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Prevalence and risk factors associated with non-traffic related injury in the older population in Ghana: Wave 2 of the WHO Study on Global AGEing and adult health (SAGE)

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ABSTRACT

Injuries are a significant cause of hospitalization in the older population, leading to a decline in physical activity and greater dependence on others. Compared to traffic related injury, relatively fewer studies have been conducted on non-traffic related injury in the older population in Ghana. This analysis provides a nationwide baseline prevalence and associated factors of non-traffic related injuries among older adults in Ghana. Data from the 2014–2015 nationally representative World Health Organization Study on global AGEing and adult health (SAGE) Ghana Wave 2 was used. A final sample of 3461 older adults living in 2827 households was used in the statistical modelling. Predictors of injury were examined using both single-level and multilevel binary logistic regression models. The prevalence of non-traffic related injury found in this study was 3.74%. The odds of being injured decreased among females (OR = 0.66, 95% CI: 0.46, 0.95) compared to their male counterparts and those who rated their heath state as moderate (OR = 0.59, 95% CI: 0.38, 0.94). Depression was the only risk factor identified in the multivariable model (OR = 2.55, 95%CI: 1.38, 4.71). The study did not observe significant residual household-level variation in injury status. The role of depression as a risk factor suggests that interventions that aim to reduce non-traffic related injury in older adults should consider improving mental health.

1. Introduction

The largest proportion (70%) of the older population globally resides in developing countries. Increased longevity globally implies that this proportion is set to increase in the near future (Beard et al., 2012). Injuries are a significant cause of hospitalization in the older population, often resulting in functional decline, reduced mobility and greater dependence (Petridou et al., 1996). The older population has a number of characteristics that predispose them to injury. Physiological atrophy is associated with a reduction in muscle mass by 30% between the third and eight decades of life, which enhances the vulnerability to fall injuries (Navaratnarajah and Jackson, 2017). Loss of bone mineral density [1% in men after age 50 years and 2–3% in women after menopause) increases the risk of fracture, along with decreased physical activity, dietary calcium deficiency and hormonal withdrawal in women (Navaratnarajah and Jackson, 2017).

Disabilities including decline in cognition, impaired vision, hearing and motor function (Peck, 2011; Coty et al., 2015; Shi et al., 2015; Tlemissov et al., 2015), the use of multiple medications (Richardson et al., 2014; Tsai et al., 2014; Coty et al., 2015; Jindal et al., 2019), presence of co-morbidities (Huang et al., 2012; Williams et al., 2015; Li et al., 2016), frailty (Tsai et al., 2014) living alone and single/divorced status (Alptekin et al., 2008), male sex (Grundstrom et al., 2012), alcohol consumption (Grundstrom et al., 2012) and unsafe environment (Tsai et al., 2014; Jindal et al., 2019; Schellenberg et al., 2019) are other factors that may contribute to injuries in the older population. Majority of injuries appear to occur at home in this age group (Oyetunji et al., 2012). Among all injuries, falls contribute a substantial proportion of injuries in this age group (Alptekin et al., 2008; DeGrauw et al., 2016). Other types of injury that may occur in this population include traffic and travel related injury (O'Neill, 2016), burns (Sepehripour et al., 2018), occupational injury for older adults still within the workforce (Hasebe and Sakai, 2018) and suicidal intent (Lee et al., 2018).

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Traffic related injury has already been studied in Ghana (Mock et al., 1999a, 1999b; Afukaar et al., 2003; Kudebong et al., 2011). Injury patterns have also been studied in target populations such as pregnant women (Osei-Ampofo et al., 2016) and pediatric populations (Whiteside et al., 2012). However, recent studies on non-traffic related injury using nationally representative data is limited. Furthermore, interventions addressing non-traffic related injury can differ in some respects from traffic-related injury. There is a dearth of local evidence for selection of interventions addressing non-traffic related injury. The WHO Study on Global AGEing and adult health (SAGE) Wave 1 (2007–2010) estimated the self-reported prevalence of non-traffic related injury in adults aged 50 years and older in six low- and middle-income countries to be, South Africa (1.3%), Russian Federation (3.3%), Mexico (4.2%), China (5.1%), Ghana (5.7%) and India (9.1%) (Stewart Williams et al., 2015). The present study seeks to determine the prevalence of and risk factors associated with non-traffic related injuries in Ghana at a later period (2014–2015). This should inform injury prevention planning and other health care programs targeted towards the older population.

2. Materials and methods

2.1. Data source

The study used data from the WHO Study on Global AGEing and adult health (SAGE).

Wave 2 which is a nationally representative survey conducted in Ghana through multistage cluster sampling strategies. The survey is a multi-country longitudinal study that collects data to complement existing ageing data sources to inform policy and programmes. WHO and the University of Ghana Medical School through Department of Community Health collaborated to implement SAGE Wave 2 in2014–2015. Detailed description of the methods used in the survey is published elsewhere (Charlton et al., 2016).

2.2. Study population

Individuals aged ≥50 years were interviewed regarding their chronic health conditions and health services coverage; subjective wellbeing and quality of life; health care utilization; risk factors and preventive health behaviors; perceived health status; socio-demographic and work history; social cohesion; and household characteristics. Similar information was collected on smaller sample of persons aged 18–49 years. In households identified as “older” for sampling purposes, all household members aged 50 years and older were invited to participate in the study. This study is based on older adults (i.e. ≥50 years). Further details about SAGE survey methods generally can be found through the WHO website (http://www.who.int/healthinfo/sage/cohorts/en/) including detailed information about SAGE Ghana Wave 2.

2.3. Outcome variable

Our primary outcome of interest in this study was self-reported non-traffic related injury status (all injuries except road traffic accidents). It was based on the question, “In the last 12 months, have you had any other event where you suffered from bodily injury?”. The response was then categorized as Yes or No. It was possible to distinguish non-traffic injury from traffic-related injury which was obtained by asking an earlier question: “In the last 12 months, have you been involved in a road traffic accident where you suffered from bodily injury?”

2.4. Explanatory variables

We consider risk factors such as age, ethnicity, marital status, sex, religion, health status report, household wall type, household source of drinking water, type of toilet facilities, household floor types, depression, and visual difficulty.

Age was categorized into groups (50–59; 60–69; 70–79; ≥80), ethnicity into five main groupings (Akan, Ewe, Ga-Adangbe, Guan, Northern dialects), and marital status (currently married; not currently married), sex (male; female), religion (some religion; no religion), health today status (good/very good; moderate; bad/very bad), difficulty with self-care (none; mild; moderate; severe/extreme), household wall type (durable material; non-durable material), household source of drinking water (piped; non-piped), type of toilet facilities (flush; non-flush), household floor (hard floor; earth floor), depression (none; mild; moderate; severe/extreme), and visual difficulty (none; mild; moderate; severe/extreme). These variables were considered based on factors that influence health outcomes, especially in developing countries like Ghana. Questions to ascertain past 12-month DSM-IV depression were based on the World Mental Health Survey version of the Composite International Diagnostic Interview.

2.5. Statistical analysis

Distribution of selected background characteristics of respondents were presented as frequencies with their associated percentages for qualitative variables. Association between cause of injury and sex was explored using Chi-Square test. We performed binary logistic regression analysis to examine factors at the individual, household, and community levels that might be associated with injury status and explored unobserved household level effects on the outcome. First, we applied a single level binary logistic regression models on 3461 individuals residing in 2827 households with complete measurements on injury status and potential risk factors considered to obtain a final multivariable model. We extended our final multivariable single level binary logistic regression model to multilevel binary logistic regression to allow for correlation of the outcome on individuals from the same households in the study. This is critical and warranted because of the hierarchical nature of the SAGE dataset with individuals nested within households. Not exploring the multilevel level analysis could lead to spurious statistical significance of the risk factors. Thus, the multilevel modelling approach (Goldstein, 2003) placed particular emphasis on household level differences in the risk of injury across households and the extent of nesting of injury among individuals within a household which cannot be achieved through the single level logistic regression model.

This process obtained model parameters using maximum likelihood and identity covariance structure to provide a good fit to the data in the random intercept multilevel logistic model. The single level multivariable model was compared to the multilevel model using likelihood ratio test while the variance inflation factor (VIF) was used to check multicollinearity. A VIF value below 10 was considered acceptable (Hair et al., 1995). All the analyses were performed using STATA Version 14 (StataCorp, 2015). To select candidate set of covariates for multivariable logistic regression, a p-value below 0.20 on a univariable logistic regression was used. P-value < 0.05 was used to declare statistical significance.

2.6. Ethical requirements

SAGE was approved by the World Health Organization's Ethical Review Board (reference number RPC149) and the Ethical and Protocol Review Committee, College of Health Sciences, University of Ghana, Accra, Ghana. Written informed consent was obtained from all study respondents.

Table 1
Sociodemographic characteristics of older adults in Ghana.

Characteristics	Frequency	Percentage
Non-traffic related injury		
No	3398	96.26
Yes	132	3.74
Cause of injury		
Fall	67	51.15
Struck/hit by person	42	32.06
Others	22	16.79
Age		
50–59	1275	36.12
60–69	1092	30.93
70–79	765	21.67
80 or more	398	11.27
Ethnicity		
Akan	1698	48.10
Ewe	207	5.86
Ga-adangbe	443	12.55
Guan	142	4.02
Northern dialect	1040	29.46
Marital status		
Not currently married	1549	43.88
Currently married	1981	56.12
Sex		
Male	1462	41.42
Female	2068	58.58
Religious status		
Some religion	3416	96.77
No religion	114	3.23
Walls		
Durable material	2154	61.30
Non-durable material	1360	38.70
Drinking water		
Piped source	1702	48.45
Non-piped source	1811	51.55
Toilet facilities		
Flush toilets	528	15.05
Non-flush toilets	2981	84.95
Health state today		
Good/very good	2144	60.87
Moderate	1028	29.19
Bad/very bad	350	9.94
Self-care		
None	2704	76.73
Mild	573	16.26
Moderate	194	5.51
Severe/extreme	53	1.50
Depression		
None	2273	64.48
Mild	889	25.22
Moderate	290	8.23
Severe/extreme	73	2.07
Visual difficulty		
None	2033	57.92
Mild	769	21.91
Moderate	549	15.64
Severe/extreme	159	4.53
Floor		
Hard floor	3015	85.97
Earth floor	492	14.03

Others: animal bite, fire, heat, stabbed, poisoning, etc.

3. Results

3.1. Sociodemographic characteristics

Out of the 3530 respondents residing in 2827 households, 132 (3.74%) had non-traffic related injury and majority (51%) of them had fall as the cause of the injury. Majority of the respondents were within the age group 50–59 years while 1698 (48.10%) of them belonged to the Akan ethnic group. Those who are currently married were in the majority (56.12%), among whom over half (58.58%) were females. In all, 96.77% of them followed some religion, 61.30% had durable material walls in their households, majority had non-piped source of drinking water and nearly 85% had non-flushed toilet facilities in their households. Overall, 60.87% of the older adults reported that their health state today was good/very good while 76.73% reported no difficulty with self-care. In addition, close to a third of respondents had no depression (64.48%), while 57.92% had visual difficulties. As indicated in Table 1, most respondents resided in households with hard floor types.

3.2. Univariable analyses

Risk factors significantly associated with injury status included ethnicity, sex, health state today, difficulty with self-care, household wall type and source of drinking water, depression status, and visual difficulty. However, age, marital status, religion, household toilet facility and floor types were not associated with injury status, as shown in Table 2.

3.3. Multivariable analyses

Risk factors independently associated with injury in the multivariable model included sex, health state, and depression. The significance of risk factors such as ethnicity, difficulty with self-care, household wall type and source of drinking water, and visual difficulty in the univariable analyses, however, disappeared in the multivariable analyses (Table 2).

The odds of being injured decreased among females (OR = 0.66, 95% CI: 0.46, 0.95) compared to their male counterparts and those who rated their heath state as moderate (OR = 0.59, 95% CI: 0.38, 0.94) had decreased odds of injury compared to those who rated themselves as good/very good. The odds of injury were higher among those who had moderate depression (OR = 2.55, 95% CI: 1.38, 4.71) compared to those who had no depression.

3.4. Multilevel binary logistic model

We updated our single level multivariable model in Table 2 to two-level (multilevel) logistic regression model (additional file 1, Table S1) where we accounted for the correlation of injury outcomes among individuals within households. We then compared the single level multivariable model to the multilevel logistic regression model using likelihood ratio test to determine which model provided a good fit to the data. The test revealed a Chi-square value of 1.10 and a *p*-value of 0.147, suggesting that the single level multivariable model provided a better fit to the data (additional file 1, Table S1). Thus, our data did not support the use of multilevel logistic regression in this study, suggesting no significant residual household-level variation in injury outcomes was observed.

We have conducted a subgroup analysis that attempts to explore the most occurring type of non-traffic related injury (fall and non-fall injuries) by sex and depression among the older adults in the study and its statistical significance. There were 67 and 64 older adults who suffered fall and non-fall types of non-traffic related injuries respectively. Among those who suffered fall injuries, 43 (64.2%) of them were females. Thus, higher proportion of females suffered fall injuries compared to males, while higher proportion of males (67.2%) also suffered non-fall types of non-traffic related injury compared to females (Table 3).

We investigated a possible association between sex, depression and type of non-traffic related injuries among the older adults using a Chi-Square test. Our result showed a significant association between sex and

Table 2
Risk factors for injury among older adults in Ghana from single-level logistic models.

Characteristics	Univariable binary logistic		Multivariable binary logistic	
	UOR (95% CI)	P-value	AOR (95% CI)	P-value
Age		0.684		
50–59	ref			
60–69	0.98 (0.65–1.49)	0.938		
70–79	0.74 (0.45–1.23)	0.247		
80 or more	0.94 (0.52–1.69)	0.836		
Ethnicity		0.001**		
Akan	ref		ref	
Ewe	1.38 (0.67–2.85)	0.377	1.45 (0.7–3.02)	0.315
Ga-Adangbe	0.56 (0.26–1.19)	0.13	0.56 (0.26–1.21)	0.14
Guan	0.22 (0.03–1.57)	0.13	0.21 (0.03–1.58)	0.13
Northern dialect	1.86 (1.28–2.71)	0.001**	1.29 (0.84–1.98)	0.247
Marital status		0.29		
Not currently married	ref			
Currently married	1.21 (0.85–1.73)	0.29		
Sex		0.017*		
Male	ref		ref	
Female	0.65 (0.46–0.93)	0.017*	0.66 (0.46–0.95)	0.026*
Religion		0.895		
Some religion	ref			
No religion	0.93 (0.34–2.57)	0.895		
Health state today		0.083		
Good/very good	ref		ref	
Moderate	0.62 (0.4–0.95)	0.029*	0.59 (0.38–0.94)	0.026*
Bad/very bad	1.02 (0.58–1.79)	0.939	0.72 (0.37–1.42)	0.347
Difficulty with self-care		0.002**		
None	ref			
Mild	2.09 (1.4–3.12)	< 0.001***	1.21 (0.72–2.02)	0.47
Moderate	1.34 (0.64–2.81)	0.437	0.82 (0.34–1.97)	0.66
Severe/extreme	2.55 (0.9–7.22)	0.079	2.84 (0.82–9.78)	0.098
Walls		0.006**		
Durable material	ref		ref	
Non-durable material	1.64 (1.16–2.32)	0.006**	1.45 (0.95–2.23)	0.088
Drinking water		0.005**		
Piped source	ref		ref	
Non-piped source	1.68 (1.17–2.4)	0.005**	1.23 (0.81–1.86)	0.331
Toilet facilities		0.478		
Flush toilets	ref			
Non-flush toilets	1.21 (0.72–2.02)	0.478		
Floor type		0.163		
Hard floor	ref		ref	
Earth floor	1.38 (0.88–2.17)	0.163	0.76 (0.45–1.3)	0.317
Depression		< 0.001***		
None	ref		ref	
Mild	2.04 (1.38–2.99)	< 0.001***	1.58 (0.98–2.54)	0.063
Moderate	2.5 (1.47–4.24)	0.001**	2.55 (1.38–4.71)	0.003**
Severe/extreme	1.53 (0.47–4.99)	0.482	1.25 (0.26–6.08)	0.785
Visual difficulty		0.008**		
None	ref		ref	
Mild	1.96 (1.32–2.92)	0.001**	1.34 (0.83–2.16)	0.234
Moderate	1.35 (0.82–2.22)	0.237	1.02 (0.58–1.79)	0.94
Severe/extreme	0.83 (0.3–2.32)	0.729	0.62 (0.2–1.92)	0.409

UOR: unadjusted odds ratio. AOR: adjusted odds ratio. CI: confidence interval. ref: reference category.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

type of non-traffic related injuries (p-value < 0.001). Depression is however not associated with type of non-traffic injury (Table 3).

4. Discussion

Overall, three factors (sex, health state and depression) demonstrated an independent effect on non-traffic related injuries among older adults in Ghana. The prevalence of non-traffic related injury was 3.74%. Fall type of non-traffic related injury was more in females (64.2%) while non-fall type of non-traffic related injury was more in males (67.2%). Injuries among the older population from an earlier study in Ghana reports a prevalence of 6.3% (55–64 years) and 10.4% (≥65 years). In that facility-based sample (n = 254), overall injury prevalence was 38%, of which 64.6% were non-traffic related injuries (Oteng et al., 2015). This was relative higher than what pertained in our community-based level analysis, probably due to the use of a hospital-based sample. However, the values in our study compare with findings reported from community-based studies in South Africa (3%) (Ameh et al., 2014), Tanzania (urban 2.5% and rural 4.3%) (Moshiro et al., 2005) and in South-West Nigeria (males 5% and females 2%) (Olawale and Owoaje, 2007).

Various studies indicate that the relationship between sex and non-traffic related unintentional injury presents a mixed picture. In a study conducted in seven rural sub-districts in Bangladesh, males had more fatal and non-fatal injuries compared to females, for causes except burns (Alonge et al., 2017). Ramroop et al. (2009) estimated that the

Table 3
Association between sex, depression and types of non-traffic injury among older adults.

Type of non-traffic injury				
Variables	Fall	Non-fall	Chi-square value	P-value
Sex			12.89	0.004[a]
Male	24	43		
Female	43	21		
Depression				0.956[b]
None	32	29		
Mild	24	24		
Moderate	10	9		
Severe/extreme	1	2		

[a] Based on Pearson chi-square test.
[b] Based on Fisher's exact test.

number of injuries in males was nearly double that in females in an injury surveillance system capturing data on nearly 20,000 patients (Ramroop et al., 2009). Similarly, Moshiro et al. (2005) reported a higher risk among males compared to females in an epidemiological survey for injury in Tanzania and that male sex had the only independent effect for major injuries, most of which occurred in adults aged ≥45 years (Moshiro et al., 2005). These studies all suggest a male preponderance of reported injuries similar to another study by Olawale and Owoaje in a community-based study in South-West Nigeria (Olawale and Owoaje). These findings were in congruence with what was confirmed in this analysis where females had less odds of reporting an injury compared to males (OR = 0.66, 95% CI: 0.46, 0.95).

The influence of sex has been shown to be related to the type of injury. A study in the United States which investigated unintentional home injuries found that females experienced higher injury rates due to falls compared to males, but males had higher rates of other types of injury (Runyan et al., 2005). This was consistent with findings from our sub-analysis, which demonstrated an association between sex and type of injury ($\Sigma 2 = 12.89$, $p < 0.001$). Similarly, an earlier WHO study of fall related injury among older adults in low- and middle-income countries confirms female sex as a risk factor (Williams et al., 2015). However, in Indonesia, fall related injuries in the past two years were higher among women compared to men (Pengpid and Peltzer, 2018). Another study of 21,596 primary care, Australian patients, aged 60 years and older found female sex to be independently associated with fall-related injury (Kerse et al., 2008).

The self-reported health on the day of interview permitted three categories, namely 'very good/good', 'moderate' and 'bad/very bad'. Counter intuitively, respondents who reported their health status as 'moderate' had less odds of having an injury compared to those who reported better health. A potential explanation could be that older adults who reported moderate health might reduce their activity which reduced their exposure to injury. An older adult who already feels less healthy may be more inclined to apply caution in order to prevent further bodily harm. This finding certainly warrants further investigation.

Previous studies indicate that depression is associated with an increased risk of adverse outcomes in older adults including injuries (Williams et al., 2015; Lohman et al., 2017). The prevalence of depression among non-institutionalized older populations has been reported to range between 13% and 23% in various countries (Anstey et al., 2007; Braam et al., 2010; Hamer et al., 2011; Pellicer-Garcia et al., 2017). Depression is multifactorial in origin and is commonly found in women and people with comorbid conditions (German et al., 2011; Nicolosi et al., 2011). There is also the possibility that those who were moderately depressed may have reported the symptom due to having sustained an injury. Having employed a cross sectional study design, the association between moderate depression and injury precludes any assumptions of causality. Therefore, moderate depression could have either preceded the injury or it could have been reported as a consequence of the injury.

Depression is common in old age and has been associated with cognitive and function impairment, disability, poorer outcomes from physical illness and death (Carter, 2011). In the study by Kerse and co-authors, depression was associated with multiple falls and fall-related injury (Kerse et al., 2008). Among these patients, the odds of reporting a fall related injury among older adults with significant depression increased by 71%, compared to older adults without depression (Kerse et al., 2008). The mechanism linking depression and injury not entirely understood, but abnormal gait and impaired balance, mediated through cognitive impairment and decline in psychomotor functions in depressed older adults are potential mechanisms in fall-related injury (Buchner et al., 1996; Herman et al., 2005; Iaboni and Flint, 2013). Falls are a prevalent, but not the sole cause of injury in older adults (Pressley et al., 2007). For instance, in Ghana fall-related injury represented 44.4% of all past year injuries reported in older adults aged 50 years or higher in a WHO study (Williams et al., 2015). In the present study, fall-related injury accounted for 51.1% (67/131) of all non-traffic related injuries in the sample. Therefore, these mechanisms might not necessarily account for all other types of non-traffic related injury experienced by the older adult. Other types of non-traffic related injury reported from an earlier study in Ghana include those related to agriculture, burns, assault and lacerations (Mock et al., 1999a, 1999b). Excluding traffic- and fall-related injuries, the pattern of agriculture-related injury persisted among the elderly (Mock et al., 1999a, 1999b).

Among studies reporting injury risk factors in the older population, Pellicer-Garcia and co-authors did not find a significant association between depression and fall-related injury, in spite of a high prevalence (83.6%) of fall-related injury in their sample population (Pellicer-Garcia et al., 2017). In the present study, individuals rated as having moderate depression had more than twice the odds of reporting a non-traffic related injury compared to individuals rated as having no depression (OR = 2.55, 95% CI 1.38–4.71). The authors are unable to establish a causal association due to the cross-sectional study design, however the study indicates that addressing depression as part of the efforts to reduce non-traffic related injury in the older population might have a potential benefit.

The present study is limited in its ability to draw causal conclusions given the cross-sectional design of the study. However, the factors identified provide a basis for intervention to prevent non-traffic related injury in the relevant age group. The association with health status and mental health has important implications for policy on healthy ageing, which need not await ascertainment of causal associations as these clearly have benefits for human health. The sub-group analysis indicate interventions should focus on fall-related injury for females and non-fall related injury for males in the older population. However, the low number of injuries considered for the sub-group analysis, which can be expected in a survey of the general population, has its limitation. The use of a nationally representative sample further enhances the power of the study. The use of self-reported injury in the study has the potential to under- or over-estimate the prevalence of non-traffic related injury. However, a recent study indicated that 12-month self-reported survey data provides a good indication of injury compared to medical records, although in a military population (Mock et al., 1999a, 1999bSchuh-Renner et al., 2019). We did not use the educational level of the individual because only 1765 (50%) of the respondent have measurements on this variable. However, we conducted a subgroup analysis on those with measurements on education and found no association between overall effect of education and non-traffic related injury (results not reported).

5. Conclusion

In a nationally representative sample of older adults aged 50 years and higher surveyed in Ghana, sex, self-reported health status as

moderate and depression were independent factors associated with non-traffic related injury. Depression was a risk factor, while female sex, a relative better self-rated health states were found to be protective. Previous studies support the protective effect of female sex. The role of depression as a risk factor suggests that interventions that aim to reduce non-traffic related injury in older adults should consider improving mental health.

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Author contributions

EAU, JMA and AEY developed the concept. JMA analysed the data. JMA and EAU wrote the first draft manuscript, JMA, EAU and AEY contributed to the writing and reviewing of the various sections of the manuscript. All the authors reviewed the final version of the manuscript before submission. All authors read and approved the final manuscript.

Declaration of Competing Interest

The authors declare that there is no conflict of interest.

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