Longitudinal relationship between fertility subsidies and fertility rates

Heeran J. Cho¹, Kyu-Hyoung Jeong², Byungsun Yoo³, and Jihyun Jang⁴

¹Yuhan University
²Semyung University
³Gyeonggi Welfare Foundation
⁴Busan Social Welfare Development Institute

Abstract

Objective Concerns about the low fertility and population decline are increasing worldwide, and Korea has the lowest fertility rate in the world. This study aims to comprehensively examine the policies implemented by local governments and investigate the longitudinal impact of fertility subsidy policy on the fertility rate in Korea. Method The study utilized data on the total fertility rate of local governments from 2014 to 2018. Data analysis was conducted via SPSS 25.0 and M-plus 8.0 software. Model fit was assessed using TLI (Tucker-Lewis Index), CFI (Comparative Fit Index), and RMSEA (Root Mean Square Error of Approximation). Results The results showed a significant relationship between the rate of change in the fertility subsidy and the rate of change in the fertility rate (B=.006, p<.01). Specifically, as the fertility subsidy increased rapidly over time, the fertility rate gradually decreased. Conversely, a gradual increase in the fertility subsidy led to a sharp decline in the fertility rate. Conclusion To effectively increase the fertility rate in South Korea, it is crucial to implement comprehensive policies that take into account social, economic, and demographic factors, as well as the findings of this study regarding fertility support. Highlights

1 INTRODUCTION

Concerns about the low fertility and population cliff are growing worldwide. In particular, Korea has a total fertility rate of 0.84 in 2020, the only OECD member country with a total fertility rate of 0 to 0.¹ Along with the low birth rate, the aging rate is also the fastest among OECD member countries, and the period of population cliff is in full swing. Historically, as the mortality rate decreased as industrialization progressed and health developed, the population increased rapidly. As the social burden on the rapidly increasing population increased, birth control policies were implemented to maintain an appropriate population. However, in recent years, various efforts have been made to address the rapidly declining fertility problem worldwide. Ultimately, it can be confirmed that procreation is an essential requirement for the continuation of society.² The causes of the low birth rate in Korea are diverse. First, there is a change in personal values. The values that individuals have about the family are changing, which is acting to delay the age at first marriage and the period of childbearing fertility.³ In addition to social factors, economic factors also appear to affect the marriage rate. As a result of empirical analysis, the marriage rate decreased by 0.23 to 0.40 cases when the temporary employment rate rose by 1%p and 0.18 to 0.42 cases when the unemployment rate rose by 1%. The composite housing price index has also been proven to affect the marriage rate.⁴ A situation in which marriage is delayed or abandoned due to these social and economic factors naturally decreases the fertility rate.

Low fertility is causing various problems throughout society. First, it promotes a decrease in the economically
active population. As the low fertility and aging population continue, the economically active population will decrease, which may affect GDP growth. Second, low fertility weakens family function and is highly likely to lead to family disintegration. A decrease in the number of household members and a sharp increase in single-person households suggests that the traditional family function cannot be fulfilled. Third, social security expenses will increase along with the aging of the population, such as an increase in the number of dependents that the working-age population has to feed.

While trying various policies to overcome the low fertility, the West, which experienced the problem of low fertility earlier than Korea, conducted various studies on fertility promotion policies since the 1990s. One of the most representative fertility policies is economic support policies such as childbirth incentives and child allowances. This can be seen as a policy intended to have a positive effect on the fertility rate by increasing the cost of childbirth. However, the policy effect does not show consistent conclusions.

First, looking at the study results, the fertility promotion policy, which reduces the economic burden, showed positive effects in lowering the decrease in the fertility rate. Analysis of the effect of family benefits on the fertility rate in 22 commercialized countries from 1970 to 1990 was found to have an effect of increasing of 4%. There are also studies examining the relationship between the fertility rate and economic support in each country. In Canada, tax relief or child tax credit, family allowance, maternity leave allowance, and the relationship between the fertility rate and the fertility rate are shown. As a result of the analysis, it was confirmed that the family allowance had a positive effect on the fertility rate. The tax-free program was also an essential factor in raising the fertility rate. In the case of France, the French family allowance reform in 2004 increased the number of children born by 5%. In Australia, the child allowance policy was implemented in 2004, and from 2001 to 2013, the child allowance increased the fertility rate for women aged 15 to 19. It is found that the fertility rate for women with low socioeconomic status increased in particular. In Argentina, child subsidies increased the fertility rate, and the effect was more significant for women with children than for women without children.

If the scope of economic support is narrowed down to childbirth support, the policy effects are more complex. In Germany, the fertility rate does not positively affect raising the fertility rate of the low-income class, but it appears to have a positive effect on the birth of the second child of the high-income class. In Canada, as a result of comparing states that do not pay maternity grant, it was found that the fertility rate increased by 16% for an increase of CAN $1,000. However, it was found that the childbirth subsidy had no effect on young women and those with low household incomes.

Korea’s childbirth subsidy policy also alleviates the economic costs of raising children, such as childrearing and education expenses for childbirth families. Since this policy is not enforced by the central government but centered on local governments by enacting and operating ordinances, each local government has various names such as childbirth incentives or childbirth subsidies. Each municipality is different. The first local government to introduce the childbirth subsidy policy was Cheongwon-gun, Chungcheongbuk-do, which provided 100,000 won each to mothers giving birth in rural areas in the province. The maternity subsidy system, first implemented in 2002 by Cheongwon-gun, North Chungcheong Province, is now being adopted by most local governments across the country in many local governments that are experiencing low fertility and local extinction in Korea. In particular, in areas with severe population cliffs, such as Uiseong-gun, Gyeongbuk (18 million won for fourth and above) and Cheongyang-gun, Chungnam (20 million won for third), relatively large childbirth subsidies are provided. Currently, local governments that provide childbirth support in Korea are supporting childbirth support in 15 of the 17 metropolitan cities and provinces, and 223 out of a total of 226 local governments are providing childbirth support. Each local government differs in size and target of support.

More than 20 years after the birth incentive policy was implemented, a previous study in Korea that looked at how the birth incentive policy affected the fertility rate shows that childbirth incentives positively affected the fertility rate. Data from 2008 to 2010 were used to analyze the effect of childbirth subsidies on the rate of increase in the fertility rate. When the local government’s childbirth subsidy budget increases by 22.7 million won or the GRDP per capita increases by 260,000 won, it is estimated that the number of multiple...
births (third child) also increases by one.\textsuperscript{20} In addition, as a result of examining the effects of childbirth incentives and fertility rate enhancement, mainly in Chungcheong Province, Korea, the fertility rate steadily increased until about eight years after the introduction of the childbirth incentives. The average payment amount increased to about 2.5 million won and then decreased.\textsuperscript{21}

On the other hand, quite a few studies show that the fertility subsidy policy has no significant effect on the fertility rate. According to previous studies, it was found that policies to encourage childbirth provided by local governments did not significantly affect childbirth decisions.\textsuperscript{22} In addition, there is a study result that each local government’s fertility incentive policies are ineffective in raising the fertility rate.\textsuperscript{23} While there was no effect, it was proved that factors such as education cost, the possibility of fostering a single family, and expansion of childcare facilities affected the increase of the fertility rate.\textsuperscript{24} Although many studies have shown that childbirth subsidies positively affect the increase in the fertility rate nationwide\textsuperscript{16,17,18}, it can be seen that there are differences by region.

Most of the previous studies that verified the relationship between childbirth incentives and the fertility rate conducted in Korea are cross-sectional studies. Even if they were conducted longitudinally, there is a limitation in that the analysis was carried out in a short period of about 2-3 years. As the current ultra-low fertility phenomenon continues, active childbirth promotion policies are being introduced by local governments, and it is necessary to longitudinally check and evaluate how the childbirth promotion policies, which are changing over time, affect changes in the fertility rate. Therefore, this study aims to look at the policies implemented by local governments comprehensively and to examine how the fertility subsidy policy affects the fertility rate from a longitudinal perspective.

2 METHOD

Data

This study used data from 2014 to 2018 on the total fertility rate of local governments provided by the National Statistical Office to estimate changes in the fertility rate. In addition, to confirm the longitudinal relationship between childbirth support and the fertility rate, the Ministry of Health and Welfare compiled childbirth support policies for each local government and used the casebook of local government childbirth support policies published annually. This study analyzed the total fertility rate and fertility subsidy for 233 local governments from 2014 to 2018.

Variables

Dependent variable: fertility rate

The fertility rate used in this study is the total fertility rate (TFR). The total fertility rate indicates the average number of births that one woman of childbearing age (ages 15-49) is expected to have during her lifetime. It is the sum of fertility rates by age, and it is a representative indicator of the level of fertility.

Independent variable: maternity grant

For childbirth support, the childbirth support provided by each local government was used through the 2014 Local Government Birth Encouragement Policy Casebook of the Ministry of Health and Welfare. The maternity subsidy for each local government was set as the sum of all the subsidies per child by birth order, and the unit was 1,000 dollars.

Statistical Analysis

The analysis method and procedure for solving the research problem in this study are as follows. SPSS 25.0 and M-plus 8.0 programs were used for data handling and model analysis. First, descriptive statistical analysis was conducted to identify the characteristics of major variables. Second, latent growth modeling was conducted to estimate changes in fertility subsidies and fertility rates and verify the relationship between changes in fertility subsidies and changes in fertility rates. To determine the model fit, TLI (Tucker-Lewis Index), CFI (Comparative Fit Index), and RMSEA (Root Mean Square Error of Approximation) were used.
3 RESULTS

Descriptive Statistics

As shown in Table 1, the maternity subsidy continued to increase from an average of 8,286.84 dollars in 2014 (SD = 8,647.95) to an average of 11,233.05 dollars (SD = 11,795.13) in 2018. On the other hand, the fertility rate continued to decrease from 2014 (M=1.31, SD=0.26) to 2018 (M=1.08, SD=0.26) (Table 1).

Table 1. Descriptive Statistics

<table>
<thead>
<tr>
<th>Classification</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternity Grant ($)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maternity Grant in 2014</td>
<td>0</td>
<td>43,542.00</td>
<td>8,286.84</td>
<td>8,647.95</td>
</tr>
<tr>
<td>Maternity Grant in 2015</td>
<td>0</td>
<td>59,860.00</td>
<td>8,753.11</td>
<td>10,002.89</td>
</tr>
<tr>
<td>Maternity Grant in 2016</td>
<td>0</td>
<td>54,940.00</td>
<td>9,539.50</td>
<td>10,547.09</td>
</tr>
<tr>
<td>Maternity Grant in 2017</td>
<td>0</td>
<td>69,536.00</td>
<td>11,171.26</td>
<td>12,230.49</td>
</tr>
<tr>
<td>Maternity Grant in 2018</td>
<td>0</td>
<td>54,940.00</td>
<td>11,233.05</td>
<td>11,795.13</td>
</tr>
<tr>
<td>Fertility Rate (persons)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fertility Rate in 2014</td>
<td>.79</td>
<td>2.43</td>
<td>1.31</td>
<td>.26</td>
</tr>
<tr>
<td>Fertility Rate in 2015</td>
<td>.81</td>
<td>2.46</td>
<td>1.33</td>
<td>.27</td>
</tr>
<tr>
<td>Fertility Rate in 2016</td>
<td>.78</td>
<td>2.42</td>
<td>1.27</td>
<td>.27</td>
</tr>
<tr>
<td>Fertility Rate in 2017</td>
<td>.65</td>
<td>2.10</td>
<td>1.16</td>
<td>.26</td>
</tr>
<tr>
<td>Fertility Rate in 2018</td>
<td>.60</td>
<td>1.89</td>
<td>1.08</td>
<td>.26</td>
</tr>
</tbody>
</table>

Study Model Analysis

In this study, the potential growth model was analyzed in two stages. In the first stage, the initial value and rate of change of the fertility subsidy and fertility rate are estimated with an unconditional model.

Analysis of Unconditional Model

Before proceeding with the conditional model analysis, an unconditional model analysis was performed to understand the change in the fertility rate. In order to identify the optimal change pattern through the unconditional model, the no-change model and the linear change model were analyzed, respectively. As shown in Table 2, the fitness of the linear change model for childbirth subsidy was $\chi^2 = 39.269$ (p<.001), CFI = .965, TLI = .965, RMSEA = .091. A change model was adopted. The fitness of the linear change model for the fertility rate was $\chi^2 = 161.726$ (p < .001), CFI = .916, TLI = .915, and RMSEA = .094, which was found to explain the change in the fertility rate better than the no-change model (Table 1).

Table 2. Model Fit of Unconditional Model

<table>
<thead>
<tr>
<th>Model</th>
<th>Model</th>
<th>$\chi^2$</th>
<th>df</th>
<th>CFI</th>
<th>TLI</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternity Grant</td>
<td>No Growth Model</td>
<td>105.462***</td>
<td>13</td>
<td>.889</td>
<td>.914</td>
<td>.175</td>
</tr>
<tr>
<td></td>
<td>Linear Growth Model</td>
<td>39.269***</td>
<td>10</td>
<td>.965</td>
<td>.965</td>
<td>.091</td>
</tr>
<tr>
<td>Fertility Rate</td>
<td>No Growth Model</td>
<td>845.172***</td>
<td>13</td>
<td>.557</td>
<td>.659</td>
<td>.524</td>
</tr>
<tr>
<td></td>
<td>Linear Growth Model</td>
<td>161.726***</td>
<td>10</td>
<td>.916</td>
<td>.916</td>
<td>.094</td>
</tr>
</tbody>
</table>

**p<.001

Looking at the results of the final selected unconditional linear change model, the average initial value of the maternity subsidy was 8.143 (p<.001), and the rate of change in the maternity subsidy was .804 (p<.001), all of which were statistically significant. In other words, it was found that the maternity subsidy increased over time. Also, the variance was significant, with an initial value of 67.767 (p<.001) and a change rate of 2.570 (p<.001), which shows that there is a significant difference in the initial level and rate of change in childbirth subsidies among local governments.
The average initial fertility rate was 1.393 ($p < .001$), and the change rate of the fertility rate was -.076 ($p < .001$), all of which were statistically significant (Table 3). That is, the fertility rate was analyzed to decrease over time. Also, the variance was significant, with an initial value of .073 ($p < .001$) and a change rate of .002 ($p < .001$), which shows that there is a difference in the initial level and rate of change in the fertility rate among local governments (Table 3).

Table 3. Mean and Variance of initial score and rate of change of Unconditional Model

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean Estimate</th>
<th>S.E.</th>
<th>Variance Estimate</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternity Grant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial Value</td>
<td>8.143***</td>
<td>.583</td>
<td>67.767***</td>
<td>7.352</td>
</tr>
<tr>
<td>Rate of Change</td>
<td>.804***</td>
<td>.158</td>
<td>2.570***</td>
<td>.634</td>
</tr>
<tr>
<td>Fertility Rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial Value</td>
<td>1.393***</td>
<td>.019</td>
<td>.073***</td>
<td>.007</td>
</tr>
<tr>
<td>Rate of Change</td>
<td>-.076***</td>
<td>.003</td>
<td>.002***</td>
<td>.001</td>
</tr>
</tbody>
</table>

***$p < .001$

Analysis of Conditional Model

The conditional model analysis examined how the initial value and rate of change of fertility subsidy affected the initial value and rate of change in fertility rate. As a result of conditional model fit analysis, $\chi^2 = 349.956 (p < .001)$, CFI = .910, TLI = .908, RMSEA = 0.097, it was found that there was no problem in analyzing the model.

The initial value of childbirth subsidy was found to have a significant effect on the initial value of the fertility rate (B=.011, $p < .001$) and the rate of change (B=.002, $p < .01$) (Table 4 & Figure 1). In other words, it was analyzed that the higher the fertility subsidy, the higher the fertility rate, and the fertility rate decreased gradually over time. Conversely, it was confirmed that the lower the fertility subsidy, the lower the fertility rate, and the fertility rate declined sharply with the passage of time.

The rate of change in the fertility subsidy was found to significantly affect the rate of change in the fertility rate (B=.006, $p < .01$) (Table 4 & Figure 1). In other words, as the fertility subsidy increased rapidly over time, the fertility rate decreased gradually. Conversely, it was confirmed that the fertility rate decreased sharply as the fertility subsidy increased gradually.

Table 4. Path Coefficient of Study Model

<table>
<thead>
<tr>
<th>Path between Variables</th>
<th>Path between Variables</th>
<th>Path between Variables</th>
<th>Coef.</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Value of Maternity Grant</td>
<td>-</td>
<td>Initial Value of Fertility Rate</td>
<td>.011***</td>
<td>.002</td>
</tr>
<tr>
<td>Initial Value of Maternity Grant</td>
<td>-</td>
<td>Change Rate of Fertility Rate</td>
<td>.002*</td>
<td>.001</td>
</tr>
<tr>
<td>Change Value of Maternity Grant</td>
<td>-</td>
<td>Change Rate of Fertility Rate</td>
<td>.006**</td>
<td>.002</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, ***p < .001*
4 DISCUSSION

In Korea, which has the lowest fertility rate among OECD countries, this study analyzed the relationship between the total fertility rate and fertility subsidies from 2014 to 2018 to verify the long-term effects of fertility subsidies provided by 233 local governments on raising the fertility rate. As a result of the analysis, it was analyzed that there was a significant difference in the initial level and rate of change of childbirth subsidies among local governments in the unconditional model. Also, the conditional model analysis results showed that as the fertility subsidy increased rapidly over time, the fertility rate decreased gradually. Conversely, it was confirmed that the fertility rate decreased sharply as the fertility subsidy increased gradually. As a result of this study, it can be seen that the fertility support provided by local governments in Korea has a positive effect on the fertility rate.

These results are consistent with previous studies\(^{19,21,22}\) that an increase in childbirth subsidy has a positive effect on the fertility rate. It can be said that the results of this study provided the basis for the policy judgment that can continuously maintain and expand the policy of childbirth subsidies to maintain the local population and increase the fertility rate. In addition, it has been demonstrated that when the amount of childbirth subsidy increases slowly, the fertility rate decreases sharply. It is consistent with previous studies\(^{25,26}\) that the fertility subsidy policy cannot significantly affect the fertility rate if the child allowance is insufficient.

Then, what can be explained by the continuous decline of the fertility rate in Korea despite the positive longitudinal relationship between the fertility support fund and the fertility rate, as evidenced in this study? The decline in Korea suggests that it should not be overlooked for the maternity grant to affect the fertility rate merely\(^{27}\), as the increase in fertility rates is affected socially, culturally, and economically. While the fertility rate incentive system may have positive effects, it should not be overlooked that it may be inefficient in terms of effectiveness and cost\(^{28}\).

As proved in this study, the fertility rate of local governments that provide a large amount of childbirth support funds in Korea was found to be high. Nevertheless, why does the birth rate of Korea as a whole continue to fall? In the case of Korea, rather than providing the same amount of childbirth support nationwide, local governments provide support for childbirth support independently according to the conditions of the local government, such as the local extinction index, the number of births, and the degree of financial independence. There are large differences in fertility subsidies by region. As a specific example, taking the case of Gyeonggi-do, the metropolitan area surrounding Seoul, the capital of Korea, based on the birth of the first child, Suwon-si, with a population of more than 1 million does not have a separate maternity subsidy. However, Yeoncheon-gun provides a maternity subsidy of 1 million won. \(^{29}\) As of 2021, Suwon’s fertility rate was 0.89, while Yeoncheon-gun’s was 1.59, \(^{30}\) indicating that the fertility rate of local governments supporting childbirth subsidies is much higher. On the other hand, looking at the population growth rate, Suwon-si’s population growth rate was 1.6% in 2021 compared to the previous year. In contrast, Yeoncheon-gun was a region with a declining population in Gyeonggi-do for four consecutive years despite its high fertility rate. \(^{31}\) Comprehensively considering the fertility rate and population decline in Korea, households planning to...
have children move to a local government that provides a large amount of childbirth support in the neighboring area. The child becomes a certain age and begins to grow. Next, it can be seen that it is connected with population migration to urban areas with good living conditions. In other words, rather than interpreting that the maternity subsidy has a direct impact on childbirth, it can be more accurate to interpret the fact that the fertility rate increases by influencing households that have already planned to give birth to the city or county that pays a lot of maternity subsidy. The condition for payment of childbirth subsidy is that one must reside in the relevant city and county from 6 months before childbirth. If the amount is large (10 million won or more), it is not paid in a lump sum but installments at birth and one year after five years. Therefore, they will live in the relevant city and county during childbirth and raising children. It is worth noting that although the fertility subsidy has a temporary effect in raising the fertility rate, it has been repeatedly pointed out that it cannot be a long-term policy to counter the low fertility rate.

Therefore, to raise the fertility rate in Korea in the future, it is necessary to implement sophisticated policies that comprehensively consider social, economic, and demographic factors and the fertility support analyzed in this study. In fact, in a study analyzing the effects of childbirth subsidies promoted by district offices in Seoul in Korea on the fertility rate, the fertility subsidy did not affect the fertility rate. However, it was the same factors that have been proven to affect the increase in the fertility rate. These results can be understood as emphasizing the importance of institutional conditions in which maternity subsidies do not have an effect on Seoul and other districts with similar living conditions, a suitable environment for raising children, and a system for work-family balance, such as the parental leave system. In fact, many studies have demonstrated that the work-family balance system has a significant effect on the fertility rate, and policies to prevent career interruption in women are also shown to be effective. In four European countries, the lack of paid parental leave support showed that women’s childbearing age was delayed. It has also been demonstrated.

5 CONCLUSION

Korea has the world’s lowest fertility rate and was also selected as one of the first countries to disappear from the world in the future by the Oxford Institute of Population Aging. In this situation, the results of this study that verified the long-term effects of childbirth subsidies review promoted by each local government in Korea are very meaningful. It can also be seen as a part of the body movement, and it can be used as a basis for preparing meaningful policy alternatives to increase the fertility rate in the future. However, to increase the fertility rate and maintain the population implemented by local governments, it is necessary to develop a policy to raise the fertility rate by comprehensively considering various socioeconomic issues that affect the fertility rate and one-time policies such as fertility subsidies.

6. LIMITATION AND PERSPECTIVES

This study has several limitations that should be acknowledged. Firstly, the findings are based on data from a specific time period and may not be directly generalizable to other countries or different time frames. Additionally, the study design does not establish causation, and there may be other unmeasured factors that could influence the fertility rate. Moreover, the reliance on data from national and local government sources introduces the possibility of data limitations and potential errors.

Despite these limitations, this study provides valuable insights into the effects of fertility subsidies on the fertility rate in Korea. By analyzing the longitudinal relationship between fertility subsidies and fertility rates, the study contributes to our understanding of population policies. The findings emphasize the importance of considering fertility support as a potential factor in addressing low fertility rates. However, further research is needed to explore the long-term sustainability and potential unintended consequences of fertility subsidies, as well as the broader socioeconomic and cultural factors influencing fertility decisions. These perspectives can inform policy discussions and guide future research endeavors in addressing population challenges.

AUTHOR CONTRIBUTIONS

Kyuhyoung Jeong and Heeran J. Cho conceived and designed the study. Kyuhyoung Jeong performed
data collection. Kyuhyoung Jeong, Heeran J. Cho, and Jihyun Jang analyzed and interpreted the results. Kyuhyoung Jeong, Heeran J. Cho, and Byungsun Yoo contributed to the preparation of the draft manuscript. All authors reviewed the results and approved the final version of the manuscript.

ACKNOWLEDGEMENTS

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

ETHIC STATEMENT

We used data collected from the National Statistical Office and Ministry of Health and Welfare, which are open to the public for study purposes. Any administrative permissions were not required to access the raw data. The review of the secondary data was exempted from Semyung University Institutional Review Board (SMU IRB) with the reference (IRB) number SMU-EX-2022-03-003. The data used in this study were anonymized before its use. All methods were carried out in accordance with relevant guidelines and regulations.

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