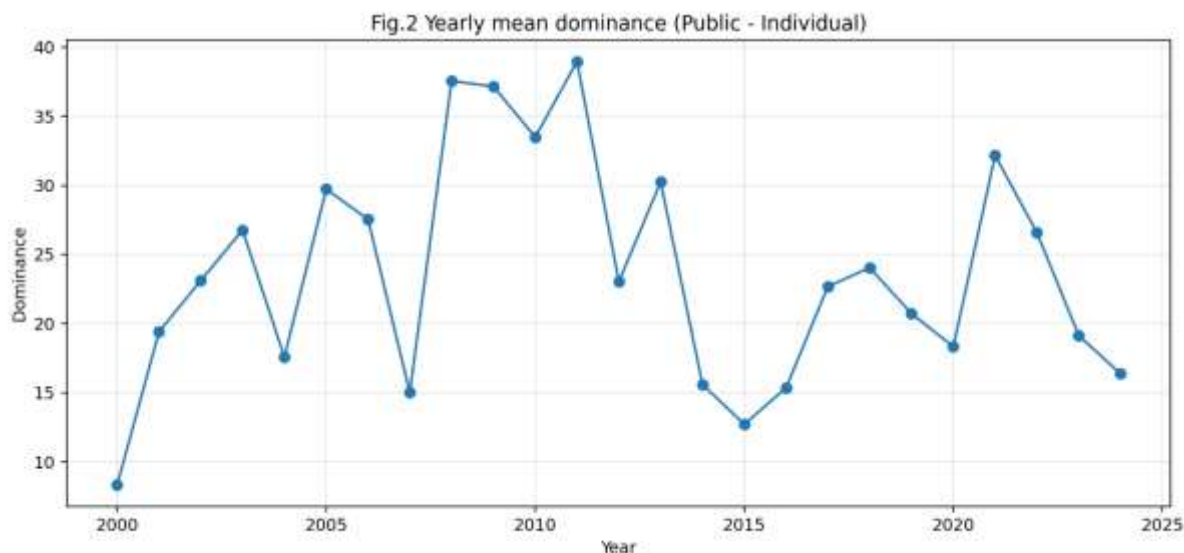


Figure 2. Yearly mean dominance index (public – individual)

Note: The dominance index (frame_dom) is defined as the public-responsibility index minus the individual-responsibility index (per 1,000 tokens). Higher values indicate the relative predominance of the public-responsibility frame.

The dominance index remains positive throughout the entire period, with a particularly pronounced expansion of public-responsibility dominance around 2008–2012. This suggests that, even though individual-behavior narratives were present, news coverage structurally favored framing health inequality in terms of public-sector responsibility and solutions.

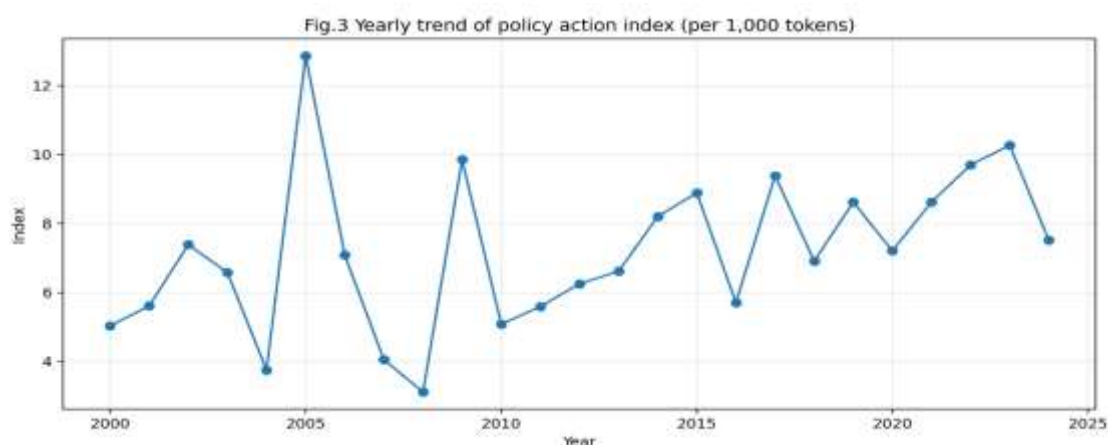


Figure 3. Yearly trend in the policy-action (policy alternative) index (per 1,000 tokens)

Note: The policy-action index is calculated by counting occurrences of implementation-oriented policy terms—such as “strengthen,” “expand,” “improve,” “introduce,” “extend,” “establish,” “reform,” “promote,” “invest,” and “guarantee”—and standardizing them per 1,000 tokens.

The policy-action index largely moves in tandem with periods in which the public-responsibility frame is strong. This pattern supports the interpretation that when the media define health inequality as a matter of public responsibility, the discourse is more likely to be accompanied by language proposing concrete policy measures.

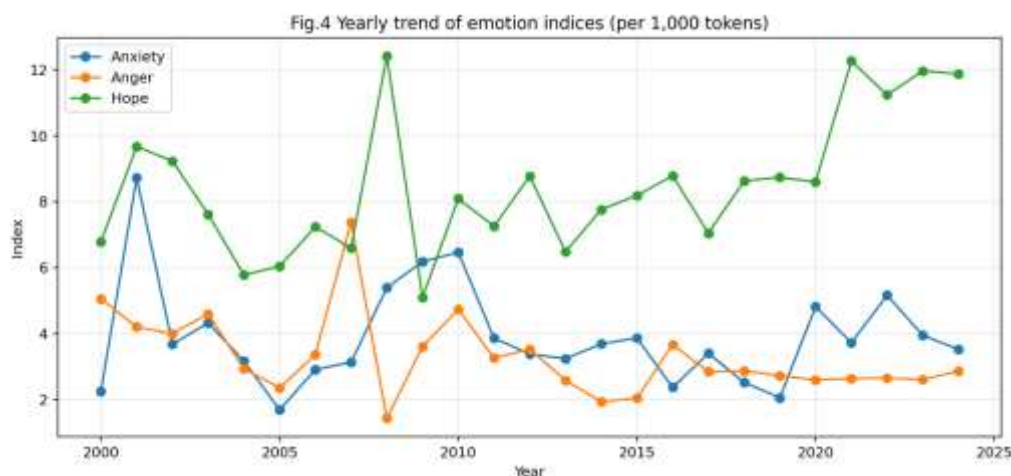


Figure 4. Yearly trends in affect indices (anxiety, anger, and hope) (per 1,000 tokens)

Note: The affect indices are lexicon-based measures calculated by standardizing the frequency of anxiety-, anger-, and hope-related keywords per 1,000 tokens.

In the 2020s, anxiety and hope rise simultaneously. This pattern may indicate a “dual affect” phase in which crisis recognition (anxiety) and solution-oriented discourse (hope) intensify at the same time, thereby creating greater scope for the expansion of policy-alternative discourse.

4.4 Topic modeling results: Structure and temporal shifts in sub-discourses

Table 3 presents the ten topics identified through LDA topic modeling, along with their top keywords and interpretive labels assigned by the researchers. The topics can be broadly categorized into: (1) institutional and financial discourses related to national health insurance, premiums, and medical costs; (2) access-related discourses concerning vulnerable groups, including low-income populations, public health centers, and people with disabilities; (3) labor and employment discourses, including precarious work and job insecurity; (4) crisis-related discourses such as COVID-19 and other infectious diseases; (5) international comparison discourses; and (6) discourses on children, education, and regional disparities.

Figure 5 displays the mean topic prevalence by period (for the six most prominent topics) and shows that the relative weight of infectious disease and crisis-related topics increases during 2020–2024 (Blei et al., 2003; Blei, 2012; Roberts et al., 2019).

Table 3. Topic modeling results for “health inequality” articles (top keywords and interpretive labels)

Topic	Interpretation (Label)	Top Keywords (12 terms)
T1	Children, education, and regional disparities	people, inequality, Korea, Seoul National University, community, Seoul, United States, time, children, members, 10,000, experts
T2	National health insurance, finance, and institutional debates	low-income groups, medical expenses, health management, insurance premiums, public health centers, subscribers, Seoul, persons with disabilities, national health insurance, vulnerable groups, Ministry of Health and Welfare, beneficiaries
T3	International comparisons and discursive borrowing	Korea, United States, our country, report, Japan, inequality, China, member countries, first place, Europe, United Kingdom, population aging
T4	Labor, employment, and social protection	workers, jobs, employees, Korea, non-regular workers, inequality, workers (plural), our country, large enterprises, small and medium enterprises, regular workers, labor market

T5	Infectious disease, crisis, and recovery discourse	COVID-19, inequality, pandemic, coronavirus, climate change, sustainability, Korea, report, climate crisis, United States, secretary-general, online
T6	Labor, employment, and social protection	United States, inequality, United Kingdom, Korea, people, China, economics, capitalism, workers, economists, middle class, democracy
T7	Infectious disease, crisis, and recovery discourse	COVID-19, infectious disease, coronavirus, Daegu, Seoul, confirmed cases, Busan, children, public healthcare, North Gyeongsang, Incheon, South
T8	Labor, employment, and social protection	Seoul, committee, Seoul Metropolitan Government, chairperson, forum, inequality, persons with disabilities, workers, citizens, community, Gwangju, member of the National Assembly
T9	Infectious disease, crisis, and recovery discourse	Republic of Korea, Democratic Party, jobs, Moon Jae-in, citizens, Democratic Party of Korea, Lee Jae-myung, inequality, real estate, coronavirus, democracy, Blue House
T10	Children, education, and regional disparities	inequality, health, society, children, high school, officials, students, Korea Institute for Health and Social Affairs, education, report, medical care, middle school

The topic modeling results indicate that discourse on “health inequality” does not revolve around a single theme, but rather consists of multiple sub-discourses, including institutional and financial debates (e.g., insurance and medical costs), labor and employment, infectious disease and crisis, children and education/regional disparities, and international comparisons. This finding supports the interpretation that policy debates (such as those concerning insurance premiums and public finance) and major social events (such as infectious disease outbreaks) can function as triggers that shift the focal point of the discourse.

Note: Topic labels were interpretively assigned by the researchers based on the semantic meaning of the top keywords within each topic.

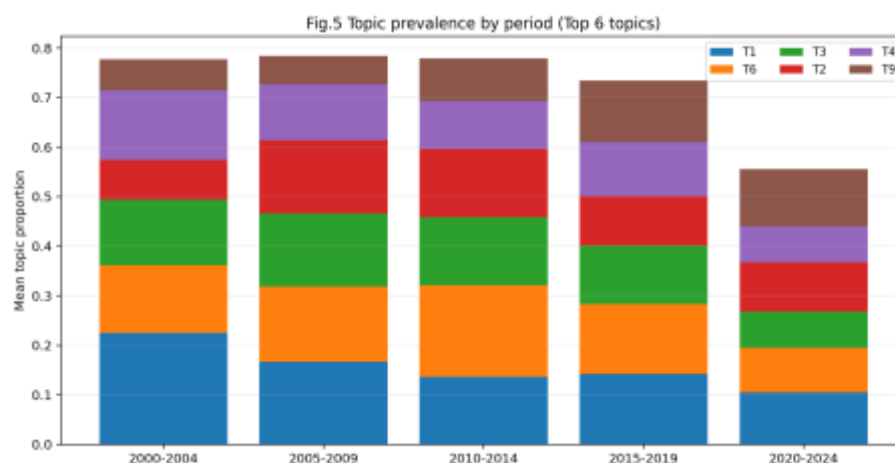


Figure 5. Topic prevalence by period (top six topics)

Note: The bars represent the mean document–topic proportions for each period (top six topics), and colors indicate topic numbers.

During 2020–2024, topics related to infectious disease and crisis (e.g., COVID-19) become relatively more prominent. At the same time, institutional and financial themes, as well as political and governance-related discourses, appear to converge with crisis-related topics. This pattern suggests that in times of crisis, discussions of health inequality can be rapidly linked to debates over healthcare system capacity and public policy responsibility.

4.5 Determinants of policy-alternative discourse: Regression analysis

Table 4 presents the results of OLS regression models with the policy-action index (policy_action_idx) as the dependent variable. Model 1 includes only the framing indices; Model 2 adds affective indices; and Model 3 incorporates an interaction term between public-responsibility framing and hope. After controlling for year and media outlet fixed effects, the public-responsibility index is positively and significantly associated with the policy-action index ($p < .001$), whereas the individual-responsibility index is negatively and significantly associated with the policy-action index ($p < .001$). Among the affective variables, hope shows a positive and statistically significant association ($p < .001$), while anxiety and anger are not significant after controls are included. The interaction term between public responsibility and hope is not statistically significant in this dataset (Liu, 2012; Mohammad & Turney, 2013; Tausczik & Pennebaker, 2010).

Table 4. Regression results for the policy-action (policy alternative) index (robust standard errors, HC1)

Variable	Model 1 Coefficient (SE)	Model 2 Coefficient (SE)	Model 3 Coefficient (SE)
Public-responsibility index (public_idx)	0.113 (0.006)***	0.113 (0.006)***	0.114 (0.007)***
Individual-responsibility index (ind_idx)	-0.020 (0.005)***	-0.019 (0.005)***	-0.018 (0.005)***
Anxiety (anxiety_idx)	–	0.009 (0.013)	0.009 (0.013)
Anger (anger_idx)	–	-0.018 (0.017)	-0.018 (0.017)
Hope (hope_idx)	–	0.049 (0.012)***	0.053 (0.013)***
Public × Hope (interaction)	–	–	-0.000114 (0.000198)
Year fixed effects	Included	Included	Included
Media outlet fixed effects (top 30 + others)	Included	Included	Included
Observations (N)	14,392	14,392	14,392
R ²	0.093	0.095	0.096
Note: Robust (HC1) standard errors in parentheses. *** $p < .001$.			

After controlling for year and media outlet fixed effects, the public-responsibility index shows a statistically significant positive association with the policy-action index, whereas the individual-responsibility index shows a negative association. This implies that when health inequality is constructed in the discourse as a matter of public responsibility and institutional reform, it is more likely to be accompanied by language proposing policy alternatives (e.g., expansion, strengthening, investment). Conversely, stronger individual-responsibility framing may be linked to weaker policy discourse, suggesting that media frames can operate as mechanisms that either legitimize or downscale policy agenda-setting processes.

Note: *** $p < .001$, ** $p < .01$, * $p < .05$. The dependent variable is policy_action_idx (per 1,000 tokens). Year fixed effects and media outlet fixed effects (top 30 outlets plus others) are included.

4.6 Qualitative patterns based on representative articles (public-dominant vs. individual-dominant)

An examination of the top and bottom articles by the dominance index (10 each per period) indicates that the public-dominant set more frequently features narratives linked to national health insurance, insurance premiums, medical costs, public healthcare, and institutional reform. In contrast, the individual-dominant set repeatedly emphasizes behavioral narratives such as smoking, obesity, lifestyle, and self-management. These patterns suggest that even when addressing the same topic—“health inequality”—the diagnostic and prescriptive emphasis can tilt toward either a policy/institutional axis or an individual behavioral axis. Appendix A provides the list of representative articles by period (Entman, 1993; Iyengar, 1991; Chong & Druckman, 2007; Druckman, 2001).

5. SYSTEM DYNAMICS (SD) INTEGRATION: FEEDBACK STRUCTURE LINKING FRAMING, AFFECT, AND POLICY DISCOURSE

This section interprets how discourse is reproduced through its coupling with policy-alternative narratives, drawing on the empirical text-based findings and a system dynamics perspective. The causal loop diagram illustrates that health inequality is not determined solely by individual health behaviors; rather, policy pathways and outcomes differ depending on how society understands responsibility attribution, and these outcomes feed back into discourse and crisis perception in a cyclical manner.

When the public-responsibility frame strengthens, health inequality is more likely to be perceived as a task to be addressed by government, institutions, and public services. As a result, policy discourse intensifies, including calls to expand coverage, strengthen public healthcare, and support vulnerable groups. As policy discourse grows, public investment increases, which strengthens health and welfare service capacity and, in turn, improves access and protection for vulnerable groups. Improved access and protection can reduce disparities in healthcare utilization and service benefits, thereby lowering the level of health inequality over the long term. In other words, the public-responsibility frame forms a “mitigation pathway” through which policy alternatives, public investment, and strengthened service capacity jointly contribute to reducing health inequality.

By contrast, when the individual-responsibility frame strengthens, health inequality is more easily interpreted as a problem rooted in individual choices, inadequate self-management, or unhealthy lifestyles. In this case, solutions tend to emphasize behavioral prescriptions such as smoking cessation, exercise, and dietary management, and policy discussions may remain at the level of campaigns or education that promote individual compliance. When behavioral prescriptions are overemphasized, demands for policy interventions targeting structural determinants—such as income and employment, housing environments, healthcare access, and inequalities in public services—may weaken or be displaced. Consequently, public investment and service-capacity expansion may remain insufficient, increasing the risk that inequalities are not reduced and may persist or worsen. Thus, when coupled with stigma or blame narratives directed at vulnerable groups, the individual-responsibility frame can generate a “vicious cycle” pathway that reproduces health inequality by weakening structural policy pressure.

In this causal map, crisis salience and problem visibility function as critical branching points. As health inequality increases, public attention rises, crisis perception intensifies, and the problem becomes more salient. However, crisis recognition does not always translate solely into stronger public-responsibility framing. Depending on context, it may amplify public demands that “the government must take responsibility and reform institutions,” or it may trigger blame and stigma narratives that strengthen individual-responsibility framing (e.g., “individuals should have been more careful”). Therefore, crisis periods may either open a “window of opportunity” for shifting health inequality into a public policy agenda or, alternatively, represent a “lost opportunity” if structural reform debates are weakened through responsibility displacement.

Taken together, the causal loop diagram highlights that a key policy lever for reducing health inequality lies in strengthening public investment and service capacity in ways that tangibly improve access and protection for vulnerable groups. At the same time, it cautions that while promoting healthy lifestyles is important, overemphasizing behavioral solutions as substitutes for structural interventions may limit progress in reducing health inequality and may even obscure public policy responsibility. From a policy perspective, crises in particular call for avoiding a narrow focus on individual responsibility and instead using a public-responsibility framing to connect discussions to institutional reform, investment, and protection of vulnerable groups, while positioning individual behavior support as a complementary element within a broader structural policy package (Forrester, 1961; Sterman, 2000; Meadows, 2008; Homer & Hirsch, 2006; Leischow & Milstein, 2006; Luke & Stamatakis, 2012; Allender et al., 2015; Rutter et al., 2017; Tausczik & Pennebaker, 2010; Mohammad & Turney, 2013).

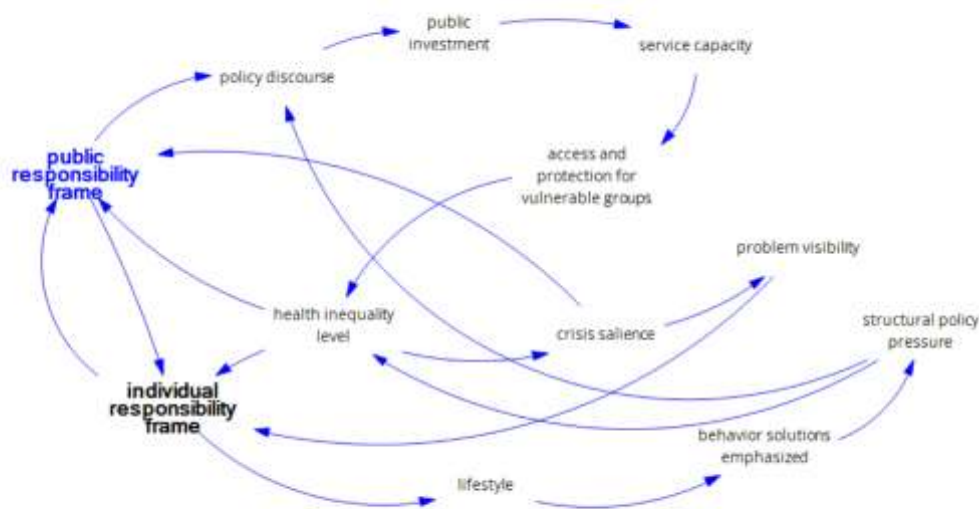


Figure 6. Feedback structure linking responsibility framing, policy alternatives, and problem visibility in “health inequality” discourse (CLD)

Note: This causal loop diagram represents a conceptual model derived from the text-based empirical analysis. Arrows indicate the direction of influence and do not represent a formally estimated quantitative model.

The public-responsibility frame may promote a balancing loop in which “policy discourse → public investment → service capacity → protection/access for vulnerable groups → reduction in inequality” reinforces efforts to mitigate disparities. By contrast, when the individual-responsibility frame becomes excessively dominant, policy agendas may narrow toward behavior-centered prescriptions, weakening structural policy pressure and potentially contributing to the reproduction of inequality through a reinforcing loop. Therefore, particularly during crisis periods, it is important to link discourses of individual practice with structural policy packages (e.g., expanded coverage, strengthened public healthcare, and protection for vulnerable groups), so that “policy windows” can translate into substantive institutional reform rather than symbolic responses.

6. DISCUSSION AND CONCLUSION

5.1 Discussion

First, the long-term corpus analysis shows that discourse on “health inequality” does not converge on a single causal diagnosis. Rather, multiple sub-discourses—related to institutions, insurance, labor, infectious disease, and education—coexist and shift in relative prominence over time. This suggests that health inequality is inherently multidimensional, and that social events (e.g., infectious disease outbreaks) and policy debates (e.g., insurance premiums and public finance) can act as catalysts that redirect the focus of discourse.

Second, the finding that the public-responsibility frame is significantly associated with policy-alternative (policy-action) discourse indicates that framing the “agent of solution” within the public sphere can strengthen the legitimacy of policy packages such as expanded coverage, public healthcare, support, and investment. In contrast, the negative association between the individual-responsibility frame and policy-alternative discourse suggests that behavior-centered narratives may weaken perceived necessity for structural policy intervention.

Third, the significant positive association between hope and policy-alternative discourse implies that crisis narratives may strengthen policy debate when they are coupled not merely with fear or anger but with a sense of possibility and resolution. However, the interaction between public responsibility and hope was not statistically significant in this dataset, suggesting that future research should examine moderating effects of affect more precisely through sentence-level analysis (e.g., identifying whether policy alternatives are explicitly proposed) or by differentiating article types.

The policy implications are as follows. (1) In policy communication addressing health inequality, it is important not to position public responsibility (institutions and services) and individual practice as oppositional, but rather to articulate an integrated narrative that explains the conditions enabling individual practice—such as education, income, labor conditions, and healthcare access. (2) During crisis periods, when public-responsibility discourse intensifies, media coverage should present concrete pathways for policy alternatives (e.g., investment, institutional reform, protection of vulnerable groups), so that short-term crisis responses evolve into sustained structural change (Chong & Druckman, 2007; Druckman, 2001; Scheufele, 1999; Link & Phelan, 1995; Adler & Newman, 2002; Krieger, 2001; Bambra et al., 2020; Rutter et al., 2017; Entman, 1993; Iyengar, 1991; Nisbet, 2009; CSDH, 2008; OECD, 2019; Marmot, 2010).

5.2 Conclusion

This study quantified long-term changes in public- and individual-responsibility framing, affect (anxiety, anger, hope), and policy-alternative discourse in a corpus of South Korean newspaper articles containing the query “health AND inequality” from 2000 to 2024. Using text mining and lexicon-based sentiment analysis, and integrating the findings through a system dynamics perspective, we proposed a feedback structure linking framing, affect, and policy discourse. In summary, the public-responsibility frame is strongly coupled with policy-alternative discourse, and during 2020–2024, increases in crisis recognition (anxiety) coincided with rising solution-oriented affect (hope). This suggests that in crisis contexts, discourse on health inequality can be reconstituted as a public policy agenda.

Several limitations should be acknowledged. First, because the analysis relies on standardized “feature extraction” text rather than full article content, it does not fully capture contextual nuance. Second, the affect measures are preliminary lexicon-based indicators rather than machine-learning-based sentiment models. Third, the corpus is limited to articles retrieved with the query “health AND inequality,” and does not include synonymous terms such as “health disparity” or “health equity.” Future research could extend the analysis by incorporating full-text morphological parsing, sentence-level frame classification, controls for article type and media ideology, and simple stock-and-flow simulations within a system dynamics framework to more precisely model the dynamics of policy alternatives (CSDH, 2008; Marmot, 2010; Solar & Irwin, 2010; Sterman, 2000; Luke & Stamatakis, 2012; Rutter et al., 2017; Entman, 1993; Grimmer & Stewart, 2013; Gentzkow et al., 2019; Pang & Lee, 2008; Liu, 2012; Mohammad & Turney, 2013).

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Ethics statement: This study analyzes publicly available newspaper texts and does not involve human participants, personal health data, or interventions. Institutional review board approval was therefore not required.

CRediT author statement (optional but recommended):

Young-Chool Choi: Conceptualization; Methodology; Formal analysis; Data curation; Visualization; Writing – original draft; Writing – review & editing.

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