



Nicotine and Smoking Effects on Burn Related Reconstruction Patient Outcomes and Complications Following Hospital Admission: Systematic Review and Meta-analysis

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ABSTRACT

Summary

Patients suffering from burn-related injuries admitted to the hospital concurrently using nicotine and/or smoke are believed to be at an increased risk of poor outcomes and the development of complications following burn reconstruction, however data varies within the literature and remains controversial. This systematic review and meta-analysis compared outcomes and complications from studies during the years 1986 to 2018 between 8568 burn patients admitted to the hospital who use nicotine and/or smoke to 299543 burn patients admitted who do not use nicotine and/or smoke. The PubMed, EMBASE, Cochrane Library, and Web of Science databases were systematically and independently searched. Clinical characteristics, nicotine/smoking use, outcomes and complications were recorded. PRISMA and Cochrane guidelines were used throughout the review. Five of the 9 studies included in our study, were eligible for meta-analysis, with results from 7 of the possible 21 outcomes and complications queried. In conclusion, this systematic review and meta-analysis found that compared to patients suffering from burn-related injuries who do not use nicotine and/or smoke, patients using nicotine/smoking were found to have a higher rate of intubation and more wound/local skin infections.

INTRODUCTION

This new systematic review and meta-analysis compared outcomes and complications between nicotine/smoking use in burn patients admitted to the hospital to burn patients admitted without these characteristics. This review is an attempt to compile information to create a uniform set of data for clinical interpretation in diverse populations. Based on peer-reviewed literature, it was hypothesized that nicotine/smoking would increase the risks of poor outcomes and complications in patients admitted to the hospital following a burn related injury, compared to burn patients admitted without any of these characteristics.

MATERIAL AND METHODS

Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines¹¹ were followed throughout the literature search process to structure the framework for the review.

Search

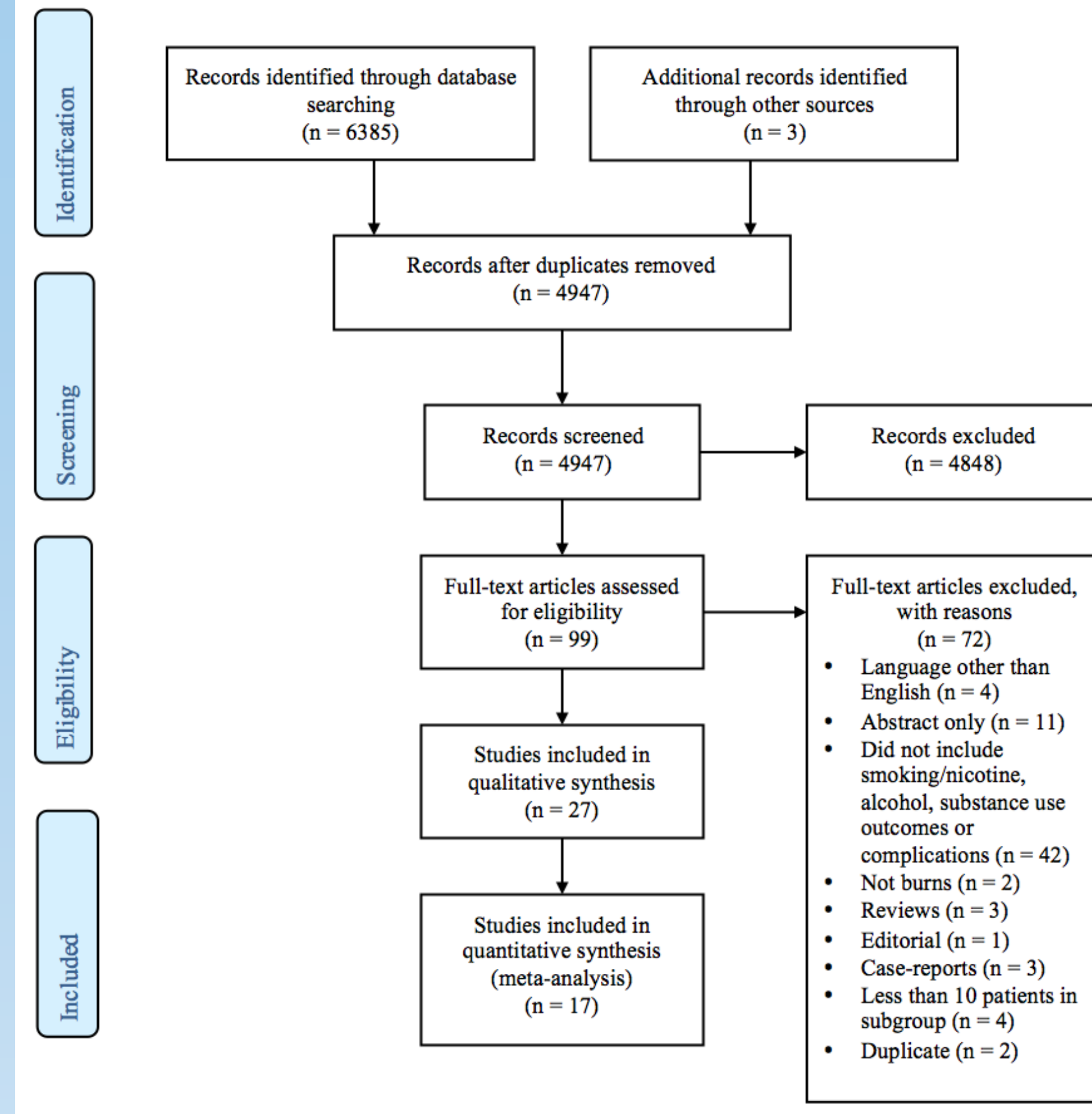
A medical library informationist (SMS) conducted the initial literature search using four databases (MEDLINE via PubMed, Embase, Cochrane, and Web of Science) from inception to December 20, 2018. Reference lists of relevant articles were hand searched to identify additional relevant studies. All references were imported into Covidence (Veritas Health Innovation Ltd, Melbourne, Australia) and reference management software and duplicates were removed.

Table Nicotine/smoking use individual study results

Author	Group	Sample size (n)	Burn related operation (n)	%TBSA (mean±SD)	LOS (mean±SD)	Time to wound closure (mean±SD)	Ventilator or days (mean±SD)	Intubation (n)	Inhalation injury (n)	ICU LOS (mean±SD)	Mortality (n)	Infection (n)	Wound/local infection (n)	DVT/PE (n)	Respiratory Complications (n)
Afshar et al.	Nicotine/smoking	572	---	---	---	---	---	---	125	---	---	---	---	---	10 ARDS
	Control	1913	---	---	---	---	---	---	---	---	---	---	---	---	102 ARDS
Al Kassia et al.	Nicotine/smoking	14	---	4±0.04	11.4±15	---	5.7±10	14	---	---	0	---	---	---	---
	Control	14	---	4±0.04	16.2±14	---	5.9±7	---	---	---	0	---	---	---	---
Carlos et al.	Nicotine/smoking	55	9	---	8.6±9	---	4.2±9	28	18	7.4±9	8	---	---	---	---
Darko et al.	Nicotine/smoking	76	---	---	---	---	---	---	---	---	20	---	---	---	---
	Control	478	---	---	---	---	---	---	---	---	22	---	---	---	---
Germann et al.	Nicotine/smoking	182	---	---	---	---	---	---	---	---	64	---	---	---	---
	Control	184	---	---	---	---	---	---	---	---	35	---	---	---	---
Heard et al.	Nicotine/smoking	7937	---	---	---	---	---	---	---	---	329	329	---	---	---
	Control	128698	---	---	---	---	---	---	---	---	3261	3261	---	---	---
	Nicotine/smoking	243	---	---	---	---	---	---	---	---	105	105	---	---	---
	Control	393	---	---	---	---	---	---	---	---	138	138	---	---	---
Hickey et al.	Nicotine/smoking	13	11±0.9	4.2±2	6.4±5	18±11.2	---	---	---	---	---	---	---	---	---
	Control	116	---	12.1±16	37±49	---	---	23±36	---	28.3±40	10	---	---	---	---
Knowlin et al.	Nicotine/smoking	464	---	24.4±25	36.9±46	---	---	21.1±30	---	28.4±36	120	---	---	---	---
	Control	18	---	---	---	---	---	---	---	---	---	---	---	---	---
Sikora et al.	Nicotine/smoking	18	---	---	---	---	---	---	---	---	---	---	1	---	---

MATERIAL AND METHODS

Figure 1. PRISMA flow chart summarizes the results of the screening process and final article selections.



Data Extraction

Two reviewers (KMK and PS) systematically and independently performed the title screening, followed by abstract screening, and full-article review to ensure quality and accuracy throughout the process. Any disagreements regarding studies to be included or excluded were resolved by discussion. If disagreements were still present after discussion, a third reviewer (CSH) resolved remaining conflict. The following data were extracted qualitatively and quantitatively for outcome and complication variables of interest: authors, year of publication, type of study, sample size, male and female distributions, nicotine/smoking used on admission to the hospital, burn related operations, graft loss/failure, percent total body surface area burned (%TBSA), depth of burn (superficial, superficial partial thickness, deep partial thickness, full thickness), skin grafting, amputations, length of hospital stay (LOS), time period of wound closure, inhalation injury, number of days on a ventilator, rate of intubation, intensive care unit (ICU) LOS, mortality, overall infections, wound/local skin infections, sepsis, decubitus ulcer (hospital acquired pressure injury), deep vein thrombosis (DVT)/pulmonary embolism (PE), renal failure, respiratory complications, and ventilator-associated events. If there were multiple reports from the same study, one data collection form was completed for the study from all of the reports to avoid duplicating results.

RESULTS

%TBSA

Three studies evaluated %TBSA.^{17,24,27} In two studies, means ranged from 4% to 12% TBSA in 130 patients consuming nicotine or smoking compared to 4% to 24.4% TBSA in 478 patients not consuming nicotine or smoking. These results were not significant (SMD: -0.38, 95% CI: -0.81, 0.04, I² = 41%, p = 0.08).^{17,27}

Hospital LOS

Four studies evaluated hospital LOS.^{17,19,24,27} In two studies, hospital LOS means ranged from 11.4 to 37 days in 130 patients consuming nicotine or smoking compared to 16.2 to 37 days in 478 patients not consuming nicotine or smoking. These results were not significant (SMD: -0.02, 95% CI: -0.22, 0.18, I² = 0%, p = 0.84).^{17,27}

Ventilator days

Two studies evaluated the number of days patients were on a ventilator.^{17,19} One study found a mean number of days a patient was on a ventilator of 5.7 days in 14 patients consuming nicotine or smoking compared to 6 days in 14 patients not consuming nicotine or smoking. These results were not significant (SMD: -0.02, 95% CI: -0.76, 0.72, I² = Not applicable, p = 0.95).¹⁷

Intubation

Three studies evaluated rates of intubation.^{17,19,27} One study was available that assessed a mean number of patients intubated. A mean of 23 patients consuming nicotine or smoking was compared to a mean of 21 patients not consuming nicotine or smoking. (RR: 4.38, 95% CI: 2.51, 7.63, I² = Not applicable, p < 0.00001).²⁷

ICU LOS

Two studies evaluated ICU LOS.^{19,27} One study found a mean ICU LOS of 28.3 days in 116 patients consuming nicotine or smoking compared to 28.4 days in 464 patients not consuming nicotine or smoking. These results were not significant (SMD: -0.00, 95% CI: -0.21, 0.20, I² = Not applicable, p = 0.98).²⁷

Mortality

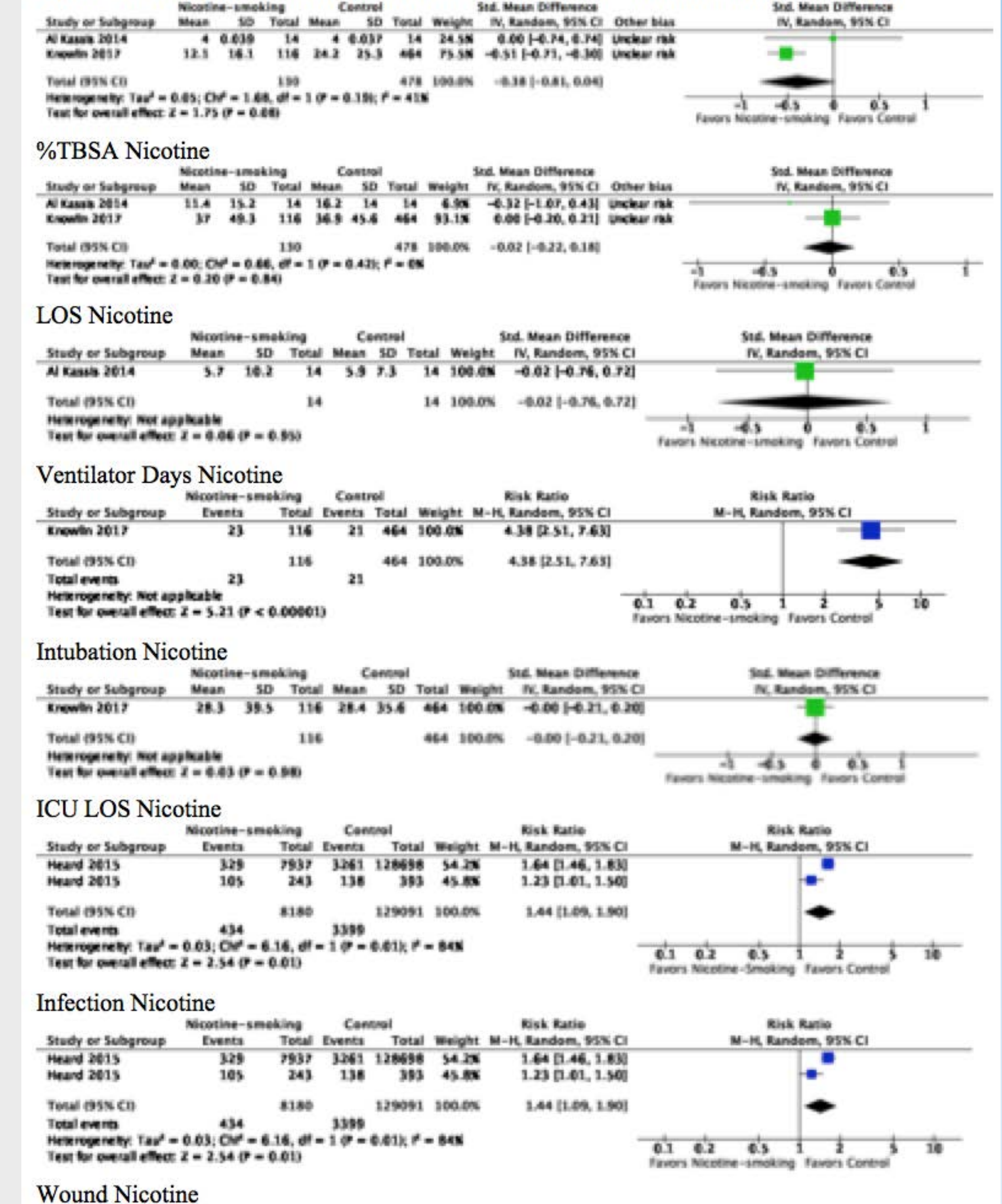
Five studies evaluated mortality.^{7,17,19,21,27} In four studies, mortality occurred in 94/388 (24%) patients consuming nicotine or smoking compared to 177/1140 (16%) patients not consuming nicotine or smoking. These results were not significant (RR: 1.53, 95% CI: 0.36, 6.53, I² = 96%, p = 0.56).^{7,17,21,27} After removing the study Knowlin et al, heterogeneity dropped from I² = 96% to I² = 91%, with a p = 0.56 to p = 0.04.²⁷ No single study could be identified for the high heterogeneity.^{7,17,21,27}

Wound/local skin infections

One study found 344/8180 (4%) cellulitis infections in patients consuming nicotine or smoking compared to 3399/129091 (2.6%) cellulitis infections in patients not consuming nicotine or smoking (RR: 1.44, 95% CI: 1.09, 1.90, I² = 84%, p = 0.01).²³ No study could be removed to assess heterogeneity.

RESULTS

Figure 3. Forest plots with comparisons of outcomes and complications in meta-analysis



CONCLUSION

Compared to patients suffering from burn-related injuries who do not use nicotine and/or smoke, patients using nicotine/smoking were found to have a higher rate of intubation and more wound/local skin infections.

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