Exploring participant attrition in a longitudinal follow-up of older adults: the Global Longitudinal Study of Osteoporosis in Women (GLOW) Hamilton cohort

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ABSTRACT

Objective We explored the magnitude of attrition, its pattern and risk factors for different forms of attrition in the cohort from the Global Longitudinal Study of Osteoporosis in Women.

Design Prospective cohort study.

Setting Participants were recruited from physician practices in Hamilton, Ontario.

Participants Postmenopausal women aged ≥55 years who had consulted their primary care physician within the last 2 years.

Outcome measures Time to all-cause, non-death, death, preventable and non-preventable attrition.

Results All 3985 women enrolled in the study were included in the analyses. The mean age of the cohort was 69.4 (SD: 8.9) years. At the end of the follow-up, 30.2% (1206/3985) of the study participants had either died or were lost to follow-up. The pattern of attrition was monotone with most participants failing to return after a missed survey. The different types of attrition examined shared common risk factors including age, smoking and being frail but differed on factors such as educational level, race, hospitalisation, quality of life and being prefrail.

Conclusion Attrition in this ageing cohort was selective to some participant characteristics. Minimising potential bias associated with such non-random attrition would require targeted measures to achieve maximum possible follow-rates among the high-risk groups identified and dealing with specific reasons for attrition in the study design and analysis.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ We used a large cohort with a relatively long follow-up period.
⇒ Different types of attrition were assessed, which provides an understanding of the factors associated with each type of attrition.
⇒ The cohort had limited racial and gender diversity which could affect the generalisability of the results.
⇒ The reasons for attrition were unavailable for more than one-third of the participants thus limiting further analysis.
⇒ We recommend caution in interpreting the results since data were based on self-reports.

BACKGROUND

Longitudinal studies require the repeated collection of data from participants over time, thus making them prone to attrition. The loss of participants may be intermittent, where they miss one wave and return at subsequent time points, or terminal, where they drop out completely from the study. Attrition complicates the analysis of longitudinal studies and could threaten the internal and external validity of study results if it is selective. Selective attrition occurs when participants who are lost are different than those who remain or complete the study. This could create differences in group compositions and changes in participant characteristics between the original cohort and analytical sample.

Selective attrition is a serious concern in longitudinal ageing studies, given the increased susceptibility of older adults to adverse experiences such as illness, hospitalisation, institutionalisation, disability and death that could affect their ability and availability to respond to follow-up assessments. In ageing studies, attrition rates as high as 77% over a 10-year follow-up and up to 40% in a shorter observation period of 2 years have been reported. Existing evidence suggests that the initial level or status of participants at study entry may predict how long they will remain in the study. Non-completers compared with completers are generally more likely to be older, have poorer cognitive function, lower socioeconomic status, lower level of education and poorer socioeconomic
METHODS

Study design, participants and setting

The GLOW study, Hamilton cohort was a multisite prospective cohort study that examined the risk factors and management of osteoporotic fractures in more than 60,000 women aged ≥55 years, drawn from 17 sites across 10 countries. The women were recruited from physician practices and enrolled between January 2007 and December 2008. Participants were followed up for 6 years and were mailed study questionnaires annually; however, there was no data collection between the fourth and fifth year. Participant completion of annual survey was captured for each year of follow-up and where there was no return, they were contacted by study personnel. Reasons for drop-out were collected where possible. Written informed consents were obtained from all participants.

Patient and public involvement

There was no patient or public involvement in the design, conduct, reporting or dissemination plans of this study.

Outcomes

Since existing evidence suggests that predictors of attrition may differ by cause, outcomes assessed were categorised by cause and included time to all-cause, non-death and death attrition. These were defined as time from study enrolment to the last wave a participant was observed in the study regardless of the reason for attrition, for all non-death reasons including refusals, loss of contact and for losses due to death, respectively. Refusal was defined as declining to continue to participate in the study when contacted after failure to return a mailed survey or mailing a withdrawal note in place of completed questionnaire. Lost contact was defined as being unreachable through mail or phone calls after online search of obituaries were conducted to determine if they were lost contact due to death. Participants who were lost to follow-up without any documented reasons were classified as unknown. Death status was ascertained by contacting participants spouses, friends or relatives and by searching electronic databases of obituaries for entries that corresponded with the participant’s full names and date of birth.

We also categorised outcomes into preventable attrition (attrition due to refusals and loss of contact which can lead to intermittent participant loss and for which the researcher may be able to mitigate with targeted strategies) and time to non-preventable attrition (attrition due to death and cognitive impairment which can lead to terminal attrition and are not modifiable by the researcher). Examining these types of is important given that attrition due to death and illness occur in both study cohort and target population while other forms of attrition are restricted to the study cohort. Consequently, the risk factors may differ, therefore, presenting varying degree of potential bias and requiring different tailored strategies to address during study design and analysis.

Participants entered the study at enrolment and their observation time ended with an event at time of attrition, or with censoring at the end of the study.

Covariates

The covariates assessed were age, educational level, race, body mass index (BMI), falls in the past year, prior fracture, osteoporosis, polypharmacy, smoking, alcohol use, health-related quality of life (HRQoL) and frailty status. These are variables previously shown to be associated with death attrition and included other new variables available in the dataset. Prior fracture was defined as any baseline self-reported fracture that occurred since the age of 45. Polypharmacy was defined as taking or taken five or more medications at study entry. Participants who responded ‘yes’ to the question: ‘Have your doctor or any other health provider ever told you that you had osteoporosis?’ were classified as having osteoporosis. Smoking was defined as smoking at least once a week while alcohol use was defined as having seven or more drinks of alcohol per week. HRQoL was measured using the European Quality of Life 5 Dimension 5 Level (EQ5D5L). Frailty status was derived from a categorisation of frailty index (FI), as computed by previous studies that utilised the same dataset. Briefly, an FI composed of 34 baseline variables.
(15 comorbidities, 12 activities of daily living, 6 symptoms and signs and 1 healthcare utilisation measure) was constructed by mapping each level of a categorical deficit to a value from 0 to 1 to indicate the frequency and severity of the deficit. The values of the deficits were summed and divided by the 34 deficits assessed to yield FI scores for each participant. Then, the FI was categorised into non-frail, prefrail and frail based on cut-points (0.20 and 0.35) from a previous study of the same cohort.\(^2\)

All the variables included in the analyses were based on self-reports.

**Statistical analysis**

Descriptive analysis of participants baseline characteristics by attrition status were presented as frequencies with percentages and means with standard deviation (SD) for categorical and continuous variables, respectively. Graphs were used to show the pattern and rate of participant loss across the waves of follow-up. The pattern of missingness created by participant loss was generally monotone, that is, a participant who missed a wave of assessment was unlikely to be available for subsequent waves; therefore, time-to-event analysis was considered to be the most appropriate regression method for the data. We performed univariate and multivariable analysis using Cox proportional hazards model with robust standard errors (SEs) to account for potential clustering within physician practices. For the multivariable analysis, all covariates were included simultaneously in the model regardless of statistical significance in the univariate analysis. Proportional hazards assumption was checked using both graphical diagnostics based on scaled Schoenfeld residuals and a statistical test.

Sensitivity analyses were performed to assess the robustness of results to and missing covariate data—educational level (13.9%), BMI (4.5%), fall (0.8%), osteoporosis (4.7%), smoking (0.73%), drinking (0.68%), hospitalisation (0.98%), HRQoL (3.6%). Multiple imputation using chained equation was used to handle missing baseline data assuming the data were missing at random. Ten imputed datasets were created, and the imputation model included all the covariates in the analytic model and Nelson-Aalen cumulative hazard estimator. All analyses were performed using Stata V.17 (Stata) and regression results were considered statistically significant at p<0.05. Additional sensitivity analyses were performed adjusting for multiple hypothesis testing using Bonferroni correction and results were considered significant at a lower threshold of <0.01.

**RESULTS**

Characteristics of the GLOW Hamilton cohort by attrition status are presented in table 1. A total of 3985 were enrolled in the study. The mean age of the cohort was 69.4 (SD: 8.9) years. At baseline, the majority of the participants were white (93.3%), non-smokers (88.7%), had high school or lower education (64.1%), no prior fracture (78.4%), osteoporosis (73.8%) and no hospitalisation in the past year (88.7%). Generally, the participants had relatively subjective good health at study entry, EQ5D5L: 0.72, frailty status: 81% non-frail or prefrail. The cohort was observed for a median of 4.59 (Q1–Q3: 3.04–4.67) years. Over the observation period, attrition occurred in 1206 (30.0%) of the participants: 1042 (86.4%) due to non-death causes and 164 (13.6%) due to death. The reasons for participant loss include loss of contact 223 (18.5%), refusal 330 (27.4%), ineligible to continue due to cognitive impairment 62 (5.1%), death 164 (13.6%) and unknown 427 (35.4%).

**Figure 1** shows the flow chart of participant loss due to death and non-death causes from enrolment to last wave of follow-up. The pattern of attrition which was generally terminal; approximately 99% of participants did not return after a missed survey (online supplemental table S1). In **figure 2**, the attrition rates were stable in the first three waves, then spiked up at the last wave for both all-cause and non-death attrition.

**Table 2** shows the results of the multivariable analyses of the relationship between all-cause, non-death and death attrition and the factors examined while **table 3** shows the results of the regression analyses for preventable and non-preventable causes of attrition. Increasing age (HR 1.19, 95% CI 1.12 to 1.25, p<0.001), smoking (HR 1.69, 95% CI 1.47 to 1.95, p<0.001), hospitalisation (HR 1.24, 95% CI 1.03 to 1.49, p=0.022) and being frail (HR 1.36, 95% CI 1.16 to 1.59, p=0.001) or frail (HR 1.82, 95% CI 1.46 to 2.26, p<0.001) were associated with increased hazards of all-cause attrition. Conversely, higher educational level attrition (HR 0.81, 95% CI 0.70 to 0.94, p=0.006) and higher HRQoL (HR 0.66, 95% CI 0.46 to 0.94, p=0.022) were associated with lower hazards of all-cause attrition. These relationships were comparable to the results of the non-death attrition analysis. For attrition due to death, increasing age (HR 1.59, 95% CI 1.38 to 1.83, p<0.001), smoking (HR 2.29, 95% CI 1.44 to 3.64, p<0.001) and being frail (HR 3.11, 95% CI 1.59 to 6.08, p<0.001) were the only factors significantly associated with attrition. The results of the analyses for preventable causes of attrition were similar to the analyses for all-cause and non-death attrition. For the non-preventable causes of attrition, the results were comparable to the analyses of attrition due to death but differed in the magnitude of the hazard ratios of the risk factors identified and with an additional statistically significant factor, race (HR 2.22, 95% CI 1.12 to 4.39, p=0.022). The proportional hazard assumptions were satisfied. However, the results of the missing data analyses differed slightly from the primary analyses for all-cause and non-death attrition (online supplemental tables S2 and S3). Further, the results adjusted for multiple testing differed in statistical significance for two factors (hospitalisation and quality of life) in all-cause attrition and one factor (race) in the non-death attrition regression analyses (online supplemental tables S4–S6).
DISCUSSION
This study showed a moderately high attrition rate over the 6-year period of follow-up at 30%, which is comparable to population-based studies with similar duration of observation.\textsuperscript{12,26} The pattern of attrition was inconsistent across the waves of follow-up, which we attribute to a gap in data collection between the fourth and sixth year of the study owing to funding constraints. The losses that occurred during that period, which were observed at the fourth and last wave of data collection, was double what was recorded over the three preceding waves. In previous longitudinal ageing studies, attrition rates were stable over time.\textsuperscript{12,16} The pattern seen in our study is similar to what has been observed in studies with longer follow-up duration of up 10 years.\textsuperscript{14} Our contrasting finding underscores the importance of consistent follow-up, as factors that increase attrition rates such as declining interest, loss of contacts and relocations could be heightened during unplanned breaks in data collection.

### Table 1  Baseline characteristics of participants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total n=3985</th>
<th>LTFU n=1206</th>
<th>Retained n=2779</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years), mean (SD)</td>
<td>69.4 (8.9)</td>
<td>72.3 (9.8)</td>
<td>68.2 (8.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Education, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school or less</td>
<td>2509 (64.1)</td>
<td>840 (71.7)</td>
<td>1669 (60.9)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>More than high school</td>
<td>1405 (35.9)</td>
<td>331 (28.3)</td>
<td>1074 (39.1)</td>
<td></td>
</tr>
<tr>
<td>Race, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>3717 (93.3)</td>
<td>1119 (92.8)</td>
<td>2598 (93.5)</td>
<td>0.417</td>
</tr>
<tr>
<td>Non-white</td>
<td>268 (6.7)</td>
<td>87 (7.2)</td>
<td>181 (6.5)</td>
<td></td>
</tr>
<tr>
<td>Body mass index (kg/m²): mean (SD)</td>
<td>27.7 (5.8)</td>
<td>27.7 (6.2)</td>
<td>27.7 (5.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Falls, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>2471 (62.5)</td>
<td>702 (59.0)</td>
<td>1769 (64.0)</td>
<td>0.003</td>
</tr>
<tr>
<td>Yes</td>
<td>1483 (37.5)</td>
<td>488 (41.0)</td>
<td>995 (36.0)</td>
<td></td>
</tr>
<tr>
<td>Prior fracture, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3123 (78.4)</td>
<td>899 (74.5)</td>
<td>2224 (80.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Yes</td>
<td>862 (21.6)</td>
<td>307 (25.5)</td>
<td>555 (20.0)</td>
<td></td>
</tr>
<tr>
<td>Osteoporosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>2801 (73.8)</td>
<td>779 (69.4)</td>
<td>2022 (75.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Yes</td>
<td>995 (26.2)</td>
<td>344 (30.6)</td>
<td>651 (24.4)</td>
<td></td>
</tr>
<tr>
<td>Polypharmacy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3604 (90.4)</td>
<td>1091 (90.5)</td>
<td>2513 (90.4)</td>
<td>0.972</td>
</tr>
<tr>
<td>Yes</td>
<td>381 (9.6)</td>
<td>115 (9.5)</td>
<td>266 (9.6)</td>
<td></td>
</tr>
<tr>
<td>Smoking, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3510 (88.7)</td>
<td>1009 (84.9)</td>
<td>2500 (90.3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Yes</td>
<td>447 (11.3)</td>
<td>179 (15.1)</td>
<td>268 (9.7)</td>
<td></td>
</tr>
<tr>
<td>Alcohol intake, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3441 (87.0)</td>
<td>1026 (85.9)</td>
<td>2415 (87.4)</td>
<td>&lt;0.216</td>
</tr>
<tr>
<td>Yes</td>
<td>517 (13.0)</td>
<td>168 (14.1)</td>
<td>349 (12.6)</td>
<td></td>
</tr>
<tr>
<td>Hospitalisation, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3498 (88.7)</td>
<td>996 (84.2)</td>
<td>2502 (90.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Yes</td>
<td>448 (11.3)</td>
<td>187 (15.8)</td>
<td>261 (9.4)</td>
<td></td>
</tr>
<tr>
<td>EQ5D5L, mean (SD)</td>
<td>0.72 (0.23)</td>
<td>0.66 (0.26)</td>
<td>0.75 (0.22)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Frailty status (n %)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-frail</td>
<td>1924 (48.3)</td>
<td>407 (33.8)</td>
<td>1517 (54.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Prefrail</td>
<td>1290 (32.4)</td>
<td>428 (35.5)</td>
<td>862 (31.0)</td>
<td></td>
</tr>
<tr>
<td>Frail</td>
<td>771 (19.4)</td>
<td>371 (30.8)</td>
<td>400 (14.9)</td>
<td></td>
</tr>
</tbody>
</table>

%, proportion; EQ5D5L, European Quality of Life 5 Dimension 5 Level; LTFU, lost to follow-up; n, number.
Participants drop-out in the study was largely terminal with 99% of participants who missed a wave of data collection unavailable for subsequent follow-up. This pattern of attrition was unexpected as study personnel made efforts to recontact participants when they failed to return mailed surveys. Such reminder strategies have mostly shown favourable effects in improving retention\textsuperscript{27,28} including postal surveys among older adults.\textsuperscript{29} It appears a single measure was insufficient to minimise attrition in this study. Reviews of retention strategies found higher retention rates among studies where multiple methods were used.\textsuperscript{30,31} As such, it is possible that this study could have benefited from using a combination of different retention measures.

Our study also showed that attrition was selective with respect to some participants characteristics. While increasing age, smoking and being frail were common to all forms of attrition examined, additional factors such as lower education, prior hospitalisation, lower quality of life, and being prefrail at study entry were associated with non-death attrition and preventable causes of attrition. Being white was significantly associated with greater risk of non-preventable causes of attrition. This could be explained by the fact that the cohort was largely white and that all participants who dropped out of the study due to cognitive impairment were white, which increased the number of events for this group when added to the other non-preventable cause of attrition, death. Notwithstanding, our findings are consistent with previous studies that showed that risk factors could differ by reasons for attrition.\textsuperscript{11-19}

Age is an established predictor of attrition\textsuperscript{4,13} and this is further confirmed in our study with older participants having a higher risk of study loss. As participants age, they are likely to experience decline in health status and functioning, as well as death which could interfere with data collection.\textsuperscript{7} While the ageing process is beyond the control of the researcher, some measures such as oversampling of older participants\textsuperscript{18} and use of proxy respondents\textsuperscript{32} could provide a buffer against attrition as participation becomes more challenging with age. Participants who had lower levels of education were also more likely to drop out of the study for reasons other than death or impairment, which is consistent with most evidence on this risk factor.\textsuperscript{1,2,11,13,14,33} A person’s level of education may influence what they know and understand about research, thus affecting their attitudes towards continued participation in the research process. Therefore, retaining participants of lower educational status could benefit from continuous targeted messaging on the value of completing the study. In addition, our study supports existing literature in which smokers were consistently less likely to complete follow-up assessments.\textsuperscript{1,17,34} This factor remained significantly associated with attrition across all the types examined. Smoking is associated with many health risks and worsening health outcomes in older adults,\textsuperscript{35} consequently affecting the ability of those participants to continue in the study. As such, it is important to prioritise smokers as a high-risk group in the design of retention strategies for cohort studies of older adults.

The multidimensional measures of health assessed in this study, frailty status and European Quality of Life 5 Dimension 5 Level, suggests an increased risk of attrition at poorer levels of these health variables. For frailty, which is an indicator of vulnerability to poor health outcomes,\textsuperscript{36} participants who were prefrail or frail, that is, those who had a FI>0.20 were more likely to drop out of the study than the non-frail group for any reason. However, losses due to death and impairment were higher among frail participants. This finding was expected as higher levels of frailty are related to increased risk of morbidity and mortality,\textsuperscript{36,37} which affects participation. The EQ5D5L index which is a measure of the participants perceived HRQoL\textsuperscript{23} indicated that those with higher scores had greater chances of completing the study. However, it was not significantly associated with the non-preventable...
causes of attrition in contrast to previous studies. Nevertheless, the results of the composite measures support existing evidence that poor health status is an important predictor of participant loss. These health index measures could be useful for streamlining the number of individual health variables that would otherwise be too many to consider when designing strategies to minimise attrition. For example, being hospitalised in the past year was also associated with increased risk of participant loss in this study. Frailty is a known risk factor for hospitalisation among older adults. Therefore, a frailty measure could be used to capture participants whose risk of attrition is related to previous or even future hospitalisation.

The differences observed in the characteristics of participants who were lost and those who completed the study extends the evidence on non-random losses in longitudinal ageing studies. While the risk factors of attrition identified in this study are unmodifiable person-level characteristics that cannot be changed by the researcher, these can be accounted for in the study design. Some of the strategies that have demonstrated positive effects on retention in the ageing literature include, inclusion of proxy respondents, transportation support, at-home assessment, financial incentives, flexible data collection schedule, provision of periodic update on study progress as well as participant appreciation. Most of these measures may not be effective in addressing non-preventable attrition, that is, attrition due to death or illness which are common in ageing studies. Uncommon but cost-effective measures such as substitution sampling, which involves the recruitment of new participants as replacements for losses based on shared baseline characteristics, could be used to mitigate this type of attrition.

In designing retention strategies, it is important to consider what could constitute increased participant burden to avoid a counterproductive effect. According to a recent meta-analysis of longitudinal cohort studies, strategies that offered flexibility to participants and were less burdensome provided the greatest benefits. Further, successfully retaining older adults in longitudinal studies may require reviewing the strategies periodically to determine what works best, as in the Gates et al study.
transferring from a long face-to-face questionnaire to a shorter postal survey increased response rates and reduced questionnaire error rates.

Attrition causes missing data problems, and our study and others have shown that this missingness could be non-random in ageing cohorts.\(^2\)\(^9\)\(^{14–16}\) Notwithstanding, the common method for handling participant losses in longitudinal studies of older adults is by exclusion from analysis based on the assumption of random loss.\(^4\)\(^9\) This assumption is not plausible where the probability of attrition is dependent on participant characteristics. There are statistical methods that could be used to handle missing data due to selective attrition, such as multiple imputation, joint models and mixed models,\(^5\)\(^0\)\(^–\)\(^5\)\(^2\) but the discussion is beyond the scope of this paper. It is important to note that these post-hoc measures may not completely eliminate potential attrition bias, particularly when the missing data are large.\(^7\) As the popular saying goes, ‘prevention is better than cure’, so it is most valuable to use measures that ensure maximum follow-up rates possible are achieved.

**LIMITATIONS**

We examined potential risk factors for different types of attrition in a large, population-based sample of older adults. However, the study is not devoid of limitations. Since our study cohort was predominantly white and involved females only, the findings may not apply to more racially diverse populations and genders. In addition, we only investigated the associations between baseline characteristics and attrition; however, some of these characteristics may have changed over time which could impact attrition rates across different waves of data collection. The data were obtained in a self-reported manner and were not validated by patient clinical records. As such, there is possibility of underestimation or overestimation. Notwithstanding, the source of our death data has also been proven to be reliable.\(^5\)\(^3\) Lastly, the reasons for attrition were unavailable for more than a third of the participants who did not complete the study, thus limiting our analyses and narrowing our understanding of why participants drop out which is critical to designing retention strategies.
CONCLUSION
This study extends evidence on the occurrence of inevitable and non-random attrition in ageing cohort studies, showing risk factors that are common and specific to different types of attrition. Addressing these potential sources of attrition bias will enhance our understanding of the ageing process with longitudinal data. This would require targeted measures to achieve maximum possible follow-rates among high-risk groups and dealing with specific reasons for attrition in the design and analysis of cohort studies of older adults.

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Contributors
CO and LT conceptualised and developed the study. CO analysed the data and drafted the manuscript. GI, JA, AP and LT provided professional support and made critical revisions to the manuscript for important intellectual content. All the authors approved the final version for publication. CO is responsible for the overall content as the guarantor and accepts full responsibility for the work and/or omissions arising from translation and adaptation or otherwise.

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