

# Corticosteroids associated with improved outcomes of adolescent patients with e-cigarette associated lung injury.

Corticosteroid intervention on the outcomes of adolescent and young adult patients (aged 15-30) with e-cigarette and vaping product use associated lung injury (EVALI), a systematic review.

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## Background

The recent outbreak of electronic cigarette and vaping product use associated lung injury (EVALI) in adolescents and young adults worldwide requires effective treatment, which may be through corticosteroid therapy.

## Objective

To examine literature for analysis of corticosteroid clinical course specifics and the effect on the improvement of EVALI patient outcomes.

## Methods

Adhering to PRISMA guidelines, confirmed or probable cases of EVALI in patients aged 15-30 were identified using online databases. Studies included were published in English, with e-cigarette exposure 90 days before symptom onset and assessed at least two outcomes on patient follow up. Full inclusion criteria is depicted in **Table 1**. Studies excluded were patients outside of the defined age range or with comorbidities. Based on quality and risk of bias assessment, 8 studies were included for quantitative synthesis, all of which were published in 2020, the process through which is shown in **Figure 1**.

## Results

As presented across all studies in the current review, CS treatment for adolescent and young adult EVALI patients results in improved patient outcomes; in documented patient notes, improved PFT capacity, association with shorter hospitalization durations and less required oxygen support on discharge and are found summarized in **Table 3**. Clinical courses of corticosteroids varied between studies, as presented in **Table 2** and **Figure 2**.

## Discussion

The novelty of the EVALI outbreak, and the lack of standard set of PFTs, differing clinical courses of CS, and the loss of patients at follow up in pulmonary clinics creates limitations in the current review.

## Conclusion

IV or oral corticosteroids, including prednisolone and methylprednisolone were prescribed in majority of cases with many noting improvement of outcomes due to clinical intervention. Course specifics, including duration, dosage and length of taper varied significantly between studies. Improvement of PFTs following CS intervention was noted, but deterioration in the outpatient setting also occurred.

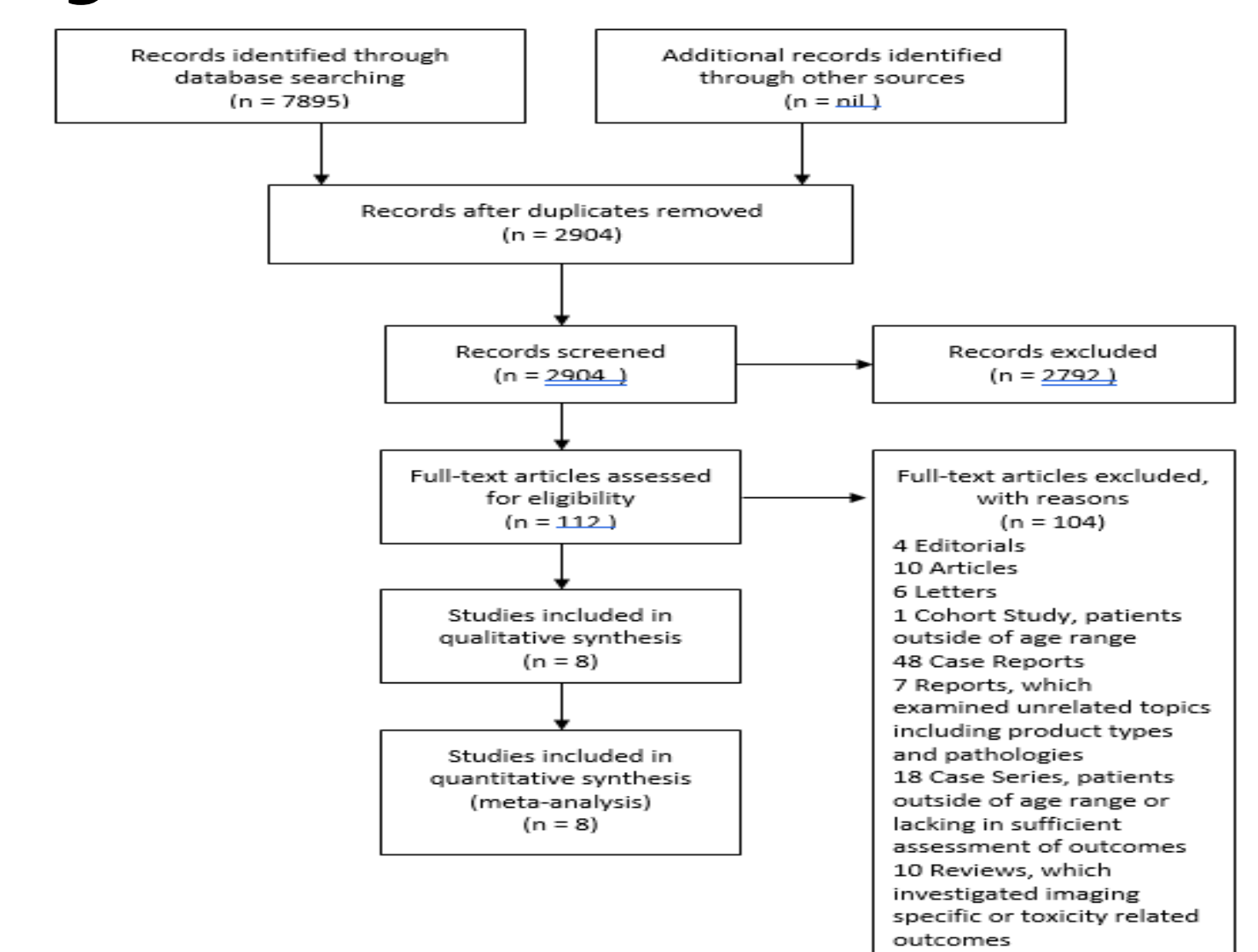
## Acknowledgements

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**Table 1: Inclusion Criteria**

Population	- Adolescents and young adults aged 15-30 - Patients with documented or suspected EVALI - E-cigarette or vaping product exposure 90 days prior to symptom onset - Patients with no pre-existing comorbidities
Interventions	- Corticosteroids (IV or oral) used as treatment for EVALI
Outcomes	- Duration of hospitalization - Oxygen support at discharge - Pulmonary Function Testing results in hospital and outpatient settings (including DLCO values, FEV1 and 6 Minute Walk Test results)

**Figure 1: PRISMA Flowchart**



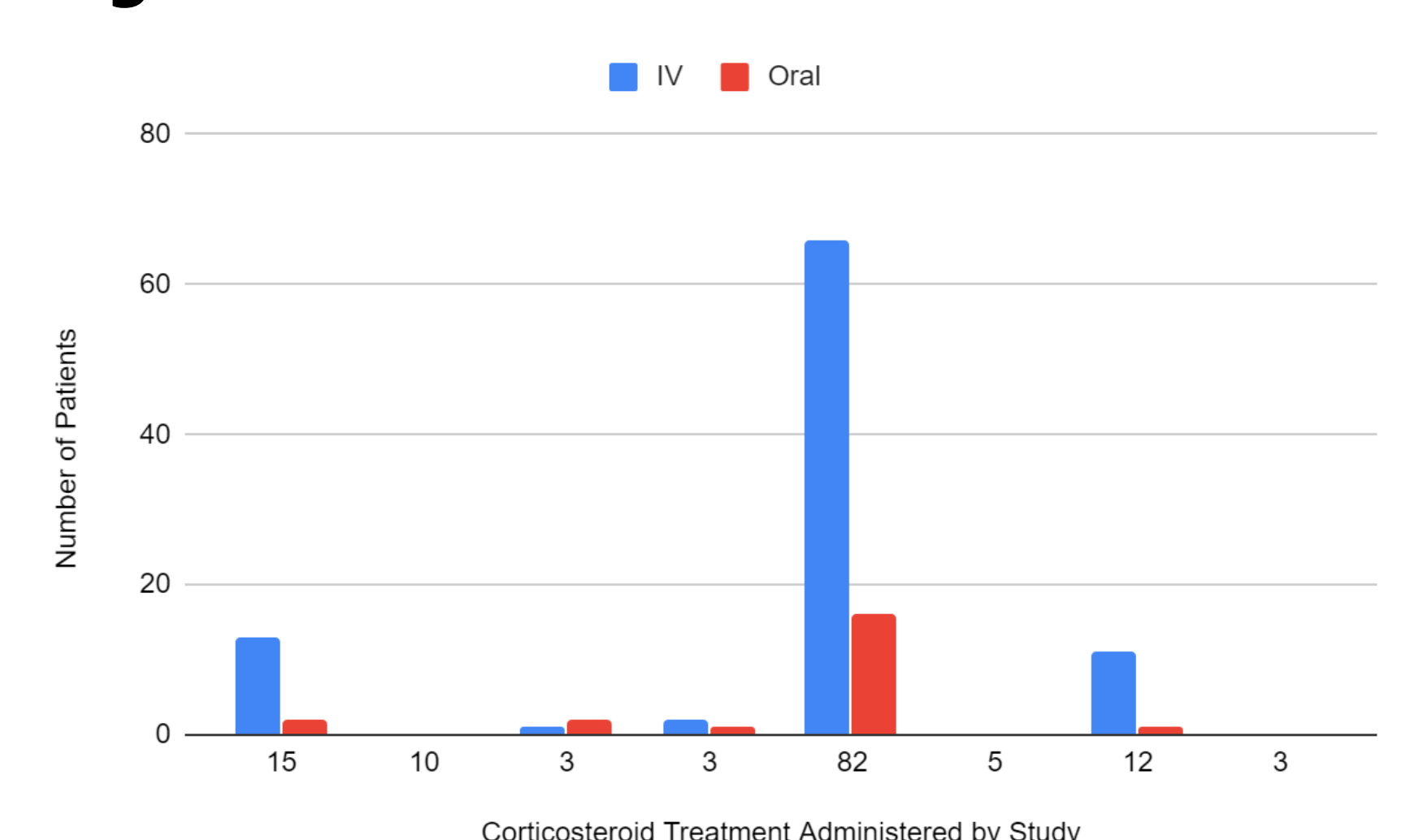
**Table 2: Characteristics of Included Studies**

Study	Type	Intervention	Outcomes
Carroll, 2020	Cohort Study, 15 patients with a median age of 17.1 years old.	All patients received corticosteroids, in short, intermediate or extended course durations.	Hospital was able to decrease time from admission to administration with earlier recognition of EVALI. Approximately half of all patients improved, while the other noted residual abnormalities including in DLCO. 2 patients relapsed.
Chidambaram, 2020	Case Series, 11 patients with a median age of 16.6 years old.	10/11 patients received glucocorticoids.	Median hospitalization duration was 5 days, and 78% of patients exhibited diminished DLCO on follow up.
Choe, 2020	Case Series, 4 patients ranging from 18-29 years of age.	3 patients underwent CS therapy, with one receiving N-acetyl cysteine in addition.	The median hospitalization duration of CS treated patients was 8.3 days, while the last patient spent a total of 24 days in hospital on VV ECMO. IV methylprednisolone was administered at 60-125 mg/ day and tapered over a 13-20 period at discharge.
Corcoran, 2020	Case Series, 7 patients ranging in age from 25-18 years old.	3 patients treated with corticosteroids, 2 with IV methylprednisolone and 1 on 60mg of oral prednisone.	When compared, patients receiving corticosteroids appeared to spend less time in hospital than their counterparts who did not receive CS therapy. Hedge's g was calculated at 0.297.
Layden, 2020	Case Series, 98 patients with a median age of 21.1.	84% of patients received IV or oral corticosteroids.	All but 5 cases had clinical courses over 7 days in length, and improvement due to glucocorticoid administration was found in half of all patient notes.
Messina, 2020	Case Series, 6 patients from 15-20 years of age.	5 patients treated with corticosteroids.	Median course duration was 10.2 days. 69% of patients received antibiotics prior to CS therapy, but no improvement could be attributed to this treatment alone.
Rao, 2020	Case Series, 13 patients with a median age of 15.9 years old.	12 of 13 patients treated with glucocorticoids, 7 with pulse dosing.	11 patients improved within 24 hours of CS administration, and all patients reported resolution of symptoms. However, 31% were discharged on supplemental oxygen.
Silverman, 2020	Case Series, 3 patients ranging in age from 18-21.	All patients were treated with CS treatment.	Hospitalization ranged from 6-9 days in duration and all patients were discharged on a steroid taper.

**Table 3: Summary of Findings**

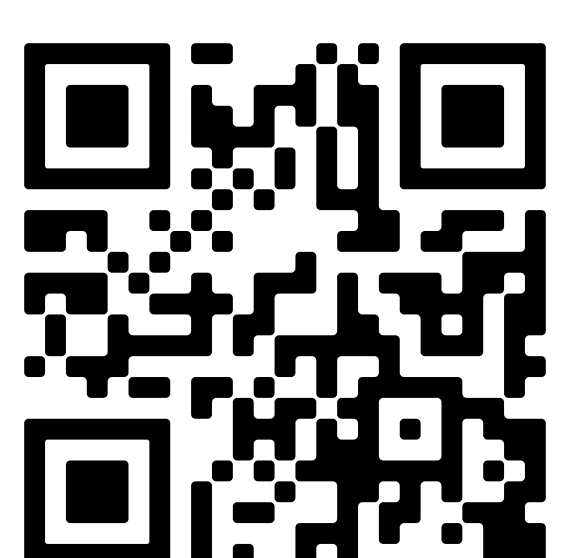
Outcome	Relative Effect
Patient Improvement	CS therapy resulting in improvement was observed in all studies, and documented in patient notes in 51-75% of cases.
Hospitalization Duration	Hospitalization of patients was a median of 8.1 days. In the Corcoran et al study, CS treated patients appeared to spend less time in hospital than their non-CS counterparts.
Oxygen Support	Residual abnormalities resulting in the need for inhaled CS upon discharge was noted in 3/8 studies.
PFT Results	Administration of CS resulted in immediate improvement of PFT's, however many studies noted deterioration of these values in the outpatient setting

**Figure 2: Corticosteroid Treatments**



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