Journal of Oncology Research and Treatments

Key words: RF-EMF; Radiofrequency; Mobile phone; Cancer

Abbreviations: RF-EMF: Radiofrequency Electromagnetic Fields; OR: Odds Ratio; CI: Confidence Interval.

Introduction

The increasing spread of Radiofrequency Electromagnetic Fields (RF-EMF) has aroused wide concern about health care. Mobile phones are one of the most important factors that can give rise to human exposure of RF-EMF. There are some studies indicating that mobile phones or similar equipment may be factors that cause oxidative stress and even cause damage to DNA, which may lead to the development of different pathology including tumors [1,2]. But the confidence level and specific mechanism still remain unclear, which makes it necessary to evaluate the risk of cancer. In the year of 2011, the International Agency for Research on Cancer (IARC) concluded that Radiofrequency (RF) radiation from personal devices like mobile phones and other devices is classified as a Group 2B, meaning that RF-EMF is possibly carcinogenic to humans. But it is only weak mechanistic evidence that proves the relativity. As mobile phone gradually being a necessity of life, the relativity needs to be proved [3].

When it comes to mobile phone and tumors, it is true that glioma, meningioma and acoustic neuroma are more common disease. Gliomas are the most common primary intracranial tumor, representing 81% of malignant brain tumors and they cause significant mortality and morbidity. More and more factors have been speculated and confirmed as potential contributors to glioma risk including exposure to ionizing

*Corresponding author:

Received: **Editor assigned:**
                                    Reviewed:
            Revised:6;

good number of epidemiological researches, if one of the properties (A or B) is su ciently rare (this is called the rare disease assumption), then the OR is approximately equal to the corresponding Risk Ratio (RR).

ere are several previous studies that have discussed the association between wireless phones and above-mentioned tumors while concluding the opposite result. Michael Carlberg found relationships between exposure of mobile phone and other similar devices while Michael H Repacholi have the contrary conclusion [7,8]. Michael Carlberg and Lennart Hardell's meta-analysis of case-control studies drew the conclusion that glioma is caused by RF radiation by using the nine Bradford Hill viewpoints [7]. Also, Elisa Carvalho de Siqueira provided evidence of relation between parotid tumor and wireless phone use though presenting mild e ect. However, divergence exists [8]. Michael H Repacholi found no consistent relationship between glioma, meningioma, acoustic neuroma, or parotid gland tumors and wireless phone use in both *in vivo* and epidemiology studies, knowing that the four tumors originate in the areas of the head that most absorb the RF energy from wireless phone [9]. In a word, inconsistency remains in the study of whether cancer is associated with wireless phone use. Besides, the duration of use is also controversial. ere have been few studies highlighting the fact that long-term (>10 years) wireless phone use may increase the risk of cancers like acoustic neuroma, meningioma and glioma [10,11], according to which we divide the group of the latency time in 1-5 years as short-term use, 10 years as long-term use and remaining part as medium-time use.

Above all, this meta-analysis was to evaluate the relationship of glioma, meningioma, acoustic neuroma and duration of use of mobile/cellular phones in order to nd supportive results.

Materials and Methods

We searched PubMed, EMBASE, and the Cochrane Library in September 2021, using "(cordless phones OR mobile phone OR cellular phone OR electromagnetic elds OR radiofrequency electromagnetic elds) and (glioma OR meningioma OR acoustic neuroma OR vestibular

DerSimonian and Laird is a simple and now standard way of performing random effects meta-analyses. In other cases, we used fixed-effects method (inverse variance). Heterogeneity was assessed by Chi-square based Q-test and I squared test. If P value for Q test <0.05 or I^2>50%, heterogeneity is significant. By performing sensitivity analysis, we excluded several studies to reduce the heterogeneity as far as possible. We estimated publication bias using Begg's and Egger's test. When there is publication bias the p-value<0.05. The Stata/MP 16.0 software was used for statistical analysis (StataCorp, College Station, Texas, USA).

Results

Totally 41478 participants including 13021 cases and 28457 controls were enrolled in the final analysis (Table 1). The most common Der22 l

Due to the heterogeneity and publication bias between studies, subgroup analyses were performed to evaluate the association between length of mobile/cellular phone use and specific type of cancer.

Glioma

All the included references (6 articles including 18 studies about length of exposure and risk of glioma) had similar basis for grouping reported time since first use of wireless phone. Two studies, from S. Lönn and L. Hardell were excluded because they demonstrated significant heterogeneity. Then we calculated OR and CI values of L. Hardell's research (2015), and put this result (OR, 1.05; CI: 1.05-1.47) into meta-analysis. Therefore, 6 articles including 16 studies were analysed by selecting the three groups (Short, Medium and Long) as the

exposure and people never/rarely use mobile/cellular phone as referent group to calculate the pooled OR value. In the random effect models, no association between duration of use mobile/cellular phones and gliomas was found (Figure 3).

Meningioma

Subgroup analyses were performed to identify the association between duration and cancer risk. We calculated the OR and CI values of two studies from E. Cardis (OR: 0.846; CI: 0.745-0.961) and M. Carlberg (OR: 0.909; CI: 0.778-0.963) and put them into meta-analysis. As shown in Figure 4, there were 6 articles was put into subgroup of short, medium and long time use respectively. The result from fixed effect models indicated that using mobile/cellular phones for a short or
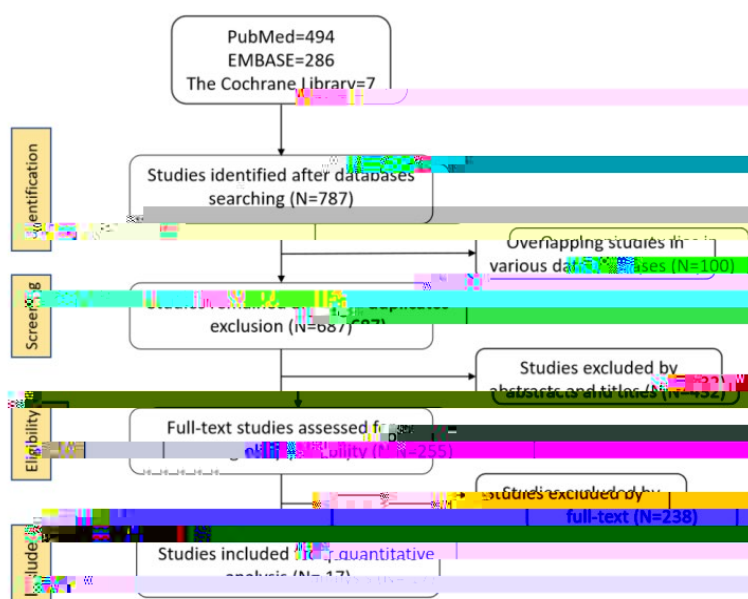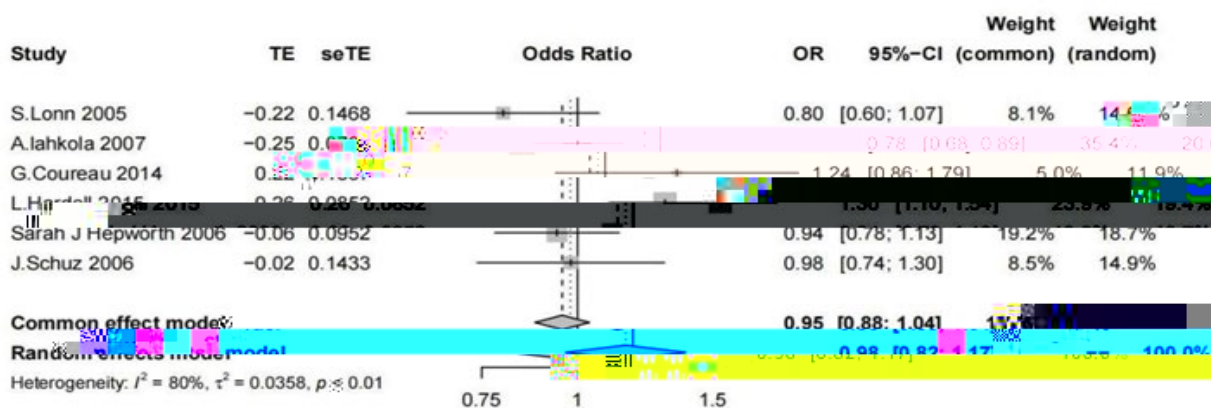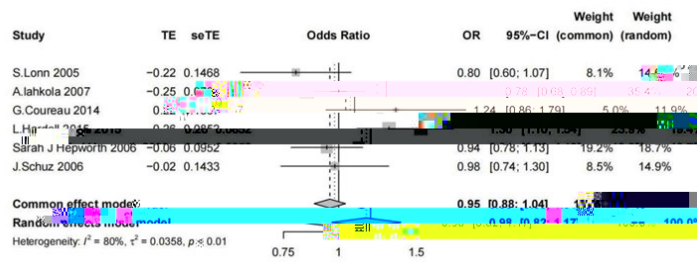

Figure 1:

Figure 2:
Note: ES-Effect Size (odds ratio), CI-Confidence Interval.

Study	TE	seTE	Odds Ratio	OR	95%-CI	Weight (common)	Weight (random)
S.Lonn 2005	−0.22	0.1468		0.80	[0.60; 1.07]	8.1%	14.%
A.lahkola 2007	−0.25	0.		0.78	[0.68; 0.89]	35.4%	20.
G.Coureau 2014	0.			1.24	[0.86; 1.79]	5.0%	11.9%
L.H. 2015-2015	0.26	0.0852		1.30	[1.10; 1.54]	23.9%	19.4%
Sarah J Hepworth 2006	−0.06	0.0952		0.94	[0.78; 1.13]	19.2%	18.7%
J.Schuz 2006	−0.02	0.1433		0.98	[0.74; 1.30]	8.5%	14.9%
Common effect model				0.95	[0.88; 1.04]	1.	
Random effects model				0.98	[0.82; 1.		100.0%

Heterogeneity: $I^2 = 80\%$, $\tau^2 = 0.0358$, $p \leq 0.01$

0.75   1   1.5

(A) Glioma

(B) Meningioma

Figure 4:
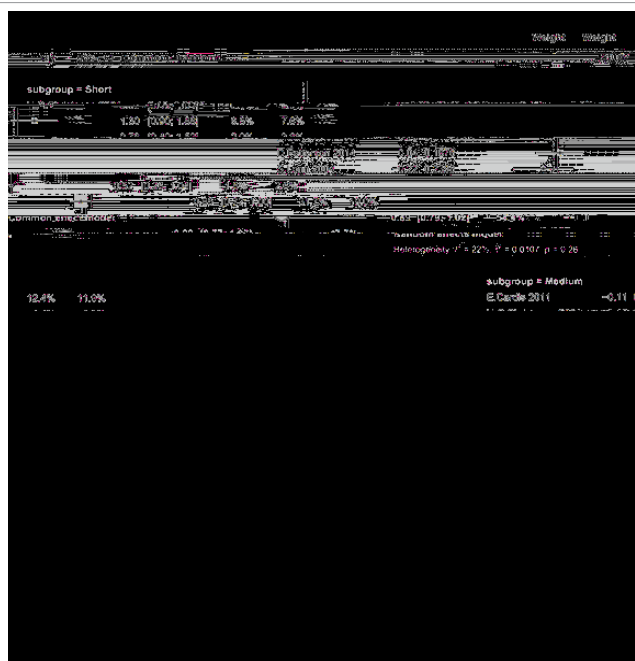**Note:** OR-Odds Ratio, CI-Confidence Interval.

Figure 5:
Note: OR-Odds Ratio, CI-Confidence Interval.

medium time (10 years) could reduce the risk of meningioma (OR, 0.83; 95% CI, 0.76-0.90; I²=39.5%, p=0.142; OR, 0.83; 95% CI, 0.75-0.93;

meningioma and acoustic neuroma based on the duration of use. We found use of mobile phone can decrease the risk of meningioma, especially when the time since rst use was between 0-5 years and 5-10 years, while the protective e ect disappeared in longer term (more than 10/11 years). For glioma and acoustic neuroma, there was no statistical signi cance in our meta-analysis. More studies and more cases are needed to explore the possible in uence of long-term use of mobile phone, and one standard protocol is also needed for large scale research.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

Competing Interests

e authors have no relevant nancial or non- nancial interests to disclose.

Author Contributions

All authors contributed to the study conception and design.

(I) Conception and design: YF

(II) Administrative support: YW

(III) Provision of study materials or patients: YW

(IV) Collection and assembly of data: YF, ZZ, QF

(V) Data analysis and interpretation: YF, ZZ, QF

(VI) Manuscript writing: All authors

(VII) Final approval of manuscript: All authors.

References

Citation: