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ORIGINAL RESEARCH ARTICLE

Unveiling the Biosimilar Paradox of Oncologists' Perceptions and Hesitations in South Korea: A Web-Based Survey Study

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Abstract

Introduction Biosimilars offer a cost-effective alternative to original biopharmaceuticals with comparable efficacy and safety. The perception and familiarity of prescribers toward biosimilars play a critical role in their market penetration. Yet, few studies have explored the perception of oncologists toward biosimilars, much less in Asia.

Objectives The objective of this study is to understand barriers of adopting biosimilars among oncologists and explore strategies to promote their use in clinical practice settings.

Methods A web-based survey was conducted among Korean oncologists from September to October 2022, assessing their perception of biosimilars and prescribing practices.

Results Among the 118 surveyed oncologists, 75.4% (89 out of 118) had previously prescribed biosimilars. When asked about their preference, 48.3% (57 out of 118) of the respondents preferred originators to biosimilars, whereas 16.1% (19 out of 118) favored biosimilars over the originators. The primary reason for preferring the originators was trust in safety and efficacy (94.7%, 54 out of 57). Still, a paradox was noted as 87.0% (47 out of 54) and 85.2% (46 out of 54) of these also acknowledged the comparable efficacy and safety of biosimilars. A relatively small number of the respondents (16.1%, 19 out of 118) did not consider prescribing biosimilars to biologic-naïve patients at all, and up to 56.8% (67 out of 118) expressed reluctance to switch prescriptions from originators to biosimilars. However, 90.7% (107 out of 118) of respondents considered changing their prescription to biosimilars if patients faced financial stress. Concerns regarding the efficacy when switching to biosimilars were expressed by 42.7% (38 out of 89) of oncologists with biosimilar prescribing experience, increasing to 69.0% (20 out of 29) among those without such experience.

Conclusion Korean oncologists perceived biosimilars to be as safe and effective as originators. However, there is a notable mismatch between this perception and their prescribing practices, particularly among those who have not prescribed biosimilars before. The financial burden of patients served as a significant driver for prescribing biosimilars, yet marginal price differences between originators and biosimilars may be associated with the low adoption rate of biosimilars in Korea. Active price competition may enhance market penetration of biosimilars.

Key Points

Despite acknowledging the comparable safety and efficacy of biosimilars, Korean oncologists paradoxically exhibit a reluctance to prescribe the biosimilar.

Economic considerations serve as a powerful motivator for oncologists to contemplate the switch to biosimilars in Korea.

These findings underscore the need for more substantial price reductions and the implementation of demand-side policies to facilitate the widespread adoption of biosimilars, thereby achieving significant cost savings.

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1 Introduction

Biopharmaceuticals, with their high specificity and low toxicity, have emerged as a promising class of anticancer treatments by effectively targeting specific cancer cells [1]. Their growing use stems from their potential for personalized medicine and adaptability for individual patients [2], leading to improved treatment outcomes. As biotechnology continues to advance, biopharmaceuticals are poised to play a pivotal role in shaping the future of cancer therapy.

However, the growing prevalence of biologics in cancer treatment is accompanied by high prices, placing significant strain on healthcare budgets [3, 4]. This financial burden is projected to escalate with the utilization of high-priced immunotherapies [5] and the introduction of advanced treatment options such as chimeric antigen receptor (CAR)-engineered T cell therapies, which cost up to half a million US dollars (USD) per treatment [6]. Consequently, the widespread adoption of biosimilars presents an opportunity to alleviate financial burden, particularly as patents for major biologics approach expiration [7–12].

At present, Korea has authorized 41 biosimilars for use, including 10 indicated for cancer treatment. The industry landscape is on the cusp of significant changes as several high-cost immunooncology biologics, such as pembrolizumab (Keytruda®, Merck Sharp & Dohme Corp.) and nivolumab (Opdivo®, Ono Pharmaceutical Co.), with patents expiring in 2028, and atezolizumab (Tecentriq®, F. Hoffmann-La Roche AG), with its patent expiring in 2032, approach the end of their exclusivity [11, 12]. As a result, more biosimilars are expected to enter the market, expanding the range of biologic brands available for healthcare professionals to select for patient treatment. This trend is likely to enhance the options available to healthcare professionals and ultimately benefit patients [13].

South Korea has positioned itself as one of the global leaders in shaping biosimilar industry [14–16], notably being the birthplace of the world's first monoclonal antibody biosimilar for infliximab. Furthermore, this Korean company took the lead in developing the first antibody biosimilar for anticancer drug, trastuzumab [14]. Despite this notable achievement, the market penetration of biosimilars in Korea remains considerably lower than that observed in countries such as the United Kingdom or France [17]. For instance, in the first quarter of 2018, the adoption rate of infliximab biosimilars in the United Kingdom reached 89%, whereas it was only 35% in Korea [17]. Given that demand-side policies, such as prescription guidelines or monitoring prescription patterns, have been implemented many countries, including the United Kingdom and France, whereas they were lacking in Korea [17], the perception of physicians toward biosimilars plays a critical role in determining market penetration of biosimilars in Korea. Furthermore, the prevailing approach in Korea, especially in oncology, tends to be physician-centered rather than patient-centered or multidisciplinary [18–20], further emphasizing the physicians' perception in the adoption of biosimilars. It has been reported that Asian gastroenterologists, compared with their European counterparts, expressed greater concerns and less confidence in the use of biosimilars in clinical practice [21], which could explain the low market share of biosimilars in Korea and Japan [17, 22].

In a global context, studies from various countries have revealed a wide range of healthcare providers' perceptions and attitudes toward biosimilars. Some studies have shown that 54–97% of physicians express confidence in prescribing biosimilars [13, 23–25], with a notable shift in Europe, where those with low confidence decreased from 63 to 19.5% over time [26]. However, other studies have pointed out concerns, such as doubts about interchangeability, efficacy, and safety [27–30]. Moreover, the intention to prescribe biosimilars seems to be influenced by multiple factors, such as previous prescribing experiences and the perceived acceptability by patients [13, 24, 27, 30]. Thus, understanding these global trends is crucial to contextualize and compare the findings from our current study in Korea.

The perception of prescribers regarding their interchangeability of biosimilars is crucial, as biosimilars are highly similar but not identical to the originators in terms of their safety and efficacy [13]. Given that the perception toward biosimilars vary across specialties, perceptions conducted in other specialties might not be generalizable to oncologists [31]. Thus, it is important to specifically identify the perception of oncologists toward biosimilars. Also, prescribers' preference for biosimilars have been shown to differ based on the timing of the survey and specialties [30, 32]. However, there is a lack of recent studies conducted among oncologists regarding their perception toward biosimilars, much less in Asia.

Accordingly, we conducted online surveys to gather the perception of oncologists regarding the use of biosimilars in Korea. Specifically, we sought to identify the factors associated with the barriers to biosimilar utilization among oncologists and explore strategies to promote the adoption of biosimilars in clinical practice in Korea.

This study seeks to address these gaps by conducting a targeted investigation into the perceptions of Korean oncologists regarding biosimilars. Our goal is to enhance our comprehension of the factors influencing biosimilar adoption among oncologists, a relatively understudied area, particularly in the Asian context. Our findings are intended to inform targeted interventions and policies aimed at promoting utilization of biosimilars in cancer treatment.

2 Methods

2.1 Survey Design

Questionnaires were developed based on previous studies to understand the perception of oncologists and utilization of biosimilars in oncology practice [13, 24, 32–35]. Additionally, several items utilized adaptive questioning techniques, which were displayed conditionally based on responses given to other items. This approach aimed to minimize the overall number of questions and simplify their complexity. Two medical oncologists (D.K. and B.K.) reviewed and tested the questionnaires for feasibility, validity, and technical functionality to address any potential logistical issues. The survey covered topics such as prescription practices, experiences, motivations, safety, efficacy, and value of biosimilars. It also assessed oncologists' intent to incorporate biosimilars and potential for the broader adoption. The survey spanned eight screens (pages), with two to four questionnaire items per page. The survey was conducted in Korean, and the English version of the questionnaire is available in the Online Resource.

2.2 Target Population

The target population for the web survey was a convenience sample of oncologists, specifically chosen based on their availability and willingness to participate. Participants were required to be oncologists practicing at either general or general tertiary hospitals. There are approximately 400 oncologists in South Korea meeting this criterion. Remarkably, 93.8% of them, or 375 oncologists, are members of the Korean Cancer Study Group (KCSG). The KCSG is a leading oncology academic society in Korea, recognized for its pivotal role in conducting and supporting cancer research. To maximize response rate, all oncologists currently practicing at a general or general tertiary hospital were included (no exclusion criteria). We sent invitations to participate in the web survey to the 375 members of KCSG via email. To protect the confidentiality of their membership, KCSG autonomously handled the distribution of email invitations for the survey.

2.3 Survey Procedure

A national web-based, voluntary, self-administered survey was conducted over a period of 15 days, from 28 September 2022 to 12 October 2022. The initial contact with potential participants was made on the internet. An email invitation for this closed survey included a link to the online survey platform. Upon accessing the survey, participants were presented with an informational page outlining the purpose of the survey. The survey questionnaires were structured in such a way that respondents were required to answer all questions before being able to submit their responses, ensuring the completeness of the collected data. Additionally, respondents were able to review and change their answers during the process. To prevent duplicate submissions, the survey tool utilized cookies to allow only one response per computer or device and restricted further access to the questionnaire once a participant completed the survey. Upon completion of the survey, participants were offered a coffee coupon as a token of appreciation for their time and input.

2.4 Ethical Approval

The study was conducted in accordance with the national ethical guidelines for research. To ensure complete anonymity for all participants, a study setting was implemented. The study received approval from the Institutional Review Board of Ewha Womans University (IRB ewha-202209-0016-01).

2.5 Statistical Analyses

The survey comprised 18 questions, offering closed-end responses including single and multiple-choice options. A Likert scale was used to rank their agreement on a scale of either 1–3 or 1–5, depending on the question. Categorical data were analyzed by calculating frequencies and proportions, and data visualization was done using bar plots and stacked bar plots. Descriptive analysis included frequency and cross tabulation, and the chi-square test was applied to examine group differences. A significance level of less than 0.05 was considered statistically significant. Data were analyzed using SAS 9.4.

3 Results

3.1 Respondent Characteristics

Every respondent who agreed to participate successfully completed the questionnaire, thus achieving a 100% completion rate. Invitations were emailed to 375 oncologists, yielding a response rate of 31.5%. Of the 121 initial respondents, 3 were excluded for not meeting the inclusion criteria (not currently practicing oncologists). Hence, for the purposes of maintaining the quality and reliability of our data, only completed questionnaires were analyzed. The final analysis included a total of 118 participants, resulting in a response rate of 31.5%. The demographic characteristics of the survey participants included in the final analysis are presented in Table 1.

Table 1 Characteristics of the respondents

	N	%
Years of practice as a specialist		
< 10	18	15.3
10–19	57	48.3
20–29	39	33.1
> 30	4	3.4
Hospital location[a]		
Metropolitan	79	66.9
Nonmetropolitan	39	33.1
Level of clinical facility		
Tertiary hospital	80	67.8
General hospital	38	32.2
Type of clinical facility		
Private hospital	80	67.8
Public hospital	38	32.2
Total	118	100.0

[a]"Metropolitan" includes Seoul, Incheon, and Gyeonggi, while "nonmetropolitan" includes Busan, Ulsan, Gyeongnam, Daegu, Gyeongbuk, Daejeon, Chungcheong, Sejong, Gwangju, Jeonra, and Gangwon

Table 2 Korean oncologists' preferences for originators versus biosimilars and the reasons for preference

	N	%
Preference of biosimilars compared with the originators ($N = 118$)		
Strongly preferred originators	7	5.9
Slightly preferred originators	50	42.4
Neutral	42	35.6
Slightly preferred biosimilars	16	13.6
Strongly preferred biosimilars	3	2.5
Reasons for preferring originators ($N = 57$[a])		
Trust originator (safety, efficacy)	54	94.7
OOP difference not significant	37	64.9
Preference for foreign pharmaceutical companies	1	1.8
Reasons for preferring biosimilars ($N = 19$[a])		
Decreased patient's OOP	15	78.9
Trust biosimilar (safety, efficacy)	11	57.9
Prefer to domestic product	9	47.4
Saving on NHI expenditure	9	47.4

Survey question: How would you rate your preference toward biosimilars compared with originators? What are the reasons for your preference for originators or biosimilars?

OOP Out-of-pocket, *NHI* National Health Insurance

[a]Multiple choices allowed

3.2 Biosimilar Preferences and Perceptions

3.2.1 Preferences

The survey results revealed that nearly half of the respondents (48.3%, $n = 57$ out of 118) preferred originators over biosimilars, with 94.7% ($n = 54$ out of 57) citing trust in the safety and efficacy of originator as the main reason. Interestingly, of these respondents prioritizing safety and efficacy ($n = 54$), 87.0% ($n = 47$ out of 54) and 85.2% ($n = 46$ out of 54) believed biosimilars offer comparable levels of efficacy and safety, respectively.

Additionally, a marginal difference in out-of-pocket (OOP) cost between the originators and biosimilars was mentioned as the reasons for their preference towards originator (64.9%, $n = 37$ out of 57). In contrast, 16.1% ($n = 19$ out of 118) favored biosimilars, with 78.9% ($n = 15$ out of 19) stating that reducing the financial burden for patients was the primary motivation (Table 2).

For a more detailed understanding, we conducted a subgroup analysis on factors such as hospital location and type of clinical facility. When focusing on hospital location, 58.2% ($n = 46$ out of 79) of the respondents in the metropolitan area (Seoul, Incheon, and Gyeonggi) slightly or strongly preferred originators, while only 7.6% ($n = 6$ out of 79) preferred biosimilars. In contrast, in nonmetropolitan areas, the preference for originators was diluted, with 28.2% ($n = 11$ out of 39) of respondents favoring originators and 33.3% ($n = 13$ out of 39) preferring biosimilars ($p < 0.001$, chi-square test). Moreover, upon examining the type of clinical facilities, both public (57.9%, $n = 22$ out of 38) and private hospitals (43.8%, $n = 35$ out of 80) consistently favored originators. However, compared with private hospitals (12.5%, $n = 10$ out of 80), public hospitals showed a more pronounced preference for biosimilars (23.7%, $n = 9$ out of 38). This heightened preference can be attributed to the fact that oncologists in public hospitals had fewer neutral opinions.

3.2.2 Determinants of Biosimilars versus Originators Prescription

When considering the determinants for prescribing biosimilars or originators, the survey revealed that efficacy was considered the most crucial factor. A total of 95.8% ($n = 113$ out of 118) of the respondents rated efficacy as important (37.3%, $n = 44$) or very important (58.5%, $n = 69$), a significant majority. Safety ranked closely behind, with 94.1% ($n = 111$ out of 118) of respondents considering it very important (44.1%, $n = 52$) or important (50%, $n = 59$).

In contrast, patient preference was given less importance, with only 5.1% ($n = 6$) and 33.1% ($n = 39$) of the respondents rating it as very important and important, respectively, in the decision-making process for prescribing biosimilars or originators (Fig. 1). Meanwhile, 16.1% ($n = 19$ out of 118) of all respondents stated they would not consider prescribing biosimilars to biologic-naïve patients.

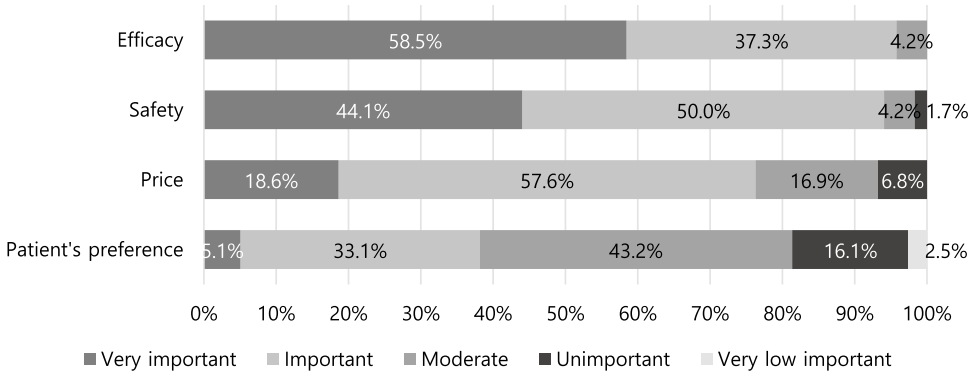

Fig. 1 Factors influencing the prescription of biosimilars (n = 118). Survey question: How would you rate the relative importance of the following factors in prescribing biosimilars: (1) efficacy, (2) safety, (3) price, or (4) patient's preference?

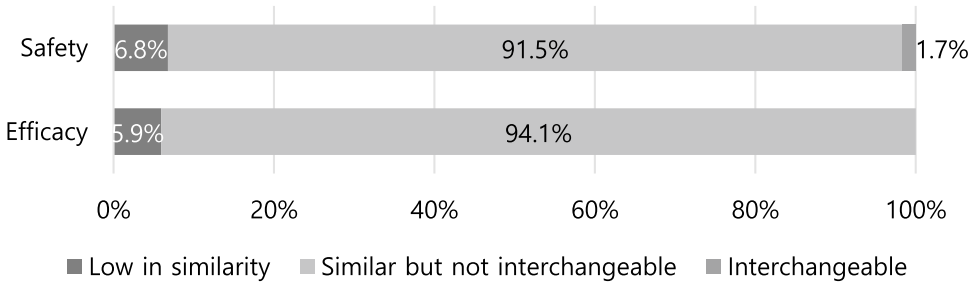

Fig. 2 Evaluating the therapeutic comparability of biosimilars and originators. Survey question: How do you rate the comparability of biosimilars with reference to originators in terms of (1) safety and (2) efficacy?

3.2.3 Safety and Efficacy of Biosimilars: Perceived Comparability with Originators

The survey results indicate that the majority of respondents recognized the safety and efficacy of biosimilars to be comparable with the originators. Specifically, 91.5% (n = 108 out of 118) and 94.1% (n = 111 out of 118) of the respondents perceived the safety and efficacy of biosimilars to be "similar but not interchangeable" to originators, respectively. Only 6.8% (n = 8 out of 118) and 5.9% (n = 7 out of 118) of the respondents believed that the safety and efficacy of the biosimilars were "low in similarity" to their originators, respectively. Interestingly, 1.7% (n = 2 out of 118) of respondents believed that biosimilars were "interchangeable" to originators in terms of the safety (Fig. 2).

3.3 Prescribing Biosimilars: Respondents' Experience and Rationales

3.3.1 Experience with Prescribing Biosimilars

The survey showed that a significant portion of respondents (75.4%, n = 89 out of 118) had prescribed biosimilars previously, yet 24.6% (n=29 out of 118) reported having no experience of prescribing biosimilars at all (Fig. 3A). Specifically, 30.5% of the respondents (n = 36 out of 118) had both switched from originators to biosimilars and prescribed to biologic-naïve patients. 43.2% (n = 51 out of 118) of the respondents reported having prescribed biosimilars only to biologic-naïve patients, while merely 1.7% (n = 2) reported having only switched to biosimilars. Interestingly, 12.7% (n = 15 out of 118) of respondents expressed a desire to prescribe biosimilars but were unable to do so due to external factors, such as not being included in the formularies (n = 8) or disagreement from patients (n = 7, data not shown).

The primary reasons for prescribing biosimilars were their economic value (cost effectiveness), both for biologic-naïve patients (51.7%, n = 45 out of 87) and those who switch from other biologics (52.6%, n = 20 out of 38). Furthermore, biosimilars were also prescribed when the originator biologics and their biosimilars were not listed in the Korean National Health Insurance (NHI), where a higher percentage was reported for biologic-naïve patients (32.2%, n = 28 out of 87) compared with the switch patients (26.3%, n = 10 out of 38). (Fig. 3B).

3.3.2 Rationales of Prescribing or Switching to Biosimilars

Figure 4 demonstrates that the financial burden of patients is the most frequent reason to prescribe biosimilars (90.7%, 107 out of 118), which is more than twice as high as the second-ranked reason (adverse events with originators, 33.1%, 39 out of 118). Figures 3 and 4 highlight that the primary motivation for prescribing and switching to biosimilars is to alleviate patients' financial burden. Another noteworthy reason is the response regarding efficacy. Respondents would not switch prescriptions when patients respond well to the originator (47.5%, n = 56 out of 118) and when patients have a poor response to the originator (56.8%, n = 67 out of 118)

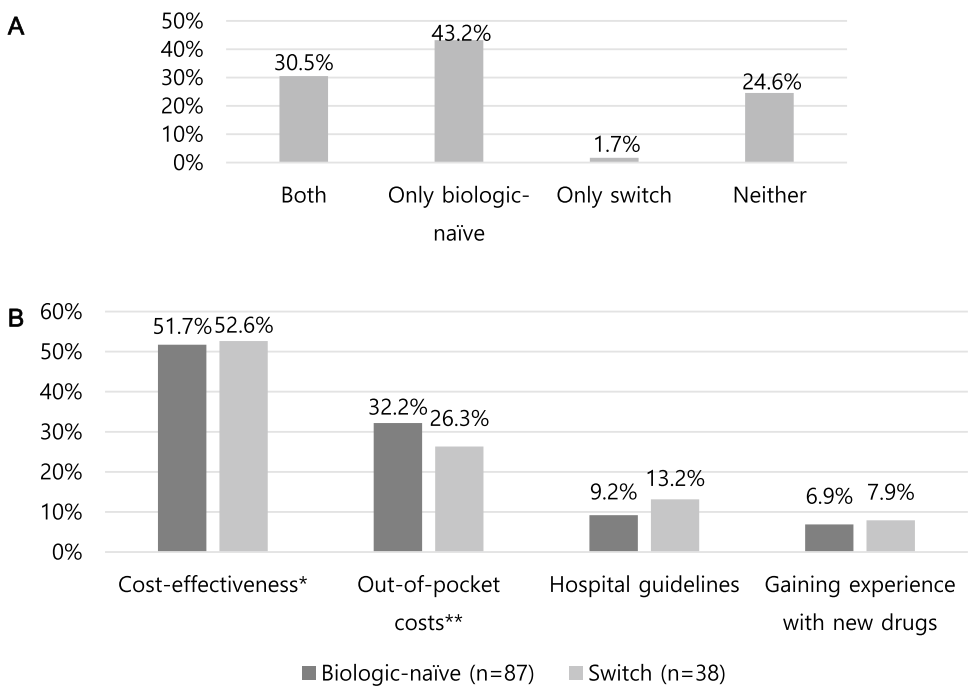

Fig. 3 **A** Respondents' experience of prescribing biosimilars ($n = 118$). **B** Primary reason for prescribing biosimilars (naïve = 87 and switch = 38). Survey question: **A** Have you ever prescribed biosimilars for biologic-naïve patients, switched a patient's anticancer treatment from originators to biosimilars, both, or none? **B** What was your primary reason for (1) initiating treatment with biosimilars ($n = 87$) and (2) deciding to switch patients to biosimilars ($n = 38$)?. *"Cost-effectiveness" means measures of the value of the drugs; namely, it considers health outcomes (efficacy and safety) relative to cost. **"Out-of-pocket costs" reflects patients' financial burden (eSupplementary Information)

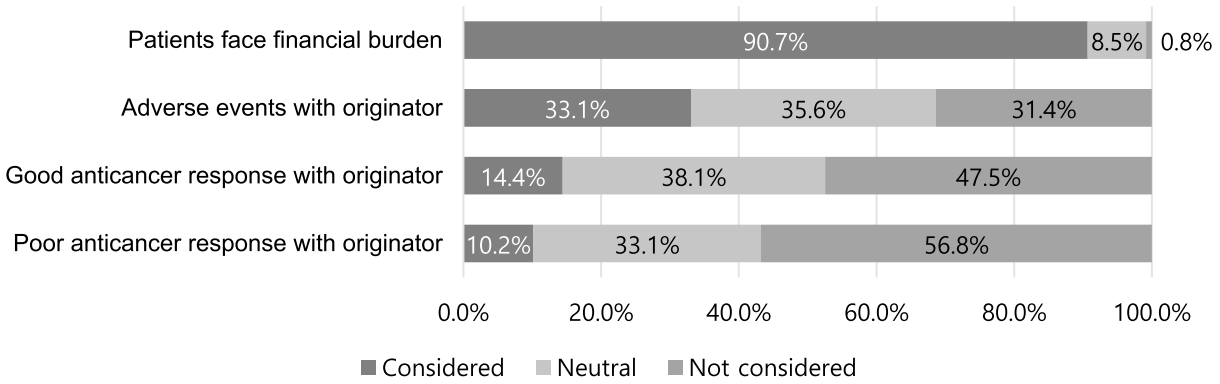

Fig. 4 Consideration of prescribing biosimilars in different scenarios with the availability of both biosimilars and originators ($n = 118$). Survey question: If both biosimilars and originators are available for prescribing, which type of patients would you consider prescribing these to: (1) those who perceive the cost of the originators as burdensome, (2) those who have experienced adverse events with the originators, (3) those who have had a good anticancer response with the originators, or (4) those who have had a poor anticancer response with the originators?

(Fig. 4), which indicates that the perception of efficacy plays a role in the decision to prescribe to biosimilars.

3.3.3 Concerns When Switching Prescriptions to Biosimilars

In terms of concerns related with switching to biosimilars, efficacy emerged as the primary concern for 49.2% ($n = 58$ out of 118) of oncologists (Table 3). All seven respondents, who believed that biosimilars were less effective than originators, are included in this group. Furthermore, it was found that among those respondents who had previously prescribed biosimilars, 42.7% (38 out of 89) harbored concerns regarding efficacy when switching patients to biosimilars. This percentage rose to 69.0% (20 out of 29) among respondents who had not prescribed biosimilars before, indicating a heightened level of concern about efficacy when considering a switch to biosimilars for those with no prior experience prescribing them.

Regarding patient-related factors when switching to biosimilars, the most significant concern was that the patients' trust in pharmacological intervention might decrease with using biosimilars. A majority of 66.9% ($n = 79$ out of 118) of respondents emphasized the necessity of providing patients with detailed explanations regarding their

Table 3 Prescribers' expressed concerns regarding switching from originator to its biosimilars

	N	%
Therapeutic concerns when switching the prescription to biosimilars ($N = 118$)		
Efficacy	58	49.2
Safety	32	27.1
Quality control	14	11.9
No concerns	14	11.9
Concerns for the patients when switching to biosimilars ($N = 118$)		
Lack of confidence in the efficacy	71	60.2
Decreased trust in the physician	26	22.0
Adherence	6	5.1
No concerns	15	12.7
What should be communicated to patients when switching from originators to its biosimilars ($N = 118$)[a]		
Reasons for switching	79	66.9
Cost	59	50.0
Adverse effects	25	21.2
Mechanism of action	26	22.0
Not explained to the patient	35	29.7

Survey question: (1) What are your therapeutic concerns when switching a prescription from the originators to biosimilars? (2) What concerns might patients have when their prescription is switched to biosimilars? (3) What information should be communicated to patients if you switched from originators to its biosimilars?

[a]Multiple choices allowed

medication choices, as outlined in Table 3. These findings shed light on the importance of addressing concerns about efficacy and ensuring effective communication with patients when prescribing biosimilars.

4 Discussion

In this first, national-level survey targeting oncologists in Korea, we identified that Korean oncologists perceive biosimilars positively in terms of efficacy and safety, yet their utilization did not match their perception. Specifically, we discovered that there first was a paradoxical reluctance about biosimilars among the respondents. Intriguingly, while a majority of the respondents who preferred originators (94.7%, $n = 54$ out of 57) expressed a high level of trust in the safety and efficacy of originators, over 90% of them also acknowledged that biosimilars present comparable levels of safety and efficacy as originators. This recognition of the comparable safety and efficacy between originators and biosimilars aligns with findings from previous studies [29, 36–38]. However, despite this acknowledgment, there remains an underlying concern about switching to biosimilars. Notably, among those who expressed a preference for originators due to their safety and efficacy ($n = 54$), 87.0% ($n = 47$ out of 54) and 85.2% ($n = 46$ out of 54) believed that biosimilars offer comparable levels of efficacy and safety, respectively. These findings highlight the influence of unconscious biases and the complexity of decision-making processes, as demonstrated by behavioral economic research [39, 40]. This research suggests that patients and providers may not always make rational economic decisions due to inherent biases, impacting the adoption of biosimilars. This paradoxical perception signals that the low adoption rate of biosimilars in South Korea cannot be simply addressed by promoting or educating on the safety and efficacy of biosimilars alone.

Second, Korean oncologists show a strong preference for originators over biosimilars. The survey results highlight the inclination of respondents towards originators, with nearly half of them (48.3%, $n = 57$ out of 118) expressing a preference for originators over biosimilars. This preference is consistent with findings from previous studies [24, 26–28, 41, 42]. Interestingly, among those respondents who had experience prescribing biosimilars, 42.7% ($n = 38$ out of 89) expressed concerns about efficacy, while 69.0% ($n = 20$ out of 29) of those who had not prescribed them expressed concerns, suggesting that those with experience prescribing biosimilars tended to have a more positive perception of the efficacy of biosimilars. Korean oncologists, compared with physicians in other specialties, tend to place greater importance on the absence of negative impacts on safety and efficacy [33]. These perceptions could act as a barrier to the widespread adoption of biosimilars [43]. Our findings emphasize the importance of fostering proactive biosimilar policies to

increase actual exposure. By gaining more experience and exposure with biosimilars, oncologists may become more comfortable with their use and promote their wider usage in oncology practice.

Third, Korean oncologists demonstrate reluctance to switch to biosimilars, particularly for patients who have already received biologics. Although only 16.1% ($n = 19$ out of 118) of respondents were hesitant to prescribe biosimilars to biologic-naïve patients, a significantly larger proportion (31.4–56.8%, $n = 37$ to 67) expressed reluctance to switch prescriptions for patients who were already on biologics, with reasons extending beyond economic considerations. Our finding is consistent with previous studies, which indicated that gastroenterologists are more likely to prescribe biosimilars for biologic-naïve patients compared with those who are already on biologics [26, 28, 31] These findings highlight the need for targeted educational efforts and evidence-based communication to address concerns and increase awareness about the safety, efficacy, and appropriate use of biosimilars among patients who have previously received biologics.

Lastly, it is noteworthy that 90.7% of the respondents would prescribe biosimilars when patients face financial burden. Additionally, there was a higher preference for biosimilars among respondents from nonmetropolitan areas and public hospitals, which tend to serve a higher portion of low-income patients. Therefore, financial considerations play a critical role in the market penetration of biosimilars. Our subgroup analysis revealed that, with the exception of those in nonmetropolitan areas, respondents across all other subgroups exhibited a higher preference for originators. This is not surprising, as it aligns with what has been reported in numerous previous studies [24, 26–28, 41, 42]. However, what notably stands out and demands attention is the unexpectedly elevated preference for biosimilars in nonmetropolitan areas and public hospitals. While the primary empirical advantage of biosimilars is cost savings [23, 26, 29, 30, 36, 44–46], this factor may have limited impact in South Korea, where biosimilars are only 20% cheaper than originators. This marginal price difference makes biosimilars less financially attractive to healthcare providers and patients [17]. Furthermore, the copayment reduction for cancer patients in South Korea further diminishes the perceived price difference, potentially creating a "trap" of the cost-sharing waiver program. This situation poses challenges in promoting the prescription of biosimilars. Similar patterns have been observed in other countries. For example, a study conducted in Belgium found that rheumatologists showed no preference (0%, $n = 0$ of 41) for biosimilars when they were priced identically to originators [41]. In Ukraine, the majority of physicians, especially oncologists, demanded that the prices of biosimilars be 40–50% lower than originators, with oncologists specifically expecting price reductions of more than 50% [46]. Thus, to maintain a competitive edge in the market, biosimilars should be priced considerably lower than originators [47].

These characteristics may account for the relatively low prescription rate in Korea, despite its status as a biosimilar powerhouse. While some studies suggest that providing demand-side policies, such as clinical evidence of biosimilars and educating healthcare providers, are crucial for increasing their prescription rates [14, 30, 32, 48, 49], our research suggests that clinical information alone may not be sufficient to drive the expected prescribing habits among physicians. Therefore, alternative policy initiatives, including supply-side measures (such as price reduction), are necessary to address barriers to biosimilar adoption. While policies targeting both the supply and demand sides have been adopted in various countries to promote sustainable use of biosimilars, Korea has had limited availability of supply-side measures, such as price reduction [17]. Implementing more assertive price reduction measures, in conjunction with proactive demand-side interventions such as educating physicians and patients, can significantly boost the adoption of biosimilars in the market. In general, supply-side regulations, such as price linkage and tendering, can deliver short-term savings but potentially hinder long-term biosimilar penetration, whereas demand-side strategies, such as pharmaceutical budgets for prescriptions and physician-targeted financial incentives, are generally seen as fostering positive biosimilar uptake [50]. For instance, the United Kingdom not only applies supply-side policies but has also established forceful demand-side strategies. These include a target of having 90% of new patients prescribed with the most cost-effective biological medicine within 3 months of a biosimilar's launch and an aim to have at least 80% of existing patients switch within a year [51]. These measures have proven effective, with biosimilar rituximab accounting for 80% of total rituximab prescriptions within 10 months and biosimilar trastuzumab achieving the same rate in only 8 months [52]. Based on these findings, it becomes critical for South Korea to consider not only strengthening the price advantages of biosimilars, but also implementing demand-side policies, such as providing prescription requirements/guidelines or monitoring prescription [8, 53].

Although our study represents the first investigation of the attitudes of oncologists toward biosimilars in South Korea, several limitations of the survey should be acknowledged. The methodology of our survey carries certain limitations. The use of closed-ended questions, for instance, has the potential to limit the depth and complexity of respondents' feedback. Also, although the questionnaire was pretested by oncologists, it was done by the authors, which is another limitation. While the response rate in our study is about 30% (118 oncologists) may raise concerns about its

representativeness, it is crucial to contextualize this within the scope of our specific population—an academic medical society encompassing both active and nonactive physicians. Thus, within this specialized group, our yield could be considered fair. Indeed, our response rate aligns with that of similar studies where rates have ranged between 4 and 47% [21, 24, 33, 34, 54–56], demonstrating the targeted nature of these surveys. However, due to the limited number of oncologists in public hospitals, our result should be interpreted with caution. Furthermore, physicians from other specialties, such as rheumatology or dermatology, might hold different perceptions toward biosimilars compared with oncologists. Thus, our findings may not be generalizable to other specialties, and further research is needed to understand the perceptions and preferences of healthcare providers in different medical fields. Finally, assumptions were made about the familiarity with biosimilar terminology in South Korea, given that their use has exceeded a decade; however, no consideration was given to potential knowledge gaps. The survey was conducted at a specific time point when only a limited number of oncology biosimilars were available. However, it is important to note that oncology biosimilars currently constitute the largest segment of the biosimilar therapeutics market [57]. Given the anticipated growth of this segment in the near future, the findings derived from our study hold considerable significance. In future research, an interesting avenue could involve collecting data directly from patients to gather their perspectives and experiences.

5 Conclusion

Despite positive perception of biosimilars among oncologists, there seems to be a disconnect between their perception and the actual prescription of biosimilars. The primary driver for prescribing biosimilars has been the financial burden placed on patients. Therefore, the marginal price difference between originators and biosimilars, rather than negative perception of biosimilars, may be associated with the low adoption rate of biosimilars in Korea. Further price reduction of biosimilars and ensuring biosimilars' affordability relative to originators may enhance market penetration of biosimilars.

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Declarations

Author Contributions All authors have contributed to this study, reviewed and approved the final version of the manuscript. Conceptualization, GS and SB; participation in the study design, BK, SB, and DK; investigation, GS and SB; data collection, DK and GS; interpretation of the results, GS, DK, BK, and SB; writing—original draft preparation, GS; writing—review and editing, DK and SB; supervision, DK and SB; project administration, SB.

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Availability of Data and Material Survey materials used in the current study are included in the Supplementary Information. The raw data generated during this study are not publicly available due to privacy restrictions but are available from the corresponding author upon reasonable request.

Code Availability Not applicable.

Conflict of Interest The authors declare no conflict of interest.

Ethics Approval The study received approval from the Institutional Review Board of Ewha Womans University (IRB ewha-202209-0016-01).

Consent to Participate Written informed consent was obtained from all individual participants included in the study.

Consent for Publication All participants provided consent for their data to be published.

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