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Breaking the board: the rise of female Go players in Korea

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In the historically male-dominated world of Go—a game with a rich history and a current global player base of 46 million—recent years have marked a significant shift in gender dynamics, highlighted by Choi Jeong’s historic achievement as the first female to reach the open major world tournament finals. This study investigates the rise of female Go players in Korea through multiple lenses: descriptive analyses cover demographic data, Elo ratings, and competition statistics, while social representation analyses employ in-depth interviews and core-periphery analysis. A core finding is the profound transformation within the Korean Go community, where female players are not just witnessing increased representation but also significant enhancements in performance, opportunities, and financial rewards. Narratives from the players unravel the intricate web of performance disparities, community engagement, and evolving infrastructures. Economic incentives, societal and cultural shifts, and institutional support are identified as key contributors to their success. Beyond its application to professional Go, this research underscores a paradigmatic shift, illuminating strategies for fostering gender inclusivity in fields traditionally overshadowed by male dominance.

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Introduction

The game of Go, also known as Weiqi in Chinese and Baduk in Korean, is an abstract strategy board game for two players, each taking turns placing black and white stones on a grid with an objective to surround more territory than their opponent (Shotwell 2008). Originating over 2,500 years ago in China, Go has achieved global popularity, with over 46 million people worldwide knowing how to play Go and over 20 million active players (International Go Federation, 2016).

Despite its widespread popularity, the Go community has historically been dominated by men. This is reflected in the gender imbalance in professional Go leagues and tournaments, in addition to the overall player base. In most countries, less than 20% of the player base is female, with the female players making up less than 15% (International Go Federation, 2016).

However, recent years have witnessed a significant shift: the rise of Korean female Go players. Until 2008, Korean female players were largely obscure and less successful compared to their international counterparts. Over the past decade, this dynamic has changed significantly. The number of Korean female players has increased substantially and their performances have garnered global recognition. One of the landmark events in this transformation was Choi Jeong's historic achievement at the 2022 Samsung World Master, where she became the first female professional to reach the open major world tournament finals. Her achievement marked a significant milestone for women's Go, highlighting the increasing prominence of female players in the game.

The social representation theory, developed by Serge Moscovici in 1961, offers a lens to interpret this change. According to this theory, societal shared beliefs and understandings, known as social representations, shape individual perception and interaction (Moscovici 1981; Wagner 2011). Traditionally, these social representations have viewed Go as a predominantly male domain, limiting female participation and success.

Our study investigates how the changing social representations of gender within the Go community have influenced the rise of Korean female Go players. Despite growing interest in gender dynamics in competitive gaming, little research has focused specifically on the experiences and achievements of female Go players. We aim to examine the societal and cultural factors that contributed to their success and investigate how this shift in representation may redefine the role of women in the intellectual game of Go.

To achieve this, we have framed our research around two key questions:

RQ 1. How has the representation, performance, and prize earnings of female Go players in Korea changed over time compared to their counterparts in other countries?

RQ 2. What are the social representations of female Go player in Korea?

We have adopted a mixed-method approach to address these questions. Descriptive analyses, including demographic, Elo rating, and Go competition analyses, were conducted to compare the representation, performance, and earnings of female Go players across the three major Go-playing countries: Korea, China, and Japan. Social representation analyses including in-depth interviews, thematic analysis, core-periphery analysis, and visualizing thematic relationship, were employed to comprehensively examine the social representations of gender that might influence the presence and success of female Go players in Korea. Drawing from this multifaceted approach, we will discuss the factors contributing to their success, and the broader impact of their achievements on Go community, with a focus on the implications for gender equality in gaming (Shevchuk et al. 2015).

Overall, this study aims to broaden our understanding of the challenges and opportunities women encounter in competitive intellectual pursuits, and how societal and cultural factors can shape their success as previously marginalized groups. Using Korean female Go players as a case study, this research illuminates broader issues of gender and power in intellectual competition. The insights derived from this study will contribute to the expanding body of literature on gender differences in gaming and could offer valuable perspectives for enhancing women's participation and representation in traditionally male-dominated fields (Passaretta and Triventi 2023; Samtleben and Müller 2022).

Background

The evolution of the professional Go system for female players.

The professional Go system, which certifies players to participate in official tournaments and earn from their gameplay, originated in 17th century Japan with the establishment of the Four Go Houses. These state-endorsed schools significantly enhanced gameplay due to the competitive environment they fostered (Ishida 1986). By the 20th century, they paved the way for the Japanese Go Association, formed in 1924, which elevated both the gameplay level and financial support within the system. The model's success inspired similar professional Go systems in other countries, including the Korea Go Association in 1945 and the Chinese Go Association in 1962. These organizations have expanded the game's global reach, managing regional professional Go systems, and promoting the game extensively (Moskowitz 2013; Kang et al. 2022).

The journey of the professional Go system for female players, however, has a shorter history. The game, traditionally associated with religious establishments, was initially only open to men at the professional level. The introduction of a professional Go system for women began post-World War II. Japan initiated this movement in 1952 with the All-Japan Women's Championship (renamed the Japanese Female Honinbo in 1982). Over time, Japan introduced additional tournaments for female players, such as the Japanese Female Meijin in 1988 and the Japanese Female Kisei in 1997 (Ishida 1986). Korea started its women's professional Go system in 1975, which was revived in 1990 after a 15-year hiatus. China embraced the women's professional Go system in 1982, highlighting its commitment when female player Rui Naiwei advanced to the semifinals of the Ing Cup World Go Championship in 1992 (Moskowitz 2013).

In the 21st century, Japan, Korea, and China have progressively developed their women's professional Go systems in response to the increasing number of female Go players. In 2000, China established a national women's Go team to foster top female players, and Korea and Japan followed with similar initiatives. A notable landmark was the inclusion of Go for the first time in the 2010 Guangzhou Asian Games, acting as a catalyst for expanding competitions for women's Go. These developments have resulted in an increase in the number of female players participating in Go (Cho & Nam 2012).

Female players in intellectual games

Female players in the game of Go. Scientific studies addressing the involvement of women in Go are scarce, with just a handful of research endeavors dedicated to this topic. A standout study by Cho and Nam explores the history of Korean women's Go, positioning it as the only paper focused on female players in the game of Go. The study delineates the growth of Korean women's Go into five distinct phases: the dawning period (1963–1973), the quickening period (1974–1980), the growing period (1981–1995),

the developing period (1996–2005), and the jumping period (2006–2010) (Cho & Nam 2012).

In the dawning period, the first Korean female Go tournament, Women's Wangwi occurred in 1963, with only a few women having the chance to play Go with men's support. The quickening period saw the establishment of the Korea Women's Baduk Federation in 1974 and the inception of the first recurring female Go tournament, Women's Guksu. Despite the emergence of the first female professional Go player in 1975, the professional Go system for women went dormant for about 15 years until 1989.

The growing period marked the proliferation of Go to various demographics, including girls, children, female students, working women, and housewives. During this period, the professional Go system for women was resuscitated, with the advent of multiple female Go tournaments and professional Go teams for women. The developing period was characterized by a rapid surge in the number of women participating in Go, with the count of female professional players growing, and professional institutions and systems created to nurture female players.

In the jumping period, Korean female Go players made a significant breakthrough by securing the gold medal at the Asian Olympics in Guangzhou. This period saw an expansion of women's activities in Go, resulting in an overall enhancement of women's status and role in the Go world.

While Cho and Nam's study is pioneering in its investigation of female Go players' history, it has certain constraints. The research is solely based on materials published in the "Baduk" magazine from 1967 to 2010, potentially neglecting key events or advancements outside this period or not reported in the magazine. This reliance on a singular source could narrow the study's viewpoint. Furthermore, the study is confined to the history of women's Go in Korea, which may limit its generalizability to other regions. Lastly, categorizing the history of women's Go into five distinct periods may oversimplify the intricate and nuanced progression over time. These constraints should be acknowledged when interpreting the findings, and more research is needed to gain a more holistic understanding of the history and advancement of women's Go.

Female players in chess. Chess and Go share parallels that allow for the interchange of ideas. Both board games necessitate strategic cognition, pattern recognition, and decision-making abilities. Research dedicated to chess provides an opportunity to apply existing knowledge and expertise to Go, specifically in relation to female players.

The engagement of female players in chess has often been influenced by several factors such as disparity in access to resources, cultural stereotypes, and the impact of societal and economic structures. Unequal access to educational and resource opportunities is a prominent factor impacting the involvement of female players in chess. Studies reveal that females, from young girls to women, often face limited access to quality coaching, training facilities, and other essential resources for skill improvement, potentially affecting their performance in comparison to their male counterparts (Bilalić et al. 2009).

Prevailing cultural norms and stereotypes also play a significant role in the gender imbalance in chess. Female players often face societal pressures or stereotypes that deter them from seriously pursuing chess. Research suggests that gender stereotypes can detrimentally affect female chess players' self-confidence, resulting in reduced participation and underperformance (Charness and Gerchak 1996; Eccles 1987; Steele 1997; Maass et al. 2009; Cassell and Jenkins 2000; Lucas and Sherry 2004). Societal gender role expectations can further discourage female players by pressuring them to prioritize familial and caregiving responsibilities over their chess careers, thus restricting their time and

energy for training and competition (Chabris and Glickman 2006).

Societal and economic systems also contribute to the gender imbalance in chess, especially regarding women's opportunities. Access to resources, representation, and cultural norms significantly impact the gender disparities observed in chess (Handelman et al. 2005). Some research indicates that female chess players in countries with less gender equality typically have lower participation and performance rates (Howard 2005; Cassell and Jenkins 2000).

While some studies examine potential biological differences in cognitive and spatial abilities between genders, such as the Spatial Abilities Hypothesis suggesting men might have superior spatial skills compared to women, influencing game performance (Halpern 2013; Voyer et al. 1995; Feng et al. 2007), these studies have yet to consistently and conclusively prove that such inherent biological differences significantly contribute to the gender gap in chess (Howard 2005; Bilalić et al. 2009; Cassell and Jenkins 2000).

In conclusion, the participation of female players in chess is influenced by a blend of factors, such as unequal access to resources, societal expectations and stereotypes, and the impact of social and economic systems. Addressing this gender disparity necessitates a comprehensive approach that ensures equal opportunities and support for female players. Understanding the factors affecting female players in chess can inform strategies to foster more balanced gender representation in the game of Go, enriching the community and advocating for equality in this classic strategic game. The research conducted on chess offers valuable insights and serves as a springboard for investigating the gender disparity in Go.

Social representation theory for gender dynamic study. Serge Moscovici introduced the Social Representation Theory in 1961, laying a foundation for understanding and applying social psychology (Moscovici 1961). The theory elucidates how shared social knowledge comes into existence and evolves over time, underlining its profound influence on individual behavior. A key component of this theory is the core-periphery structure, offering an in-depth understanding of the dominant and more marginal elements of these shared meanings (Jodelet 2008).

Social representations encompass a community's collective understanding and interpretation of reality, embodying the ideas, values, and practices that shape their worldview (Moscovici 1961). As a dynamic form of collective consciousness, social representations adapt in line with changing social, cultural, and historical contexts, reflecting a society's intellectual and emotional relationship with its environment (Jodelet 2008).

The core-periphery structure of social representations signifies the dichotomy within these collective interpretations. Central core elements embody the stable, consensus-based aspects of a social representation, expressing shared values, beliefs, and historical experiences of the community. These core elements often resist change and maintain the continuity of the representation across different contexts. In contrast, peripheral elements represent more flexible, context-dependent aspects. These elements interact closely with the immediate realities of everyday life and can adapt more easily to changing circumstances, facilitating the functional adaptation of social representations to new situations or experiences (Lo Monaco et al. 2017).

This theoretical lens helps articulate prevalent gender disparities, especially in fields such as sports and gaming. Gender-specific roles and stereotypes, often perpetuated by prevailing cultural narratives, shape individual perceptions and behaviors. This can lead to systemic biases that further reinforce gender disparities (Messner 1988; Jenson and de Castell 2010; Smith et al. 2015).

For instance, in sports, traditional narratives often position men as active participants and women as mere spectators. This implicit societal representation may discourage women from active participation, thereby contributing to gender imbalance in the field (Messner 1988). Similarly, in video gaming, a prevailing social representation identifies it as a ‘male domain’, which can discourage women’s involvement and result in further gender disparities (Jenson and de Castell 2010; Kowert et al. 2014).

Understanding the social representation theory and its core-periphery structure can guide future research and interventions aimed at addressing these gender disparities. In strategic board games, it is observed that the social construction of games as male-dominated influences individual attitudes and perceptions, resulting in fewer women playing professionally (Bilalić et al. 2009; Maass et al. 2009).

Addressing this issue necessitates a critical examination of the traditional gender narratives and the challenge of existing social representations. This process involves reshaping both the core and peripheral elements of gender-based social representations to facilitate more balanced and equitable participation across various domains. By cultivating inclusive narratives and fostering adaptable, context-dependent peripheral elements, society can reshape the social representation of gender in these fields, working towards a more balanced and inclusive environment.

Methods

To answer the two research questions, a mixed-methods approach was employed. Descriptive analyses were performed to examine RQ1, and Social Representation analyses were performed to examine RQ2.

Descriptive analyses. To answer RQ 1, we conducted a comparative study focusing on the representation, performance, and earnings of female Go players in the top three Go-playing countries: Korea, China, and Japan (Dieckhoff et al. 2016). First, we evaluated the representation of female players using a demographic analysis, comparing the proportion of active female players. Second, we examined the performance of female players via the Elo rating system, comparing the Elo ratings of active female. Third, we delved into the earnings of female Go players via the Go competition analysis for the total number of competitions, average prize money, and total prize money of female Go competitions.

Demographic analysis. For the representation of the female Go players, we conducted a demographic analysis for female professional players within Korea, China, and Japan from 1994 to 2023. We identified 2379 global professional Go players during this period, categorized by nationality as follows: Korea had 456 players, China had 925 players, and Japan had 772 players. Their playing records were sourced from the Go4Go database, a globally recognized professional Go record database. Gender and nationality details were collected from the official databases of the professional Go associations, supplemented by with social media accounts and news reports when necessary.

To analyze the data, we calculated the annual proportion of active female Go players by dividing the number of active female players by the total number of active Go players in each country. Players who had been inactive for a minimum of one year since their last match were excluded from our analysis, as professional players retain their professional status indefinitely, even if they stop competing. We then plotted these ratios on a line graph with the years on the x-axis and the proportion of active female players on the y-axis, separated by country.

Elo rating analysis. For the performance of female Go players, we employed the Elo rating analysis for female professional players within Korea, China, and Japan from 1994 to 2023. The Elo rating system is a method to quantify the relative skill levels of players in zero-sum games such as chess and Go. Each player is assigned a numerical rating reflective of their past performance, with higher ratings indicating stronger players (Elo 1978). We employed a variant of the Elo rating system known as the Whole-History Rating (WHR). This modified version computes ratings across the entire history of all players, resulting in a more accurate representation by considering variations in player strengths over time (Coulom et al. 2008).

We collected the annual Elo rating of 2379 global players identified from our demographic analysis, resulting in a total of 27,419 data points from 1994 to 2023. The primary source of this data was Go Ratings, a global Go player site that generates player rankings based on Elo ratings.

We categorized active players by gender and nationality for each year within our timeframe, using the same criteria as in our demographic analysis. We then calculated the average Elo rating of active female Go players each year by dividing the sum of the Elo rating of active female players by the total number of Go players in each country. We plotted these average ratings on a line graph, with years on the x-axis and average Elo ratings on the y-axis, separated by country.

Go competition analysis. For the prize earning of female player, we examined Go competitions and associated prize money within Korea, China, and Japan. We gathered comprehensive details about each competition, including competition name, participant category (Open - all genders, Women’s—exclusively for female players), country, founding year, and the winning prize. The primary data source for this was Go associations in Korea, Japan, and China, supplemented with information extracted from various Go databases and media records.

We calculated the number of competitions, average year founded, and total prize money for each country and participant category. We only included national competitions that were active as of August 2023 and did not include any that were not held within their original organizing cycle.

The number of competitions was a simple count of the tournaments held in each category, indicating the level of activity and opportunities available for female players. The average year founded was computed by averaging the founding years of all competitions in a category. This metric indicates the historical development and longevity of support for female players; a lower average year suggests a longer history, while a higher average year points to more recent efforts in promoting female tournaments. The total prize money was computed by summing all the prize money in each category, reflecting the overall financial investment and support for female players in each country. Then, we created a bar chart of the total prize money for each country and participant category.

Social representation analyses. To answer RQ2, we undertook a comprehensive examination of social representations of gender that might influence the presence of professional female Go players in Korea. First, we conducted in-depth, semi-structured interviews with nine players to gain insights into their individual experiences and perceptions of gender dynamics within the Go community. Second, we proceeded with a thematic analysis, utilizing open, axial, and selective coding to identify emerging themes. Third, we employed the core-periphery algorithm to delineate the structure of the themes. And finally, we visualized the relationships of the themes for the social representation of gender dynamics.

Table 1 Biographical information of interviewed Korean Go professionals players.					
Full Name	Gender	Rank	Date of Birth	Professional Debut	Interview Date
Song Tae-kon	Male	9p	1986-09-08	1999-12-31	2023-02-16
Song Jihoon	Male	8p	1998-02-23	2015-01-16	2023-01-31
Won Seong-jin	Male	9p	1985-07-15	1998-01-01	2023-03-04
Choi Jeong	Female	9p	1996-10-07	2010-05-17	2023-02-19
Park Soyul	Female	3p	2004-09-21	2020-01-10	2023-02-11
Oh Jeonga	Female	5p	1993-03-24	2011-03-20	2023-02-06
Kwon Juri	Female	3p	1997-09-08	2015-08-21	2023-05-09
Kim Miri	Female	5p	1991-03-24	2008-11-06	2023-05-09
Kim Sangin	Female	3p	2002-09-22	2018-12-14	2023-05-10

Table 2 Interview guide topics and questions.	
Topic	Questions
Gender differences in Go	- How do you perceive gender differences in the game of Go?
Roles and expectations within the Go community	- What are your thoughts on the current gender dynamics in professional Go?
	- What roles and expectations are placed on male and female Go players within the community?
Instances of gender-based discrimination or bias	- How do these roles and expectations impact your career?
	- Can you share any experiences of gender-based discrimination or bias in the Go community?
Cultural factors impacting gender dynamics	- How do you think these experiences have affected your professional journey?
	- What cultural factors do you believe influence gender dynamics in Go?
	- How has the cultural context in Korea shaped the opportunities and challenges for female Go players?
Promoting gender equality and empowerment	- What strategies do you believe are effective in promoting gender equality in Go?
	- How can the Go community support the empowerment of female players?
PerfoRMANCE DISPARITY BETWEEN MALE AND FEMALE PLAYers	- What factors do you think contribute to performance disparities between male and female Go players?
	- How do you think these disparities can be addressed?
Engagement and commitment to the game	- How do levels of engagement and commitment to the game differ between genders?
	- What drives your personal commitment to Go, and how do you stay motivated?
Infrastructure and access to resources	- How does access to resources, such as training facilities and coaching, differ for male and female players?
	- What improvements in infrastructure do you think are necessary to support female players?
	- What is your experience with financial support and prize money?
Financial support and prize money	- How do economic incentives influence the participation and performance of female players?
	- Who have been your role models in Go?
Influence of role models	- How have they influenced your career?
	- What training opportunities are available to you, and how do they compare to those available to male players?
Training opportunities and physical capability	- How do you perceive the physical and mental demands of Go, and do you think they differ by gender?
	- How does fan support and sponsorship impact your career?
Fan support and sponsorship	- Do you think there is a difference in the level of support received by male and female players?

In-depth interviews. We recruited nine professional Go players from Korea, comprised of three males and six females based on their professional proficiency, diverse backgrounds, and willingness to share personal experiences. Notably, Choi Jeong, globally recognized as the top female Go player for her landmark victory at the 2022 Samsung World Master, was included due to her significant impact on the gender dynamics of Go. Detailed biographical information of our participants is provided in Table 1. All participants consented to the publication of their interviews and associated names.

The semi-structured in-depth interviews was designed following the principles of Social Representation Theory. Participants were guided by a list of themes outlined in Table 2, with follow-up questions, probes, and comments. The sequencing and wording of the questions were modified

by the interviewer to best fit the interviewee and interview context.

Interviews were conducted in person at locations convenient for each participant. Before the interview, the interviewer explained the purpose of this study to the participants, and they filled out a consent form. All interviews were recorded and transcribed, with each session lasting approximately one hour.

Thematic analysis. The transcribed interviews underwent a thematic analysis in alignment with the principles of Social Representation Theory. We implemented a three-step coding process: open, axial, and selective coding. This iterative process allowed us to uncover and refine emerging themes from the interviews.

In the open coding stage, two independent researchers conducted an initial review of the interview transcripts to identify

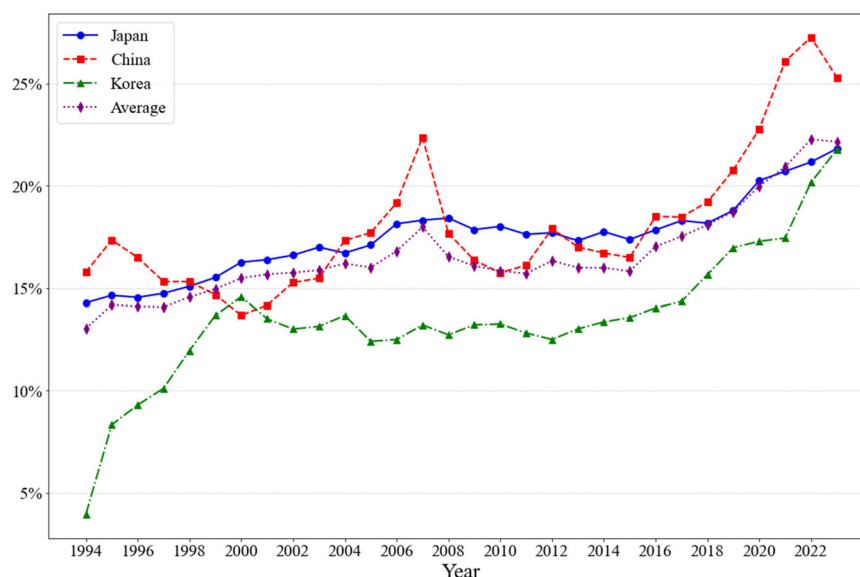


Fig. 1 Proportion of active female players by country (1994–2023).

potential themes related to the gender dynamics in the Go community. Any differences in their findings were thoroughly discussed and reconciled, leading to an agreement on the preliminary themes.

In the axial coding stage, these emerging themes were further refined and organized, considering their interconnections and underlying patterns. Associations with broader cultural and social concepts were also examined, aligning our analysis with the larger theoretical framework of Social Representation Theory.

Finally, in the selective coding stage, we identified core themes central to the social representation of gender dynamics in professional Go playing. These core themes played a pivotal role in our subsequent core-periphery analysis. The coding process was iterative and reflective, ensuring that the identified themes accurately encapsulated the key insights and social representations from the interviews.

Core-periphery analysis. Following the thematic analysis, we used the core-periphery algorithm proposed by Borgatti and Everett (2000) to delineate the structure of the themes. This process allowed us to categorize the themes into “core” and “periphery” based on their centrality and interconnectedness within the broader social representation of gender dynamics.

We first quantified the degree of co-occurrence of the themes in the interview transcripts, constructing a co-occurrence matrix to capture the frequency with which two themes appeared together. From this matrix, we identified denser clusters of interrelated themes, which we defined as core elements. The remaining, less densely connected themes were classified as peripheral.

To further formalize this categorization, we calculated the “coreness” of each theme using UCINET statistical software. Coreness, a measure of a theme’s centrality within the network of themes, allowed us to quantitatively assess the relative significance of each theme within the social representation with a clear delineation of core and peripheral themes. Core

Visualizing thematic relationships. We visualized the social representation of gender dynamics within the Korean Go community by constructing a Maximum Tree. This technique provides an intuitive graphical portrayal of the interconnections among core and peripheral themes (Jung et al. 2009).

We used analysis of similarity, based on co-occurrence in the interview data, to quantify the strength of relationships among themes (Degenne and Vergès 1973). We employed Jaccard’s coefficient, calculated as $J(X, Y) = |X \cap Y| / |X \cup Y|$, to assess the similarity between themes.

The construction of the Maximum Tree followed a series of steps. We first selected the theme with the highest frequency, or ‘salience’, in the interview data. Among the remaining themes, we chose the one with the highest similarity to the already-selected theme, as determined by the Jaccard’s coefficient. In cases of equal similarity values, we prioritized the theme with the highest salience. This process continued until all themes were included in the Maximum Tree.

Results

Descriptive analyses. Figure 1 shows the proportion of active female Go players by country from 1994 to 2023. The percentage of female Go players in Korea has been consistently low compared to China and Japan, but has recently increased dramatically. Korea’s proportion rose from 4.0% in 1994 to 21.7% in 2023, compared to Japan’s increase from 14.3% to 21.8% and China’s from 15.8% to 25.3%; Korea had 100 female professionals out of 456 players by 2023, China had 234 out of 925, and Japan had 168 out of 772.

Figure 2 portrays the average Elo rating of active players by country. The rating for active female players from Korea surged from 2946.7 in 1994 to 3012.2 in 2016, with a particularly sharp rise between 2008 and 2016. In contrast, the ratings of active female players from Japan and China have remained stable or exhibited a minor decline over the same period.

Table 3 provides the Go competition statistics including the number of competitions, average year founded, and total prize money by country and participant category. Korea hosts nine competitions for women, Japan six, and China only two. The average year founded for women’s competitions in Korea is 2017, more recent than Japan’s 2003 and China’s 2013. Figure 3 compares the total prize money for open and women’s categories by country. Korea shows the smallest discrepancy in total prize money between open and women’s competitions, with a gap of

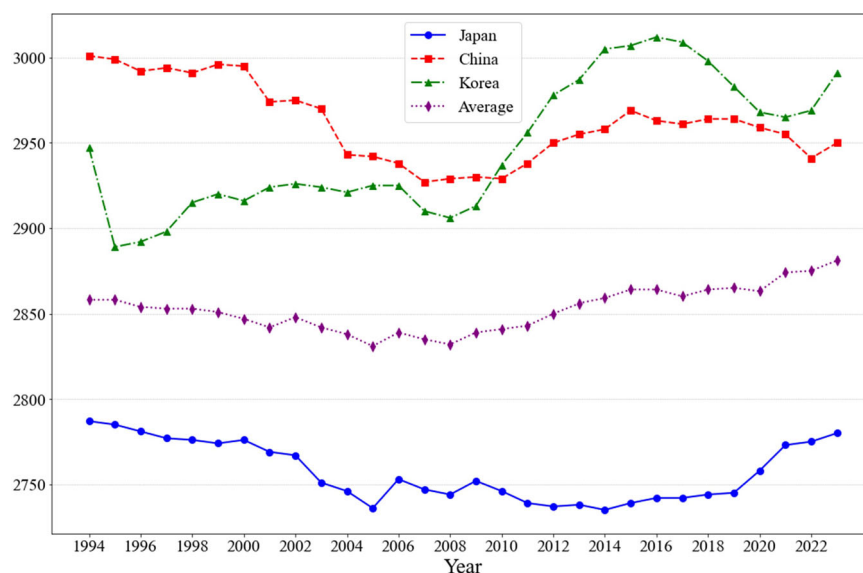


Fig. 2 Average Elo rating of active female players by country (1994-2023).

Table 3 Go competitions statistics for each country and participant category.

Country	Participant category	Number of competitions	Average year founded	Total winning prize (\$)
Korea	Open	23	2012	688,210
	Women	9	2017	192,345
Japan	Open	16	1980	1,336,977
	Women	6	2003	247,058
China	Open	17	1999	798,096
	Women	2	2013	77,145

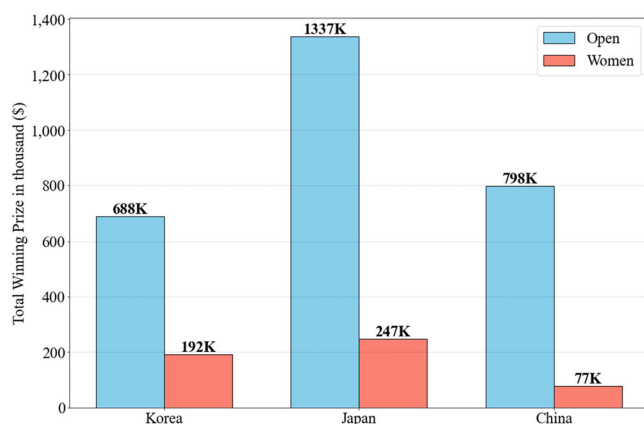


Fig. 3 Comparison of total winning prizes (Open vs. Women) in Korea, Japan, and China.

\$495,865. In contrast, the gap in Japan is \$1,089,919, while in China, it is \$720,951.

Social representation analyses. Table 4 summarizes the twelve key themes from our participants' experiences and perspectives on gender dynamics in professional Go, as identified from thematic analysis. They include Representation Disparity,

Performance Disparity, Stereotypes and Bias, Playing Style, Engagement, Infrastructure, Financial Resources, Fan and Sponsor, Family Expectation, Physical capability, Training Opportunity, and Role models.

The core-periphery analysis, as shown in Table 5, categorizes these themes by their coreness and membership statuses. The core group, with coreness values exceeding 0.40, includes Performance Disparity, Engagement, and Infrastructure. These core themes represent the primary challenges and considerations within the Korean Go context. The peripheral themes, while less central, remain highly relevant to the broader discussion on gender dynamics.

In our analysis, Performance Disparity emerged as a central theme, highlighting both perceived and actual differences in skill levels between male and female players. One participant noted, "There is this lingering belief that men are naturally better at Go, which can be discouraging for female players." Engagement and Infrastructure were also identified as core themes, with one player stating, "I dedicate just as much time and effort to training as male counterparts, if not more, even with exercising and meditating" and another noting, "Access to quality coaching and training facilities has improved, but there is still room for more competitions."

Peripheral themes such as Representation Disparity and Stereotypes and Bias capture the ongoing challenges female players face in the Go community. For example, a player remarked, "More women are starting Go, especially in their 20 s and 30 s. But as skill level rises, women drop out." Other peripheral themes, like Playing Style and Physical Capability, explore gender-based perceptions and strategic approaches, while Training Opportunity and Role Models discuss the availability of resources and inspirational figures for female players.

Figure 4 illustrates the interrelationships among these themes based on their frequency of co-occurrence and similarity in the interviews. Performance Disparity connects with Engagement, Infrastructure, Playing Style, and Physical Capability, while Engagement links to Family Expectation, Role Models, and Stereotypes and Bias. Infrastructure is connected to Representation Disparity, Financial Resources, and Training Opportunity. Additionally, Financial Resources are linked to Fans and Sponsors. This hierarchical representation underscores the complex network of gender dynamics themes within the Korean Go community.

Table 4 Topics related to the rise of Korean female Go professionals players in the interview.		
Topic	Description	Quotes
Representation Disparity	Differences in the proportion of players between male and female in the Go Community	"More women are starting Go, especially in their 20 s and 30 s. But as skill level rises, women drop out."
Performance Disparity	Differences in the playing ability and achievements between male and female players	"There is this lingering belief that men are naturally better at Go, which can be discouraging for female players."
Stereotypes and Bias	Prevailing societal expectations and beliefs about gender in the Go community	"Always felt girls were weaker at Go. Boys losing to girls feels like a big deal, even if skill is equal. I tried hard not to be intimidated, but it wasn't easy."
Playing Style	Strategic approaches and tactics of individual players in the game of Go	"Female players show aggression, often unnecessarily. The difference lies in calculation of battle situations."
Engagement	Involvement and commitment of individual players to engage in the game of Go	"I dedicate just as much time and effort to training as male counterparts, if not more, even with exercising and meditating"
Infrastructure	Systems and services for players including the access to resources, facilities, coaching, and competitions.	"Access to quality coaching and training facilities has improved, but there is still room for more competitions."
Financial Resources	Financial support and income for male and female players	"Women's tournaments are booming, but prize money is too low. More resources will keep players engaged and attract newcomers."
Fan and Sponsor	Fandom and sponsorships for male and female players	"Sponsorships are crucial, and it's encouraging to see more companies supporting female Go players."
Family Expectation	Pressures and expectations from families based on traditional gender roles.	"Having kids totally messes with your game. It's tough to find time to study and practice when you are on kid duty"
Physical Capability	Capacity for male and female players to maintain physical and mental stamina during games	"There's a misconception that women can't handle the long hours of intense concentration that Go requires."
Training Opportunity	Availability and quality of training resources for male and female players	"Thanks to the women's national team system, top female players have unprecedented access to high-quality training."
Role models	Presence and influence of successful male and female players serving as inspirations and examples	"After Rui Naiwei won the Guksu title beating top players, I have dreamed of winning a world championship"

Table 5 Coreness and membership of the topics in the interview.		
Topic	Membership	Coreness
Performance disparity	Core	0.622
Engagement	Core	0.493
Infrastructure	Core	0.422
Representation disparity	Periphery	0.261
Stereotypes and bias	Periphery	0.255
Training opportunity	Periphery	0.245
Playing style	Periphery	0.204
Physical capability	Periphery	0.111
Family expectation	Periphery	0.073
Financial resources	Periphery	0.046
Role models	Periphery	0.032
Fan and sponsor	Periphery	0.001

Discussions

Our main findings from description analyses and social representation analyses present a complex and multi-dimensional picture of the gender dynamics within the Korean Go community. The discussion focuses on the rise of female Go players in Korea, their experiences navigating a traditionally male-dominated environment, the factors contributing to their increased prominence, and the broader implications for the broader context of gender dynamics in other fields.

The rise of female Go players in Korea. The descriptive analyses reveal a compelling portrait of the landscape of female Go players in Korea. The representation and performance of female Go players in Korea have shown a significant upward trend over the past few decades compared with their international counterparts. The demographic analysis shows the clear upward trend in the proportion of active female Go players in Korea, growing more rapidly than in China and Japan. The Elo rating analysis also

reveals a considerable improvement in their performance, as evidenced by the surge in their average Elo ratings. Their significant leap in representation and performance indicates that female Go players in Korea have become more competitive over time, gaining strength in a traditionally male-dominated field.

The disparity in Go competition statistics further underscores the differences among these three countries. Korea hosts more competitions for women than Japan and China, and the women's competitions in Korea have been established more recently, implying a growing acceptance and support for female Go players. Notably, Korea has the smallest discrepancy in total prize money between open and women's competitions, suggesting a more equitable reward system for female players compared to Japan and China. These findings underline a notable shift in the dynamics of Go, with Korea leading the way in fostering an environment that supports and rewards the participation and advancement of female players.

Experiences of Korean female Go players. The social representation analyses offer a multi-faceted exploration into the experiences of female Go players, elucidating the intricate dynamics of gender within the Korean Go community. Their experiences are profoundly shaped by complex interactions of core and peripheral factors in the gender dynamics prevalent in the Go community.

The key issue is the 'Performance Disparity', the perceived and actual differences in skill level between male and female players. It emerges as the central topic at the heart of participants' experiences and perceptions. This disparity is influenced by multiple intertwined systemic and individual factors, deeply entrenched in the socio-cultural and historical fabric of the Korean Go community. It reinforces traditional gender stereotypes, suggesting men are inherently superior players, but also offers women a choice to either accept this norm or challenge it, pushing societal boundaries and questioning underlying

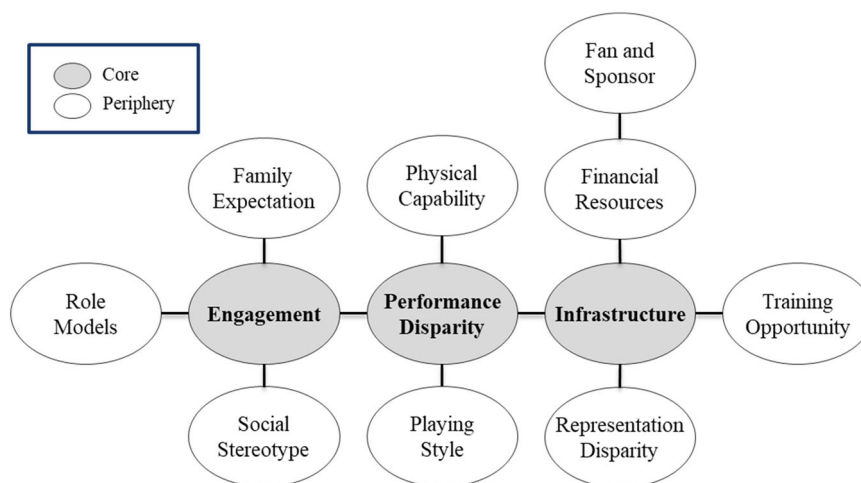


Fig. 4 Social representation map in the interview.

structures. This creates significant hurdles for women, affecting their self-confidence and hindering their progress in the game.

One solution for this disparity often lies in ‘Engagement’. Personal commitment and involvement in the game, which might be influenced by perceived or actual performance differences, can drive or deter the performance disparity. Its links with ‘Family Expectations’, ‘Role Models’, and ‘Stereotype and Bias’ signify societal pressures that shape how individuals of different genders approach the game. Many female players noted that full commitment to the game was crucial for professional growth, with supportive communities and personal determination playing pivotal roles.

Another important solution is ‘Infrastructure’. Systemic factors such as access to resources, facilities, coaching, and competitions shape disparities in performance. Its connections with ‘Representation Disparity’, ‘Financial Resources’, and ‘Training opportunity’ suggest a complex network of support and hindrances affecting gender dynamics in professional Go. Many female players emphasized how increased competitions and training opportunities have been pivotal for their career development, appreciating the Korea Go Association’s efforts to increase recruitment of female professionals, create women’s tournaments, and runs a women’s national team.

Furthermore, the connection between ‘Performance Disparity’ and ‘Physical Capability’ touches on a perception that physical or mental stamina varies between male and female players, affecting their performance. The connection between ‘Performance Disparity’ and ‘Play Style’ suggests that strategic approaches may differ between genders, impacting results. Also, the connection between ‘Financial Resources’ and ‘Fans and Sponsors’ highlights the interdependent relationship between the financial support a player receives and their fan or sponsorship opportunities.

Despite the advancements in promoting gender equality in Korean Go community, stereotypes and biases remain prevalent, often casting doubt on the capabilities of female players. Many female players expressed facing gender stereotypes and biases, potentially discouraging participation and creating a hostile environment for aspirants. However, these stereotypes appear to be waning among younger players born in the 2000s, such as Kim Sang-in and Park So-yul, who have not experienced gender-biased language. This perceptual shift among the younger generation could herald a more inclusive and gender-balanced professional Go environment in the future.

Collectively, the experiences of female professional Go players in Korea are marked by a transformative shift in a traditionally male-dominated landscape. Through their personal and systemic

changes, these women are navigating challenges and closing the performance gap. Their increasing prominence stands as a testament to their resilience and serves as an inspiration for aspiring female Go players worldwide.

Factors contributing to the rise of Korean female Go players.

The rise of Korean female Go professionals is not a singular, isolated phenomenon but is instead the result of an intricate mix of social, and institutional factors. These multifaceted factors together provide a robust framework to understand the success of female Go players in Korea.

Economic incentives and playing opportunities. Economic incentives and Playing opportunities have played a significant role in the rise of Korean female Go professionals. Improved prize money with more sponsorships create stronger economic incentives for women to participate in the game, supporting their professional development and sustaining their careers. Additionally, the increase in the number of competitions for female players has provided more opportunities to train and compete, enhancing their performance and recognition within the Go community.

Social and cultural shifts. Korean society is witnessing a progressive change in its perception of women in traditionally male-dominated spaces, including Go. This shift is reflected in the increased representation of female players, the rise of women-specific competitions, and efforts to challenge existing gender stereotypes within the Korean Go community. This increased acceptance and recognition of female players are fostering a more inclusive environment for them to thrive. The significance of this cultural shift is evident in the shared experiences of the female players, who acknowledge the empowering impact of increased gender representation and a more supportive environment.

One of the major contributors to this social and cultural shift is the presence of role models. The presence of successful female Go players has played a huge role in inspiring and motivating upcoming female players, and more importantly, in bringing about significant social and cultural shifts. These role models, along with support from family and fans, create a positive environment that encourages female players to pursue a career in Go.

Rui Naiwei, in particular, has been a pivotal figure in the growth of women’s Go in Korea. She dominated the women’s tournament and won two open national tournaments, always

previously won by men: the Guksu in 1999) and the Maxim Cup in 2004. Her success as one of the first women to compete at a high level against male players challenged existing stereotypes and provided a powerful role model for many Korean women in Go. Several interviewees noted her influence, with Choi Jeong stating, “After Rui Naiwei won the Guksu title beating top players, I have dreamed of winning a world championship.” Her achievements not only inspired female players to pursue professional careers in Go but also helped alter perceptions within the broader Go community, making it more accepting of female talent.

Additionally, male players also serve as important role models for female Go professionals. Interviewees frequently mentioned male players as sources of inspiration and learning. For instance, one interviewee remarked, “Studying the games of top male players like Shin Jinseo has significantly improved my strategic understanding.” The influence of male role models underscores that mentorship and admiration in Go transcend gender lines, providing female players with diverse sources of guidance and motivation.

Institutional support and initiatives. Institutional support and initiatives have also been crucial in promoting the rise of Korean female Go professionals. Increased access to training opportunities, initiatives aimed at ensuring equality and fairness, and greater representation of women in the Go community reflect the commitment of institutional bodies to support and nurture female talent in the game. These institutional changes have not only provided female Go players with the necessary resources and platforms to excel, signaling to the wider society that women have an equal place in the game.

Implications for gender equality in Go and beyond. The rise of female Go professionals in Korea offers insightful implications for gender equality in games, sports, and other traditionally male-dominated areas. Here, we compare the findings from our study with existing literature on female participation in chess, which shares many similarities with Go as a strategic intellectual game.

Challenging gender stereotypes. The success of Korean female Go professionals serves as a strong counter-narrative to the prevailing stereotypes that perceive women as less capable in games like Go. Similar patterns have been observed in chess, where female players like Judit Polgar have challenged stereotypes by excelling at the highest levels of competition (Bilalić et al. 2009). It is evident that given the right opportunities and support, female players can perform on par with, if not better than, their male counterparts. Thus, this study underscores the importance of challenging and dismantling such gender biases to foster an inclusive and competitive environment in Go, and other similar spheres.

Role of economic incentives and opportunities. The study highlights the significant role of economic incentives and increased playing opportunities in boosting the participation and performance of female Go players. This finding aligns with research in chess, where financial incentives and sponsorships have been found to be motivating factors for female participation (Howard, 2005). This underscores the need for similar initiatives in other games, sports or fields where female representation is low. Increasing the financial rewards and creating more platforms for women to compete can serve as strong motivational factors that encourage more women to participate and excel.

Importance of institutional support. The role of institutional initiatives in promoting gender equality in Go in Korea suggests that authorities in different domains need to take proactive steps

in fostering an environment that nurtures female talent. In chess, initiatives such as separate women’s tournaments and dedicated training programs have helped increase female participation (Charness and Gerchak 1996). This could be through providing access to quality training, ensuring fairness and equality, or increasing the representation of women. This implies that a top-down approach, where institutional changes support the rise of women, can be highly effective.

Power of role models. The influence of successful female Go players as role models emerged as a strong motivational factor in this study. This reiterates the importance of having visible female role models in all fields. In chess, players like Judit Polgar have inspired many young girls to take up the game, highlighting the importance of role models in challenging stereotypes and encouraging participation (Bilalić et al. 2009). The presence of successful women who have broken through the glass ceiling can inspire others to do the same. Thus, promoting and celebrating female successes in traditionally male-dominated areas can significantly contribute to gender equality.

Social and cultural shifts. The study sheds light on how societal attitudes and cultural norms can significantly impact gender equality. The shift in perceptions towards women in Go in Korea has played a key role in their increased representation and success. This indicates that achieving gender equality requires changing societal attitudes and cultural norms that often disadvantage women. Similar to the changes seen in Go, chess has also experienced shifts in societal perceptions, with increasing recognition of women’s contributions to the game. Studies have shown that societal support and cultural acceptance play a crucial role in encouraging female participation in both games (Maass et al. 2009). Thus, continuous efforts are needed to bring about such transformative social and cultural shifts.

In summary, the experiences and triumphs of Korean female Go players illustrate that gender equality in traditionally male-dominated fields is achievable. However, it requires a multifaceted approach that addresses economic, social, institutional, and cultural barriers. While the challenges may be significant, the potential benefits – in terms of inclusivity, diversity, and overall performance—make these efforts worthwhile. The insights from this study can serve as a roadmap for promoting gender equality in other areas, both within and beyond the world of games and sports.

Conclusion

The rise of female professional Go players in Korea offers profound insights into overcoming gender barriers within traditionally male-dominated fields. Their journeys embody potent lessons of gender equality that reverberate far beyond the Go community. It’s evident from this research that a complex tapestry of societal, cultural, and economic factors shapes these women’s experiences, dictating their unique challenges and triumphs.

These pioneering women have crafted their successes through individual dedication, strategic tools like economic incentives, institutional support, and by challenging long-standing stereotypes. Their access to resources, tournaments, and training opportunities, coupled with personal motivation, forms the bedrock of their achievements.

Nonetheless, it’s important to recognize the challenging environment that persists. Despite their progress, many female players grapple with a system that makes it difficult for them to sustain a living solely from their professional career. This issue underscores the systemic hurdles yet to be overcome.

Encouragingly, broader societal and cultural shifts, along with supportive policies and infrastructures, have significantly bolstered the female players' ability to thrive in the professional Go environment. Such measures empower these women and serve as a model for other communities striving to enhance gender balance.

The path to gender equality in Go and other traditionally male-dominated fields, while marked by progress, is far from complete. As more women continue to excel in intellectual pursuits like Go, fostering a culture of inclusivity and respect, providing equal opportunities, and amplifying women's achievements in the media become increasingly vital.

This research, while providing valuable insights, has several limitations. It delves into the experiences of top-tier female Go players in Korea, highlighting their unique challenges and victories. However, these findings may not fully capture the diverse range of experiences across all levels of play. The obstacles and opportunities encountered by top-tier players may differ significantly from those faced by those starting their careers or attempting to climb the ranks. Additionally, focusing on female Go players in Korea may not accurately represent the experiences or hurdles faced by women in other regions or cultural environments. Furthermore, it is essential to consider the impact of the COVID-19 pandemic, which disrupted a significant number of tournaments globally. In China, the pandemic may have had lasting effects, with varying lockdown durations and intensities across regions impacting the ability of the Go community to fully recover by the time this study was conducted in August 2023. These factors should be acknowledged when interpreting the findings. Future research could offer a more comprehensive picture by examining professional Go players across various levels in different regions and cultures, thereby broadening our understanding of gender dynamics within the intellectual domain.

In conclusion, the journey of Korean female Go players underscores the importance of addressing the cultural, social, and structural factors contributing to gender inequality. Even though the current environment poses significant challenges, the continuous progress made by these women signals a hopeful future. As societal attitudes evolve, and targeted measures are implemented, we anticipate an increasingly positive environment for female Go players. Furthermore, the lessons drawn from these women's experiences provide valuable insights that could inform strategies to create more inclusive and equal societies. They emphasize the importance of fostering an environment where individuals of all genders can thrive and reach their full potential. Ultimately, such changes can increase the participation and representation of women in male-dominated fields, contributing to a more balanced and equitable society.

Data availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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Author contributions

JK, HS, SK, CGL, and KK contributed to the conception and design of the study. All authors participated in the interpretation of the results. KK took the lead in writing the manuscript, but JK and HS provided substantial contributions to the drafts and revisions. JK and HS contributed equally to this work and share first authorship. KK jointly supervised this work and is the corresponding author for this paper.

Competing interests

The authors declare no competing interests.

Ethical approval

In compliance with the South Korean “Bioethics and Safety Act Implementation Rules” Enforcement from July 19, 2016, Ministry of Health and Welfare Order No. 419, our study was exempt from formal ethical review and approval. According to Article 13 of these rules, research that utilizes publicly available information or does not collect or record personal identification information, and does not involve direct manipulation of the research subject or their environment in ways that could be invasive or induce physical changes, is exempt from the requirement for institutional review board (IRB) review. Specifically, our research falls under the exemption criteria as it did not collect sensitive personal information as defined under the “Personal Information Protection Act,” Article 23. Despite this exemption, our study was conducted with strict adherence to the principles of the Declaration of Helsinki, ensuring the highest ethical standards were maintained. Participants were informed about the study’s purpose, their voluntary participation, and the anonymous and confidential handling of their responses. Informed consent was obtained from all participants, emphasizing their right to withdraw from the study at any time without consequence. We committed to safeguarding the privacy and personal information of participants, with data being securely stored and accessible only to the research team for analysis purposes. This approach ensured the dignity, rights, and welfare of participants were respected, reflecting our dedication to ethical research practices in the absence of formal ethical review requirements.

Informed consent

All participants and interviewers involved in this study provided their informed consent before participating in any research activity. Before obtaining consent, all individuals

were thoroughly briefed about the nature, purpose, and potential impacts of the research. They were made aware of what kind of data would be processed, how it would be used, and for what purpose.

Consent to participate

Participants (or their legal guardians, where applicable) were informed about all aspects of the research in detail, and their freely-given, informed consent to participate in the study was obtained. No participants were coerced, and all had the autonomy to withdraw at any stage of the research.

Consent to publish and disclosure of names

Beyond participation, individuals were also consulted regarding the publication of their data and disclosure of their names in this journal, ensuring their rights and wishes are respected in the publication of the study’s findings. All individuals, including the interviewers, consented to having their names and anonymized data published. The ethical considerations and the rights of the individuals, including the disclosed names of the interviewers, were prioritized and respected throughout the research process, adhering strictly to the ethical guidelines and standards of research integrity.

Additional information

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