Utilisation of mammography by women with mobility impairment in the UK: secondary analysis of cross-sectional data

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ABSTRACT

Objectives Research has shown that people with physical impairment report lower utilisation of preventive services. The aim of this study was to examine whether women with mobility impairments have lower odds of using mammography compared with women with no such impairment, and explore the factors that are associated with lower utilisation.

Sample and design We performed secondary analysis, using logistic regressions, of deidentified cross-sectional data from the European Health Interview Survey, Wave 2. The sample included 9491 women from across the UK, 2697 of whom had mobility impairment. The survey method involved face-to-face and telephone interviews.

Outcome measures Self-report of the last time a mammogram was undertaken.

Results Adjusting for various demographic and socioeconomic variables, women with mobility impairment had 1.3 times (95% CI 0.70 to 0.92) lower odds of having a mammogram than women without mobility impairment. Concerning women with mobility impairment, married women had more than twice the odds of having a mammogram than women that had never been married (OR 2.07, 95% CI 1.49 to 2.88). Women in Scotland had 1.5 times (95% CI 1.08 to 2.10) higher odds of undertaking the test than women in England. Women with upper secondary education had 1.4 times (95% CI 1.10 to 1.67) higher odds of undergoing the test than women with primary or lower secondary education. Also, women from higher quintiles (third and fifth quintiles) had higher odds of using mammography, with the women in the fifth quintile having 1.5 times (95% CI 1.02 to 2.15) higher odds than women from the first quintile.

Conclusions In order to achieve equitable access to mammography for all women, it is important to acknowledge the barriers that impede women with mobility impairment from using the service. These barriers can refer to structural disadvantage, such as lower income and employment rate, transportation barriers, or previous negative experiences, among others.

INTRODUCTION

Research has shown that people with physical impairment generally report worse access and utilisation of healthcare services, including preventive and screening services.1-5 Several studies have evidenced how access to some cancer screening services can be compromised due to the presence of pre-existing physical impairment.6-11 A recent study in the UK showed that disabled women—including women with physical limitations—report worse access to healthcare compared with any other group, perhaps illustrating how gender and disability intersect to create structural disadvantage for disabled women.3

There are several reasons that have been associated with lower utilisation of healthcare services by disabled people, and for women in particular. These include, among other reasons, inaccessible healthcare facilities and/or equipment, lack of appropriate parking, lack of social support, and financial constraints, and the intersection of all these factors with gender-based structural disadvantage.1 3 8 There are also several intangible barriers that negatively affect utilisation of healthcare services by disabled women; past negative experiences with healthcare professionals, being treated as low-priority patients, not being adequately informed, or having their impairments ignored, are some of the reasons women give for the low utilisation of services, including mammography.5 6

Mammography is an important screening tool for breast cancer.12 In well-resourced
settings, which include most high-income countries. WHO’s position paper on mammography recommends population-based screening every 2 years for all women aged 50–69 years.\textsuperscript{12} Several countries, including the US, Norway, Denmark, and the UK, implement such national screening programmes.\textsuperscript{13–17} A Cochrane systematic review showed that the benefits of mortality decrease might be outweighed by overdiagnosis rates and higher rates of aggressive treatment, both of which were attributed to mammography.\textsuperscript{18} However, there is strong evidence showing that population-wide screening could lead to an increase of early-cancer diagnosis, with a concomitant decrease of late-stage diagnosis, hence leading to a mortality decrease.\textsuperscript{12, 19}

In the UK, women between the ages of 50 and 70 are invited to undertake a mammogram every 3 years, as part of a national screening programme by the National Health Service (NHS).\textsuperscript{20} While there are data available regarding women in England,\textsuperscript{21} little is known regarding mammography utilisation by women with physical impairment across the UK; it is not known whether there is a difference in the utilisation rates between women with and without any mobility impairment, nor which are some of the factors associated with these utilisation rates.

Most of the existing evidence suggests that disabled women have lower utilisation rates and worse access to mammography compared with non-disabled women.\textsuperscript{8, 10, 22–25} Transportation, quality of the experience and lack of appropriate information, are among the reasons given for this.\textsuperscript{5, 26} Several of these studies are small-scale studies, which although they give important insights into the experiences of women as they navigate the healthcare system; they do not allow any conclusions regarding utilisation of preventive services at a population level. A recent large prospective study showed that disabled women in England have lower odds of having a mammogram compared with non-disabled women.\textsuperscript{21}

In this article, we examine the utilisation of mammography by women with a lower limb mobility impairment in the UK. We use this term to refer to women who report difficulty or inability to walk or climb stairs, as per the available data from the European Health Interview Survey (EHIS, Wave 2). Our aim is to examine whether women with a lower limb mobility impairment have lower odds of using mammography compared with women with no such impairment, and explore the factors that are associated with lower utilisation.

This study seeks to add to the current body of evidence regarding utilisation of mammography by disabled women, by producing population-level evidence, and examining the association of a variety of demographic and socioeconomic factors—such as low income or lack of social support—with utilisation of mammography. This knowledge can inform policy and lead to the design of comprehensive support systems and target interventions that would enable real access to services, addressing the availability of services and their utilisation.

**METHODOLOGY**

**Survey**

We performed secondary analysis, using logistic regressions, of de-identified cross-sectional data from the EHIS, Wave 2. The EHIS collects health data of representative samples of population across European Union member states, providing thus the possibility to compare health indicators between countries. It is administered every 5 years.\textsuperscript{27}

The survey consists of four modules: (1) demographic and socioeconomic variables, such as age, sex, marital status, employment, education, and so on; (2) variables on health status, for example, self-perceived general health, chronic conditions, accidents, functional limitations in daily activities, and so on; (3) variables on healthcare use, such as consultations, unmet healthcare needs, preventive services, and so on; and (4) health determinants, for instance, weight, smoking, alcohol consumption, exercise, social support, and so on.\textsuperscript{28} The survey analyses 21 areas of health concerns and health-related behaviours, and 81 specific item questions. All measures are self-reported.\textsuperscript{29} For more information on the EHIS questionnaire, refer to the survey website.\textsuperscript{27, 28}

The UK did not participate in the first EHIS wave (2006–2009), but it did take part in the second wave. Data were collected for residents in private households, over 16 years of age, residing in England, Wales, Scotland, and Northern Ireland. For Great Britain, data were collected between April 2013 and March 2014 by the Office for National Statistics. Data for Northern Ireland were collected between April and September 2014 by the Northern Ireland Statistics and Research Agency. In Great Britain, the survey was conducted as a follow-up to the Labour Force Survey; individuals who did not object in their final wave of contact, in the sampled households, completed the EHIS Wave 2 questionnaire. In Northern Ireland, a simple random sample of households on the Land and Property Services Agency property gazetteer was used. In total, the UK survey included 20,161 observations, a sample size which was much higher than the estimated minimum effective size for the country, which was 13,085.\textsuperscript{30}

The interviews involved both face-to-face (20%) and telephone interviews (80%). For the face-to-face interviews, the interviewers conducted computer-assisted personal interviews (CAPI) using laptops at the address of the respondents, while for the telephone interviews, computer-assisted telephone interviews (CATI) were conducted. The CAPI and CATI questionnaires were generally similar, with only minor changes to account for the different mode of interviewing.\textsuperscript{30}

The microdata did not contain any personal information, such as names or addresses, which would allow direct identification. In order to ensure confidentiality, a set of anonymisation rules was applied.\textsuperscript{31} Access to microdata is granted only for scientific purposes; we were granted access by the UK Data Service (www.ukdataservice.ac.uk).
Data and variables
There are two questions in the EHIS that measure mobile difficulty: (1) variable PL6, ‘Difficulty in walking half a km on level ground without the use of any aid’, and (2) variable PL7, ‘Difficulty in walking up or down 12 steps’. These two variables were merged into a new variable, called ‘mobility impairment’, with answers ‘without difficulty’ (women that answered that they had no difficulty in performing either tasks), and ‘with difficulty’ (women that replied that they had some difficulty in performing or were unable to do at least one of the tasks).

Our dependent variable, ‘up to date with mammography’, was recoded and was binary, that is, ‘Yes’ (included the answers ‘within the last 12 months’, ‘1 to less than 2 years’, and ‘2 to less than 3 years’) and ‘No’ (‘more than 3 years’ and ‘never’). This recoding was done according to the NHS guidelines on mammography. Previous research has also employed this variable, looking at women being up to date with mammography.

In total, we had 9995 observations for women that answered the question on mammography. Since STATA, by default, performs listwise deletion and displays calculations that have non-missing values on all variables listed, our total sample size was 9491 observations (6794 observations for women without mobility impairment, and 2697 observations that have non-missing values on all variables listed). Since only a very small percentage of observations was deleted, we decided not to proceed to maximum likelihood or multiple imputation. The sample is representative of the target population (test results available on request).

The control variables included the following: (1) age: 20–49/50–69/70+ (while the target group is 50–69 years old women, the survey showed that almost 30% of women outside the target group have undertaken a mammogram); (2) civil status: never married/married/widowed/divorced; (3) region: England/Wales/Scotland/Northern Ireland; (4) urbanisation: thinly populated area/moderate populated area/densely populated area; (5) education: primary and lower secondary/upper secondary/post-secondary/tertiary; (6) income quintiles (net monthly equivalised household income): first quintile/second quintile/third quintile/fourth quintile/fifth quintile; (7) employment: unemployed/employed/inactive; (8) health self-assessment: bad (answers ‘bad’ and ‘very bad’)/fair (answer ‘fair’)/good (answers ‘good’ and ‘very good’); and (9) help from neighbours (how easy it is to get help from neighbours in case of need): difficult/possible/easy.

All analyses were performed using STATA/MP V.14.2.

Patient and public involvement
Patients were not directly involved in the design or conduct of this study. However, the research aim was informed by patients’ priorities, and experiences, as these were communicated through patient and public involvement in a previous study (the Challenges of Cancer and Disability Study, Tenovus TIG2017-05).

RESULTS
Table 1 summarises the characteristics of the study sample. Table 1—showed that women with mobility impairment had 1.3 times lower odds of undertaking a mammogram than women without mobility impairment (OR 0.80, 95% CI 0.70 to 0.92, P = 0.002) (full results not presented here but available on request).

As it can be seen in figure 1, 71% of all women who undertook mammography were in the target group, that is, 50–69 years of age. Almost 30% of all women that underwent the test were outside the target group. In certain parts of England, women younger than 50 and older than 70 years are invited for mammograms, while a systematic review has shown that women out of the target group also undergo mammography.

Figure 2 shows women with and without mobility impairments that have undertaken mammography, by age group.

Figure 2 shows that almost 30% of women with mobility impairment that undertook mammography were 70+ years old, that is, outside the target group; this percentage is less than half of that for women without mobility impairment. Third, the percentage of women with mobility impairment that were inactive was double (ie, almost 80%) than that of women without any mobility problems. All these points underline the structural disadvantage faced by women with mobility impairment in the UK: lower education and lower income, coupled with a much higher likelihood of being inactive in terms of employment.
## Table 1  Comparison between women with and without mobility impairment

| Parameter                  | Women without mobility impairment (n=6794) | Women with mobility impairment (n=2697) | P value, $\chi^2$ test |
|----------------------------|-------------------------------------------|----------------------------------------|------------------------|
| Age groups                 |                                            |                                        |                        |
| 20–49 (n=3270)             | 2919 43.0                                 | 351 13.0                               | P<0.0001               |
| 50–69 (n=3971)             | 2839 42.8                                 | 1132 42.0                              |                        |
| 70+ (n=2250)               | 1036 15.3                                 | 1214 45.1                              |                        |
| Civil status               |                                            |                                        |                        |
| Never married (n=1515)     | 1259 18.5                                 | 256 9.5                                | P<0.0001               |
| Married (n=5386)           | 4097 60.3                                 | 1289 47.8                              |                        |
| Widowed (n=1324)           | 604 8.9                                   | 720 26.7                               |                        |
| Divorced (n=1266)          | 834 12.3                                  | 432 16.0                               |                        |
| Region                     |                                            |                                        |                        |
| England (n=7895)           | 5695 83.8                                 | 2200 81.6                              | P<0.0001               |
| Wales (n=421)              | 269 4.0                                   | 152 5.6                                |                        |
| Scotland (n=822)           | 596 8.8                                   | 226 8.4                                |                        |
| Northern Ireland (n=353)   | 234 3.4                                   | 119 4.4                                |                        |
| Urbanisation               |                                            |                                        |                        |
| Thinline populated area (n=1322) | 945 13.9                             | 377 14.0                               | P=0.992                |
| Moderate-populated area (n=2575) | 1842 27.1                             | 733 27.2                               |                        |
| Densely populated area (n=5594) | 4007 59.0                              | 1587 58.8                              |                        |
| Education                  |                                            |                                        |                        |
| Primary/lower secondary (n=3040) | 1699 25.0                           | 1341 49.7                              | P<0.0001               |
| Upper secondary (n=3233)   | 2394 35.2                                 | 829 30.7                               |                        |
| Post secondary/tertiary, short (n=1495) | 1156 17.0                | 339 12.6                               |                        |
| Tertiary (n=1733)          | 1545 22.7                                 | 188 7.0                                |                        |
| Income quintiles           |                                            |                                        |                        |
| First quintile (n=1962)    | 1108 16.3                                 | 854 31.7                               | P<0.0001               |
| Second quintile (n=2008)   | 1336 19.7                                 | 672 24.9                               |                        |
| Third quintile (n=1932)    | 1352 19.9                                 | 580 21.5                               |                        |
| Fourth quintile (n=1852)   | 1493 22.0                                 | 359 13.3                               |                        |
| Fifth quintile (n=1737)    | 1505 22.2                                 | 232 8.6                                |                        |
| Employment                 |                                            |                                        |                        |
| Unemployed (n=360)         | 271 4.0                                   | 89 3.3                                 | P<0.0001               |
| Employed (n=4304)          | 3836 56.5                                 | 468 17.4                               |                        |
| Inactive (n=4827)          | 2687 39.6                                 | 2140 79.4                              |                        |
| Health self-assessment     |                                            |                                        |                        |
| Bad (n=797)                | 90 1.3                                    | 707 26.2                               | P<0.0001               |
| Fair (n=1896)              | 774 11.4                                  | 1122 41.6                              |                        |
| Good (n=6798)              | 5930 87.3                                 | 868 32.2                               |                        |
| Help from neighbours       |                                            |                                        |                        |
| Difficult (n=1312)         | 805 11.9                                  | 507 18.8                               | P<0.0001               |
| Possible (n=1923)          | 1426 21.0                                 | 497 18.4                               |                        |
| Easy (n=6256)              | 4563 67.2                                 | 1693 62.8                              |                        |

For more information on the variables, see the European Health Interview Survey Wave 2 methodological manual.28
Due to a higher McFadden $R^2$, and lower deviance, and AIC and BIC values, Model (3) provided a better fit than the previous two models. There was no collinearity affecting the results, with mean variance inflation factor of 2.21.

As it can be seen in table 2, the target group for having a mammogram (ie, the 50–69 group) was the one with the highest odds of undertaking it: women in this age subgroup had 12 times higher odds of having this screening than women in the 20–49 subgroup. Regarding civil status, married women had more than twice the odds of having a mammogram than women that had never been married; divorced women had 1.5 times higher odds. Women with mobility impairment in Scotland had 1.5 times higher odds of having the mammogram than women in England. Women with upper secondary education had 1.4 times higher odds to have a mammogram than women with primary or lower secondary education. Also, women from higher income quintiles (third and fifth quintiles) had higher odds of undertaking the mammogram, with the women in the fifth quintile having 1.5 times higher odds than women from the first quintile.

**DISCUSSION**

In this study, we investigated whether women with mobility impairment in the UK were less likely to be up to date with mammography compared with women with no mobility impairment, and explored some of the factors associated with lower utilisation. The results showed a statistically significant difference between women with and without mobility impairment, with women with mobility impairment having 1.3 times lower odds of undertaking a mammogram than women without mobility impairment. Furthermore, the results showed a positive association between married civil status, high income, educational attainment and living in Scotland, and being up to date with mammography.

One of the strengths of the study is that it is based on data from a nationally representative sample. It also adds to the body of literature by examining the association of several factors with mammography utilisation for women with mobility impairment, an issue that has been generally little explored, particularly in the UK.

One of the limitations of the study is that while we established associations between various factors and utilisation of mammography by women with mobility impairment, we cannot infer causality due to the cross-sectional nature of the data. Another limitation of the study is that there is no information in the EHIS on the reasons that influence utilisation of mammography. Furthermore, the EHIS relies on self-reporting information, which leaves the instrument open to response bias; however, there is no relevant information on this aspect. Another limitation of the study is the way mobility impairment was defined, which potentially included women with only short-term impairment, together with women with longer term impairment; this might have had an impact on external validity.

The findings showed that women with mobility impairment had 1.3 lower odds of being up to date with mammography. This is consistent with previous research that shows that in the UK, there are long-standing inequalities between people’s cancer experiences. This finding is also consistent with research findings from a study in England. Bone et al performed an analysis of data from the National Cancer Patient Experience Survey. They analysed data from 71,793 patients with cancer and found evidence that patients with cancer with long-standing conditions in England, including people with physical conditions and disabilities, reported poorer care. These inequalities persisted even when controlling for other factors. Further to this, people with pre-existing disability diagnosed with cancer report low satisfaction and use of services. As Liu and Clark have shown, quality of the experience matters; previous negative experiences with mammography might deter women with physical impairments from undertaking the test in the future.
**Table 2** Factors associated with utilisation rates of mammography by women with mobility impairment in the UK

| Variables                                                                 | Model (1) | Model (2) | Model (3) |
|---------------------------------------------------------------------------|-----------|-----------|-----------|
|                                                                           | OR        | 95% CI    | OR        | 95% CI    | OR        | 95% CI    |
| **Age groups (20–49 as reference)**                                       |           |           |           |           |           |           |
| 50 – 69                                                                   | 11.57***  | 8.67 to 15.44 | 11.99***  | 8.78 to 16.38 | 12.12***  | 8.85 to 16.61 |
| 70+                                                                       | 1.69***   | 1.27 to 2.25 | 1.96***   | 1.39 to 2.75 | 1.94***   | 1.37 to 2.74 |
| **Civil status (never married as reference)**                             |           |           |           |           |           |           |
| Married                                                                   | 2.05***   | 1.48 to 2.85 | 2.07***   | 1.49 to 2.88 |
| Widowed                                                                   | 0.934     | 0.65 to 1.34 | 0.95      | 0.66 to 1.37 |
| Divorced                                                                  | 1.44      | 1.00 to 2.08 | 1.46*     | 1.01 to 2.12 |
| **Regions (England as reference)**                                         |           |           |           |           |           |           |
| Wales                                                                     | 1.00      | 0.68 to 1.48 | 1.01      | 0.68 to 1.49 |
| Scotland                                                                  | 1.48*     | 1.06 to 2.05 | 1.51*     | 1.08 to 2.10 |
| Northern Ireland                                                          | 0.91      | 0.58 to 1.41 | 0.90      | 0.57 to 1.40 |
| **Urbanisation (thinly populated as reference)**                          |           |           |           |           |           |           |
| Intermediate-populated area                                               | 0.89      | 0.67 to 1.19 | 0.90      | 0.67 to 1.20 |
| Densely populated area                                                    | 0.77      | 0.59 to 1.01 | 0.77      | 0.59 to 1.01 |
| **Education (primary/lower secondary as reference)**                      |           |           |           |           |           |           |
| Upper secondary                                                           | 1.33**    | 1.08 to 1.64 | 1.36**    | 1.10 to 1.67 |
| Post secondary and tertiary, short                                        | 1.20      | 0.91 to 1.58 | 1.21      | 0.91 to 1.60 |
| Tertiary                                                                  | 0.88      | 0.61 to 1.28 | 0.88      | 0.60 to 1.28 |
| **Employment (unemployed as reference)**                                  |           |           |           |           |           |           |
| Employed                                                                  | 0.94      | 0.54 to 1.66 | 0.93      | 0.53 to 1.63 |
| Inactive                                                                  | 1.29      | 0.76 to 2.20 | 1.30      | 0.76 to 2.22 |
| **Income (first quintile as reference)**                                  |           |           |           |           |           |           |
| Second quintile                                                           | 1.11      | 0.88 to 1.40 | 1.09      | 0.86 to 1.38 |
| Third quintile                                                            | 1.32*     | 1.03 to 1.69 | 1.29**    | 1.01 to 1.66 |
| Fourth quintile                                                           | 1.18      | 0.87 to 1.59 | 1.18      | 0.87 to 1.60 |
| Fifth quintile                                                            | 1.46*     | 1.01 to 2.11 | 1.49**    | 1.02 to 2.15 |
| **Health self-assessment (bad as reference)**                             |           |           |           |           |           |           |
| Fair                                                                      |           |           |           |           | 1.14      | 0.91 to 1.42 |
| Good                                                                      |           |           |           |           | 1.11      | 0.87 to 1.42 |
| **Support from neighbours (difficult as reference)**                     |           |           |           |           | 1.08      | 0.81 to 1.45 |
| Possible                                                                  |           |           |           |           | 1.07      | 0.85 to 1.35 |
| Easy                                                                      |           |           |           |           |           |           |

| Statistics                                                                 | Model (1) | Model (2) | Model (3) |
|---------------------------------------------------------------------------|-----------|-----------|-----------|
| Pseudo R²                                                                 | 0.1636    | 0.1908    | 0.1923    |
| χ² (21)                                                                   | 631.29    | 722.80    | 718.04    |
| Prob>χ²                                                                  | 0.0000    | 0.0000    | 0.0000    |
| McFadden R²                                                               | 0.162     | 0.179     | 0.180     |
| Deviance                                                                  | 3228.188  | 3066.311  | 3015.368  |
| AIC                                                                       | 3234.188  | 3106.311  | 3063.368  |
| BIC                                                                       | 3251.989  | 3224.610  | 3204.965  |

*P < 0.05, **P < 0.01, ***P < 0.001.
AIC, akaike information criterion; BIC, Bayesian information criterion.
The findings also showed that married women had higher odds of having a mammogram than women that had never been married. This result is in accordance with evidence demonstrating the protective role of married civil status.25 38 Indeed, married people tend to have more fixed residence, regular doctors, and fixed healthcare places, and therefore are more likely to be informed and accept preventive health services than unmarried people.38 They have also a stronger social network (for example, family members, relatives, and friends) that can offer them more emotional and practical support (for instance, transportation) to attend such screenings, as well as help them adopt healthier behaviours.

Our study also revealed that there are differences in the utilisation rates of mammography between women living in different regions in the UK, with women with mobility impairment living in Scotland having higher odds of undertaking the test than women in England. The reason behind this might be the usage of mobile screening units in Scotland, which appears to enable access to mammography for underserved populations.39

Furthermore, our study showed that women with mobility impairments with higher education had higher odds of having a mammogram than women with primary or lower secondary education. Women with mobility impairment that belonged to higher income quintiles had also higher odds of having a mammogram than women belonging to the first quintile. This result agrees with previous research that found that disabled women with higher education and an overall higher socioeconomic status were more likely to undertake preventive examinations.40 41 Educational attainment beyond upper secondary did not seem to have any further positive effect on the utilisation of mammography.

These inequalities in the experiences of patients with cancer in the UK conflict with several of the recommendations of recent strategic documents, including ‘Achieving world-class cancer outcomes: a Strategy for England 2015–2020’ and the Cancer Delivery Plan for Wales.42 43 Both documents call for access to equitable care, achieving the best experience, and promoting delivery of cancer care responsive to individual needs.

Overall, taking into account the global demographic, epidemiological and socioeconomic changes—including ageing, urbanisation, reduction in morbidity and mortality rates, and increase in chronic diseases—it is essential that preventive health services are better promoted and reach all people, especially disadvantaged groups, such as disabled people, women and the poor. WHO position paper on mammography states that:

Population-based screening programmes identify and individually invite each person in the eligible population to attend each round of screening so that each person in the eligible population has an equal chance of benefiting from screening. People with mobility impairment may, for example, face transportation barriers, which could stop them from accessing screening services, despite their availability. Women with mobility impairment, and disabilities in general, are further disadvantaged, as they also face structural disadvantage—in the form of lower education, lower income and greater poverty—than men, as shown in this study, and supported by a body of existing research.44 45 In order to enhance the utilisation of mammography (and possibly the use of other preventive services), it is important to acknowledge the barriers that stop women from using the service and adopt measures that would lead to a more equitable utilisation. The wide adoption of mobile screening units might be a way to improve access for this population. This needs to be complemented by increased disability awareness for healthcare professionals, making them sensitive to addressing impairment-specific needs in order to achieve inclusive services for all.

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Contributors The authors jointly conceived the final research question and aims and objectives, reviewed the literature, produced the analysis plan and carried out the analysis, and drafted the manuscript.

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