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REVIEW ARTICLE

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Agent Orange and head and neck cancer: A systematic review and meta-analysis

Neil P. Monaghan[1,2] | Kelsey A. Duckett[1,2] | Shaun A. Nguyen[1] | Jason G. Newman[1] | Alexandra E. Kejner[1] | W. Greer Albergotti[1]

[1]Department of Otolaryngology—Head and Neck Surgery, Medical University of South Carolina, Charleston, South Carolina, USA

[2]College of Medicine, Medical University of South Carolina, Charleston, South Carolina, USA

Correspondence
Shaun A. Nguyen, Department of Otolaryngology—Head and Neck Surgery, Medical University of South Carolina, 135 Rutledge Ave., MSC 550, Charleston, SC 29425, USA.
Email: nguyensh@musc.edu

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Abstract

Objective: To assess the incidence of head and neck cancer in patients exposed to Agent Orange and related dioxins.

Methods: Studies were identified through CINAHL, PubMed, and Scopus. Primary studies were identified through April 2023. Articles were included reporting incidence of head and neck cancer and/or deaths due to head and neck cancer in participants exposed to Agent Orange. Meta-analysis of proportions was conducted to calculate incidence and mortality by primary site in those who were exposed to Agent Orange and for control groups. A comparison of proportions was used to compare rates in exposed and control groups.

Results: Of 1530 unique abstracts screened, 13 studies were included in the systematic review. Of the exposed patients with reported subsites, oral cavity (31.2%), and larynx (14%) were the most common. Of the exposed patients with reported deaths and subsites, oropharynx (0.25%) was the most common primary site in patients who died. The most common subsites of those who were not exposed, oropharynx (0.13%), and larynx (0.16%). Head and neck cancer of all subsites was more common in those exposed to Agent Orange than in unexposed controls (difference 0.061%; 95% confidence interval: 0.04%–0.08%, $p < 0.0001$).

Conclusions: Our findings suggest that head and neck cancer is more common in those who were exposed to Agent Orange than those who were not. Additionally, individuals exposed to Agent Orange were more likely to die from head and neck cancer. Further investigation is warranted to evaluate subsite-specific outcomes given the limitations of our study design.

KEYWORDS

Agent Orange, head and neck cancer, Vietnam Conflict, Vietnam War

INTRODUCTION

The Vietnam War spanned two decades and resulted in millions of Americans being stationed in southeast Asia. According to the United States Department of Veterans Affairs (VA), over 6,000,000 of those veterans are still living and now reside in the United States. Herbicides were widely used in Vietnam to eliminate underbrush and destroy crops used by the Vietnamese forces.[1] Agent Orange, the most frequently used herbicide in the Vietnam War,[2,3] has been a hot topic of medical investigation for more than 45 years.[4–7] Agent Orange contains a mixture of chemicals, but in Vietnam, it was highly contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), the most dangerous dioxin to humans.[2]

While the mechanism is not well understood, Agent Orange has been linked to several cancers, including genitourinary cancers, thyroid cancer, and multiple myeloma.[5,8,9] A recent database study in 2020 also found it to be associated with oropharyngeal, nasopharyngeal, and laryngeal cancers.[10] Head and neck cancer (HNC) has long been associated with exposures (e.g., tobacco and alcohol use, human papillomavirus),[11–13] but the link to Agent Orange is a relatively recent development; this is not unexpected given the latency period for exposure-related cancers.

HNC, encompassing neoplasms of the head and neck region excluding skin, brain, skull-base, and endocrine cancers, comprises up to 4% of all cancers within the United States.[14,15] Common subsites include lip, oral cavity, oropharynx, nasopharynx, hypopharynx, and larynx.[11] The most common primary subsites for HNC in the United States and globally are larynx and lip/oral cavity, respectively.[11] Mortality rates vary widely based on subsite and stage, but 5-year survival rates range from just over 30% to almost 90% depending on subsite, risk factors, stage, and so on.[11] Importantly, HNC carries considerable morbidity, often secondary to oncologic resection, radiation, chemotherapy, or a combination of the three. While the link between Agent Orange and HNC has been proposed,[10] much is to be learned. We performed this review to further investigate the association between Agent Orange exposure and HNC.

METHODS

This study was conducted according to Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines.[16] The research question was developed using the PICOS (population, intervention, comparison, outcome, study design) framework. To identify studies for inclusion, a detailed search strategy was developed in the following three databases: PubMed (National Library of Medicine, National Institutes of Health), Scopus (Elsevier), and CINAHL (EBSCO). The Cochrane Library was searched separately and compared to included articles to ensure adequate article inclusion. Search strategies used a combination of subject headings and keywords for the following: "Head and neck cancer" (along with all subsites) and "Agent Orange" or "TCDD." The PubMed search strategy was modified for the other two databases. The individual search strategies are detailed in Appendix 1. Additional articles were identified through references and resources of pertinent articles. The search strategy was cross-referenced with key articles to verify the accuracy of the search.

Selection criteria

Studies reporting rates of HNC in patients based on exposure to Agent Orange were included. Abstracts were screened separately by two reviewers (N. P. M. and K. A. D.) to identify relevant articles. Discrepancies were resolved by a third reviewer (S. A. N.). Those reporting Agent Orange or related dioxin exposure and patients later diagnosed with or died from HNC were included. Non-English studies, nonhuman studies, nonjournal articles, case reports or case series including less than 10 patients, and studies including children were excluded. Studies that were included following abstract screening were then reviewed in full text by two reviewers independently. Data pertaining specifically to thyroid and parathyroid neoplasms were excluded after extraction.

Data extraction

HNC outcomes and demographic data were extracted independently by two reviewers (N. P. M. and K. A. D.). Discrepancies were resolved by a third reviewer (S. A. N.). Primary outcome measures were HNC incidence, HNC mortality, and reported standardized mortality ratio (SMR). Outcomes were extracted by HNC subsite when available.

Oxford level of evidence and risk of bias evaluation

The Oxford Center for Evidence-Based Medicine criteria was used to assess the level of evidence of each included article.[17] The risk of bias was assessed according to the Risk of Bias In Non-randomized Studies-of Exposure (ROBINS-E), Launch Version, 1 June 2022.[18] Two authors (N. P. M. and K. A. D.) performed an independent risk assessment of studies. Discrepancies were resolved by a third author (S. A. N.). Articles were evaluated for risk of bias due to confounding, exposure measurement, selection of participants, postexposure interventions, missing data, measurement of outcome, and selection of the reported result. The risk of bias for each was graded as "high," "some concerns," or "low."

Statistical analysis

Meta-analysis of continuous measures (SMR) was performed by Comprehensive Meta-Analysis version 4 (Biostat Inc). Meta-analysis of proportions (HNC incidence, mortality, etc.) was performed using MedCalc 20.305 (MedCalc Software). Each

measure (mean/proportion and 95% confidence interval [CI]) was weighted according to the number of patients affected. Heterogeneity among studies was assessed using χ^2 and I^2 statistics with fixed effects ($I^2 < 50\%$) and random effects ($I^2 > 50\%$). In addition, a comparison of proportions was done to compare HNC incidence between two groups (exposure to agent orange vs. nonexposure to agent orange or control). Finally, potential publication bias was evaluated by visual inspection of the funnel plot and Egger's regression test, which statistically examines the asymmetry of the funnel plot.[19,20] A p value of <0.05 was considered to indicate a significant difference for all statistical tests.

RESULTS

Included studies and patient demographics

A total of 13 studies were included in our meta-analysis.[10,21–32] A PRISMA diagram outlining our search is shown in Figure 1. The majority of articles selected for inclusion were level 2 and level 3 based on the Oxford Level of Evidence. The included studies were published from 1987 to 2020 and were conducted in five different countries. The descriptive features of included studies are summarized in Table 1. Risk of bias evaluation was performed for each study and can be found in Figure S1. Publication bias (Figure S2) evaluated with Egger's test (2.7, 95% CI: −2.3 to 7.7, $p = 0.2631$) demonstrated that all studies lie within the funnel with little asymmetry, suggesting a small publication bias. A total of 8,890,769 patients were included in our meta-analysis. Of 160,449 with reported race, 83.0% were white and 9.1% were Black. Critical appraisal of the studies indicated an acceptably low risk of bias for the majority of included studies (Figure S3). Potential sources of bias were most pronounced in bias arising from the measurement of the exposure, bias in the selection of participants into the study, and bias due to missing data.

Outcome data

Outcome data can be found in Tables 2–6 and Figures 2–4.

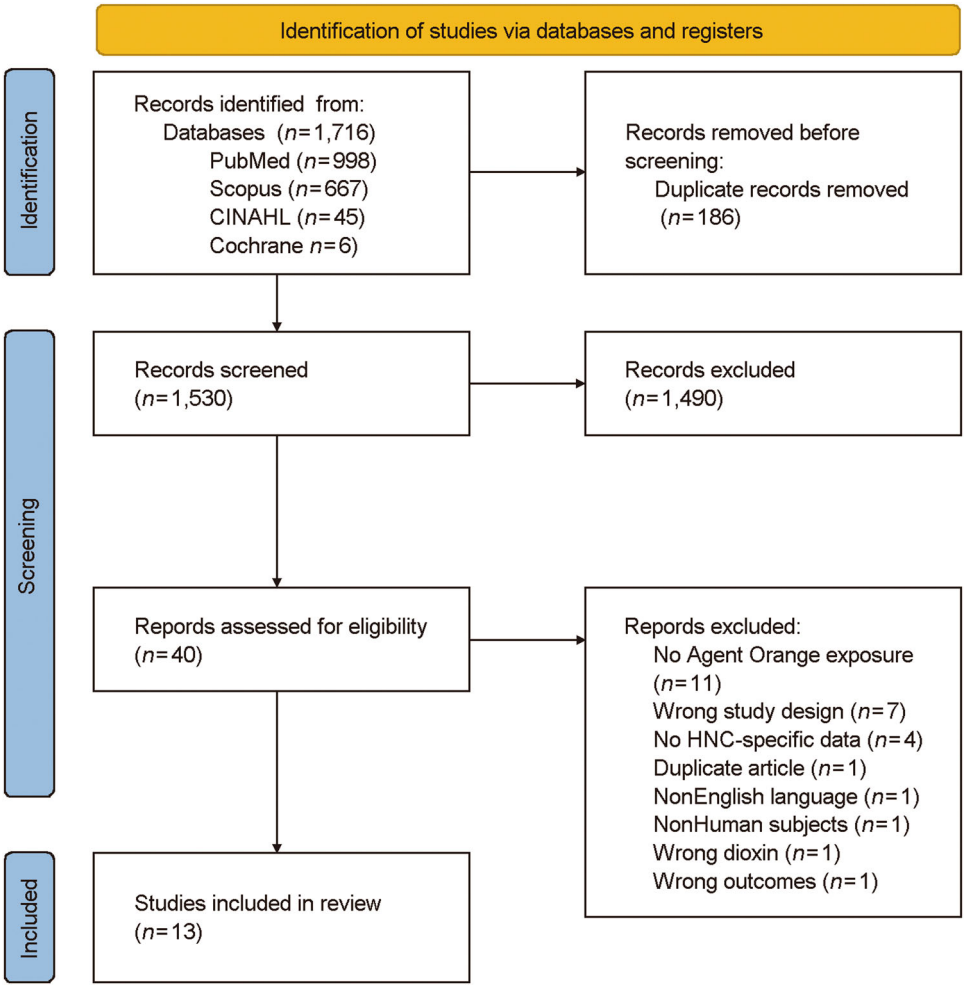

FIGURE 1 PRISMA diagram outlining the systematic review process. HNC, head and neck cancer; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analysis.

TABLE 1 Characteristics of included studies.

Reference	Country	Study design	Study setting/data source	Length of exposure	Length of follow-up from exposure	Patients exposed to AO (*n*)[a]	% male (exposed)	Controls included not exposed to AO (*n*)[a]	% male controls	Oxford level of evidence
Becher et al.[21]	Germany	PCo	Four factories	Average 11.71 years	Up to 37 years	2479	100	0		2
Bertazzi et al.[22]	Italy	RCo	Single institution	One time accident	1–10 years	36,655		0		2
Cypel et al.[24]	USA	RCo	National/defense manpower data center	Up to 8 years	Average 32 years up to 35 years	2872	100	2737	100	2
Fingerhut et al.[25]	USA	RCo	Twelve plants	1–15 years	Mean 2.7 years, up to 2 years	5172	100	0		2
Manuwald et al.[26]	Germany	RCo	One plant	Mean 6.89 years (3 months min)	Up to 55 years	1136	74.95	0		2
McBride et al.[27]	New Zealand	RCo	National/VANZ	Up to 11 years	33–44 years	2783	100	0		2
McBride et al.[28]	New Zealand	RCo	One plant	Average 4.2 years	Up to 35 years	1134	86	465	43	2
Mowery et al.[10]	USA	RCo	National/VA			1,965,810	97.8 (total)	6,912,161		2
Ott et al.[33]	USA	CC	Single institution	Up to 42 years	Up to 42 years	2187	100	0		3
Ott and Zober[29]	Germany	RCo	Multi-institution	4–5 months	24–39 years	243	100	0		2
Pesatori et al.[34]	Italy	PCo	Regional/ geographical area	One time accident		5750	0	0		2
Pesatori et al.[30]	Italy	PCo	Regional/ geographical area	One time accident	20 years	5544 (high exposure)	50.92	31,643 (low exposure)	49.66	2
Pesatori et al.[35]	Italy	PCo	Regional/ geographical area	One time accident	10 years					2
Yi et al.[31]	Republic of Korea	RCo	National/KNCIDB			85,809 (high exposure)		94,442 (low exposure)		2
Yi et al.[32]	Republic of Korea	RCo	National/KNCIDB			86,020 (high exposure)		94,619 (low exposure)		2

Abbreviations: AO, Agent Orange; CC, case-control; KNCIDB, Korea National Cancer Incidence Database; OLE, Oxford Level of Evidence; PCo, prospective cohort; PCS, prospective case series; RCo, retrospective cohort; RCS, retrospective case series; VA, Veterans Affairs; VANZ, Veterans Affairs New Zealand.

[a]Sample size is the number of patients that are included in our review. This *n* may not be the same as the overall *n* included in the study.

TABLE 2 Metaproportions of head and neck cancer (HNC) incidence following exposure to Agent Orange.

Site	Number of subjects (*n*)	Incidence (%)	95% confidence interval (%)
HNC of all sites	2,225,408	0.33	0.14–0.59
Oral cavity	2,185,438	0.14	0.06–0.25
Oropharynx	2,148,540	0.08	0.00–0.24
Hypopharynx	2,146,061	0.02	0.02–0.02
Larynx	2,151,323	0.14	0.07–0.23
Nasopharynx	2,182,716	0.02	0.01–0.04
Salivary	2,146,061	0.02	0.00–0.07

TABLE 3 Metaproportions of head and neck cancer (HNC) incidence in controls without documented exposure to Agent Orange.

Site	Number of subjects (*n*)	Incidence (%)	95% confidence interval (%)
HNC of all sites	6,915,363	0.21	0.21–0.21
Oropharynx	6,914,898	0.13	0.13–0.13
Larynx	6,912,626	0.16	0.16–0.16

TABLE 4 Comparison of proportions of incidence between group exposed to Agent Orange and controls.

Site	Difference (%)	95% confidence interval (%)	*p* Value
HNC of all sites	0.11	0.11–0.12	<0.0001
Oropharynx	0.05	0.05–0.06	<0.0001
Larynx	0.02	0.02–0.03	<0.0001

Abbreviation: HNC, head and neck cancer.

TABLE 5 Metaproportions of head and neck cancer (HNC) mortality with exposure to Agent Orange.

Site	Number of subjects (*n*)	Mortality (%)	95% confidence interval (%)
HNC of all sites	235,832	0.21	0.1–0.37
Oral cavity	190,720	0.07	0.02–0.15
Oropharynx	12,793	0.25	0.08–0.52
Larynx	193,343	0.14	0.06–0.26

DISCUSSION

Agent Orange continues to be linked to many different cancers, and with the increasing age of Vietnam war veterans, HNC following Agent Orange exposure is not uncommon. The objective of this systematic review with meta-analysis was to evaluate the incidence and mortality of head and neck cancer in patients exposed to Agent Orange. In our investigation, we found that HNC was associated with Agent Orange exposure (Table 3); however, we did not find a significant increase in the incidence of any specific HNC subsite in individuals exposed to Agent Orange when compared to control groups. Of note, there was a significant difference in our data for subsites of oropharynx and larynx, with malignancy being less common in those exposed to Agent Orange than controls (Table 3). Publication bias of controls and limitations of systematic review likely played a role in these findings. We were also able to pool SMR data

TABLE 6 Standardized mortality ratios.

Site	Point estimate	Standard error	I^2 (%)	*p* Value
HNC of all sites	32.35	15.96	100.0	0.04
Oral cavity and oropharynx[a]	1.60	0.66	98.9	0.02
Oropharynx[a]	44.76	43.25	100.0	0.30
Larynx	54.75	50.07	100.0	0.27

Abbreviation: HNC, head and neck cancer.

[a]Independent groups.

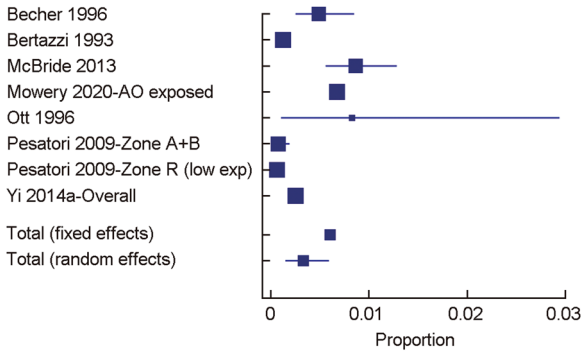

FIGURE 2 Forest plot of metaproportions of head and neck cancer incidence of all subsites with exposure to AO. AO, Agent Orange.

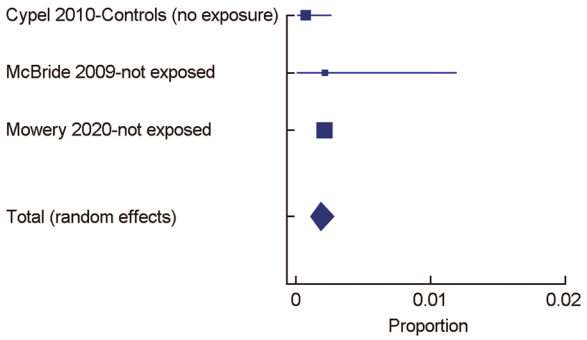

FIGURE 3 Forest plot of metaproportions of head and neck cancer of all subsites in controls.

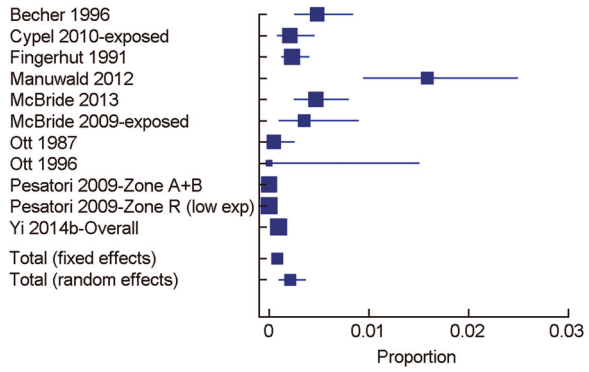

FIGURE 4 Forest plot of metaproportions of head and neck cancer mortality of all subsites with exposure to Agent Orange.

that suggest the only mortality difference is in overall HNC, with no differences identified in subsite-specific SMRs.

This study elucidates an association between Agent Orange exposure and HNC incidence. However, we were unable to discern differences in specific HNC subsites, contrasting what a previous database study that was included in this study found regarding Oral Cavity and Laryngeal Cancer.[10] It is possible that we found conflicting results due to bias introduced into individual studies and underreporting of negative cases by subsite in control groups.

Not enough data were available regarding mortality in controls not exposed to Agent Orange to allow for comparing the difference in mortality rates between exposed and controls, but some SMR data were able to be analyzed. Those who were exposed to Agent Orange were more likely to die of HNC than the general population, but there was no significant difference in subsite-specific SMRs. In other words, we were able to identify a difference in mortality without a corresponding difference in incidence between groups. This discrepancy could indicate that while incidences may not be different, Agent-Orange-related HNC may behave differently making it more deadly than HNC in those that are unexposed.

It is conceivable that this increase in overall incidence and mortality could be due to field cancerization in the aerodigestive tract where fumes and or particles may have traveled and been trapped in the cilia of the respiratory epithelium, leaving the tissue with higher carcinogenic exposure and mutation burden. This concept has been reported in the oral cavity,[36,37] so it would not be unreasonable to consider this effect on the aerodigestive tract. Additionally, carcinogenic synergy has been reported between tobacco and alcohol,[38] and a similar phenomenon may exist between Agent Orange and tobacco, which is heavily used among veterans in general and especially veterans during this period.[39] Further analysis is needed to evaluate the contribution of tobacco in patients exposed to Agent Orange. Basic science research is needed to evaluate the mechanism of carcinogenesis from Agent Orange and TCDD, especially.

This study has several limitations. Systematic reviews have a certain level of limitation inherently, as they depend on what authors report in their papers, leaving our study vulnerable to selective outcome reporting. Systematic reviews are also at the mercy of publication bias and statistical heterogeneity. This study may also be limited by confounding, especially regarding tobacco and alcohol use. It is well documented how common tobacco use is in veterans, especially during the time period of Agent Orange exposure.[39,40] Additionally, the length of exposure was difficult to reliably quantify as exposure was often reported as a range of time, limiting our ability to perform some advanced statistics like regression. Finally, the determination of exposure to Agent Orange is not always easily or uniformly determined. For example, one study used self-reporting for the determination of exposure, putting this study at risk for recall bias.[10] This could artificially inflate our incidence of HNC in those exposed to Agent Orange. Future investigation should focus on subsite analysis and further evaluate the role of confounding factors in this population.

While this study's limitations make it difficult to provide subsite-specific recommendations, it does show that there is an increased risk of developing and dying from HNC in these individuals exposed to Agent Orange. We recommend comprehensive head and neck examination in anyone with exposure to Agent Orange or a history of service in Vietnam. Additionally, we encourage paying special attention to the aerodigestive tract, which could include oral exam and flexible laryngoscopy.

CONCLUSIONS

In a powerful study including almost 9 million included patients, our findings suggest that HNC is more common in those exposed to Agent Orange than those who are not. Additionally, we found that individuals exposed to Agent Orange were more likely to die from HNC. Further investigation is warranted to evaluate subsite-specific incidence and outcomes given the limitations of our study design.

AUTHOR CONTRIBUTIONS

Neil P. Monaghan contributed to study design, data collection and analysis, drafting and critical revisions, final approval of the version to be published, and submission. Kelsey A. Duckett was involved in study design, data collection and analysis, critical revisions, and final approval of the version to be published. Shaun A. Nguyen contributed to study design, data analysis, drafting and critical revisions, and final approval of version to be published. Jason G. Newman was involved in study design, critical revisions, and final approval of the version to be published. Alexandra E. Kejner contributed to study design, critical revisions, and final approval of the version to be published. W. Greer Albergotti contributed to study design, critical revisions, and final approval of the version to be published.

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CONFLICT OF INTEREST STATEMENT

Professor Shaun A. Nguyen is a member of World Journal of Otorhinolaryngology – Head & Neck Surgery (WJOHNS) editorial board and is not involved in the peer review process of this article. The authors declare that they have no competing interests.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author.

ETHICS STATEMENT

The authors have nothing to report.

ORCID

Neil P. Monaghan http://orcid.org/0000-0002-3631-5624

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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APPENDIX 1: SEARCH STRATEGY

PubMed

("Head and Neck Neoplasms"[Majr:NoExp] OR "Squamous Cell Carcinoma of Head and Neck"[Majr] OR "Laryngeal Neoplasms"[Mesh] OR "Mouth Neoplasms"[Mesh] OR "Nose Neoplasms"[Mesh] OR "Oropharyngeal Neoplasms"[Mesh] OR "Paranasal Sinus Neoplasms"[Mesh] OR "Pharyngeal Neoplasms"[Mesh] OR "Tongue Neoplasms"[Mesh] OR HNSCC[tiab] OR HNC[tiab] OR "head and neck"[tiab] OR "head & neck"[tiab] OR "Thyroid Neoplasms"[MeSH] OR "Parathyroid Neoplasms"[MeSH] OR "Head and Neck Neoplasms"[MeSH]) OR ((hypopharyngeal[tiab] OR laryngeal[tiab] OR mouth[tiab] OR "nasal cancer"[tiab] OR oral[tiab] OR oropharyngeal [tiab] OR paranasal[tiab] OR pharyngeal[tiab] OR salivary[tiab] OR tongue[tiab] OR thyroid[tiab] OR parathyroid[tiab]) AND (cancer* [tiab] OR neoplasm*[tiab] OR carcinoma*[tiab] OR "Carcinogenicity"[tiab] OR "carcinogen*"[tiab])) AND ("Agent orange"[Majr:NoExp] OR "Agent Orange"[MeSH] OR "agent orange"[tiab] OR "2,4-Dichlorophenoxyacetic Acid"[MeSH] OR "2,4,5-Trichloroph enoxyacetic Acid"[MeSH] OR "2,4-Dichlorophenoxyacetic Acid"[tiab] OR "2,4,5-Trichlorophenoxyacetic Acid"[tiab] OR TCDD[tiab] OR "2,3,7,8-tetrachlorodibenzo-p-dioxin"[tiab] OR "2,3,7,8-tetrachloro-dibenzo-para-dioxin"[tiab] OR "Dichlorophenoxyacetic Acid"[tiab] OR "tetrachlorodibenzo*"[tiab] OR "tetrachloro-dibenzo*"[tiab] OR "Dichlorophenoxyacetic acid*"[tiab] OR "hexachlorodibenzo*"[tiab] OR "dioxin*"[tiab] OR "herbicid*"[tiab] OR "pesticid*"[tiab] OR "Environmental Pollutants/adverse effects"[Mesh] OR "Environmental Pollutants/poisoning"[Mesh] OR "Environmental Pollutants/toxicity"[Mesh] OR "Defoliants, Chemical"[MeSH] OR "Vietnam Conflict"[MeSH] OR "Vietnam War"[tiab] OR "Polychlorinated Dibenzodioxins"[MeSH] OR "Polychlorinated Dibenzodioxin*"[tiab])

998 results

Scopus (Elsevier)

(TITLE ({head and neck} OR {head & neck} OR HNSCC OR HNC OR "hypopharyngeal cancer" OR "hypopharyngeal carcinoma*" OR "hypopharyngeal neoplasm*" OR "laryngeal cancer*" OR "laryngeal carcinoma*" OR "laryngeal neoplasm*" OR "mouth cancer*" OR "mouth carcinoma*" OR "mouth neoplasm*" OR "nose cancer*" OR "nose carcinoma*" OR "nose neoplasm*" OR "oral cancer*" OR "oral carcinoma*" OR "oral neoplasm*" OR "oropharyngeal cancer*" OR "oropharyngeal carcinoma*" OR "oropharyngeal neoplasm*" OR "paranasal cancer*" OR "paranasal carcinoma*" OR "paranasal neoplasm*" OR "pharyngeal cancer*" OR "pharyngeal carcinoma*" OR "pharyngeal neoplasm*" OR "salivary cancer*" OR "salivary carcinoma*" OR "salivary neoplasm*" OR "tongue cancer*" OR "tongue carcinoma*" OR "tongue neoplasm*" OR "thyroid cancer*" OR "thyroid carcinoma*" OR "thyroid neoplasm*" OR "parathyroid cancer*" OR "parathyroid carcinoma*" OR "parathyroid neoplasm*" OR "head and neck cancer*" OR "head and neck")) OR (ABS ({head and neck} OR {head & neck} OR HNSCC OR HNC OR "hypopharyngeal cancer" OR "hypopharyngeal carcinoma*" OR "hypopharyngeal neoplasm*" OR "laryngeal cancer*" OR "laryngeal carcinoma*" OR "laryngeal neoplasm*" OR "mouth cancer*" OR "mouth carcinoma*" OR "mouth neoplasm*" OR "nose cancer*" OR "nose carcinoma*" OR "nose neoplasm*" OR "oral cancer*" OR "oral carcinoma*" OR "oral neoplasm*" OR "oropharyngeal cancer*" OR "oropharyngeal carcinoma*" OR "oropharyngeal neoplasm*" OR "paranasal cancer*" OR "paranasal carcinoma*" OR "paranasal neoplasm*" OR "pharyngeal cancer*" OR "pharyngeal carcinoma*" OR "pharyngeal neoplasm*" OR "salivary cancer*" OR "salivary carcinoma*" OR "salivary neoplasm*" OR "tongue cancer*" OR "tongue carcinoma*" OR "tongue neoplasm*" OR "thyroid cancer*" OR "thyroid carcinoma*" OR "thyroid neoplasm*" OR "parathyroid cancer*" OR "parathyroid carcinoma*" OR "parathyroid neoplasm*" OR "head and neck cancer*" OR "head and neck")) AND (TITLE-ABS-KEY("Agent orange" OR "2,4-Dichlorophenoxyacetic Acid" OR "Dichlorophenoxyacetic*" OR "Trichlorophenoxyacetic*" OR "2,4,5-Trichlorophenoxyacetic Acid" OR "2,4-Dichlorophenoxyacetic Acid" OR TCDD OR "2,3,7,8-tetrachlorodibenzo-p-dioxin" OR "2,3,7,8-tetrachloro-dibenzo-para-dioxin" OR "Dichlorophenoxyacetic Acid" OR "tetrachlorodibenzo*" OR "tetrachloro-dibenzo*" OR "Dichlorophenoxyacetic acid*" OR "hexachlorodibenzo*" OR "dioxin*" OR "herbicid*" OR "pesticid*" OR "Environmental Pollutant*" OR "pollut*" OR "Environmental toxin*" OR "Chemical Defoliant*" OR "Vietnam Conflict" OR "Vietnam War" OR "Vietnam Veteran*" OR "Polychlorinated Dibenzodioxins" OR "Polychlorinated Dibenzodioxin*"))

667 Results

CINAHL

(MH "Head and Neck Neoplasms" OR MH "Squamous Cell Carcinoma of Head and Neck" OR "head and neck" OR "head & neck" OR HNSCC OR hypopharyngeal cancer* OR hypopharyngeal carcinoma* OR hypopharyngeal neoplasm* OR MH "Laryngeal Neoplasms" OR laryngeal cancer* OR laryngeal carcinoma* OR laryngeal neoplasm* OR MH "Mouth Neoplasms +" OR mouth cancer* OR mouth carcinoma* OR mouth neoplasm* OR MH "Nose Neoplasms+" OR nose cancer* OR nose carcinoma* OR nose neoplasm* OR oral cancer* OR oral carcinoma* OR oral neoplasm* OR oropharyngeal cancer* OR oropharyngeal carcinoma* OR oropharyngeal neoplasm* OR MH "Paranasal Sinus Neoplasms" OR paranasal cancer* OR paranasal carcinoma* OR paranasal neoplasm* OR MH "Pharyngeal Neoplasms+" OR pharyngeal cancer* OR pharyngeal carcinoma* OR pharyngeal neoplasm* OR salivary cancer* OR salivary carcinoma* OR salivary neoplasm* OR MH "Tongue Neoplasms" OR tongue cancer* OR tongue carcinoma* OR tongue neoplasm* OR Thyroid neoplasm* OR Thyroid Cancer* OR Thyroid Carcinoma* OR HNC OR Parathyroid Cancer* OR Parathyroid neoplasm* OR Parathyroid carcinoma*) AND ("Agent orange" OR MH "Agent Orange" OR "agent orange" OR MH "2,4-Dichlorophenoxyacetic Acid" OR MH "2,4,5-Trichlorophenoxyacetic Acid" OR "2,4-Dichlorophenoxyacetic Acid" OR "2,4,5-Trichlorophenoxyacetic Acid" OR TCDD OR "2,3,7,8-tetrachlorodibenzo-p-dioxin" OR "2,3,7,8-tetrachloro-dibenzo-para-dioxin" OR "Dichlorophenoxyacetic Acid" OR "tetrachlorodibenzo*" OR "tetrachlorodibenzo*" OR "Dichlorophenoxyacetic acid*" OR "hexachlorodibenzo*" OR "dioxin*" OR "herbicid*" OR "pesticid*" OR MH "Environmental Pollutants/adverse effects" OR MH "Environmental Pollutants/poisoning" OR MH "Environmental Pollutants/toxicity" OR MH "Defoliants, Chemical" OR MH "Vietnam Conflict" OR "Vietnam War" OR MH "Polychlorinated Dibenzodioxins" OR "Polychlorinated Dibenzodioxin*")

45 results

Cochrane review

Head NEXT Neck NEXT (cancer or neoplasm) OR agent orange OR TCDD OR herbicide OR dioxin.

6 results.