

Abstract

Hypertension is one of the leading conditions that increase the risk of cardiovascular disease (CVD) which intimately impacts the pulmonary system. There is a significant relationship between hypertension and various pulmonary or respiratory conditions such as chronic obstructive pulmonary disease (COPD), asthma, and apnea. Since hypertension is often associated with coexisting pulmonary diseases, these conditions are often treated simultaneously. Despite the prevalence of coexisting conditions, hypertension clinical trials tend to exclude participants with coexisting pulmonary or respiratory conditions. By extrapolating data from clinicaltrials.gov regarding completed hypertension clinical trials, the study found that approximately 78.01% of pulmonary conditions and risk factors were excluded from hypertension clinical trials. An urgent increase in the proportion of included pulmonary conditions is necessary for hypertension clinical trials due to a significant and increasing worldwide population experiencing hypertension and pulmonary-related comorbidities.

Background

Hypertension is considered one of the leading risk factors for cardiovascular disease. In fact, hypertension is estimated to affect roughly 1.28 billion adults aged 30-79 worldwide, although approximately 21% of adults are being treated for the condition (World Health Organization, 2021). Hypertension has clear associations with numerous comorbidities, many of which affect the pulmonary or respiratory system including asthma, COPD, and apnea.

There is abundant literature on the relationship between hypertension and coexisting pulmonary conditions. For example patients with hypertension and asthma tend to have genetic similarities and resultant shared treatment indications and contraindications (Zolotareva et al., 2019, 1-11). Regardless of the exact relationship between such conditions, the prevalence of their coexistence has prompted inquiries into the efficacy of treatment methods in those with multiple conditions. For example, it appears that treated hypertension could prevent the progression of apnea and serious adverse health events such as stroke, heart failure, heart attack, asthma, or COPD (Mitra et al., 2021, 88).

While controlled hypertension could minimize disease progression, it's still unclear how effective many treatments are on coexisting pulmonary conditions directly. One study found that medicines such as acetazolamide may improve symptoms related to both hypertension and obstructive sleep apnea. In this study, acetazolamide was able to simultaneously reduce blood pressure, arterial stiffness, and sleep-disordered breathing (Eskandari et al., 2018, 309-317). Due to the notable coexistence of hypertension and pulmonary conditions combined with the potential improvements in disease recovery, a greater population of clinical trials should represent populations with coexisting hypertension and pulmonary conditions or risk factors.

Methods and Results

To assess the inclusion and exclusion frequencies of pulmonary conditions and risk factors in hypertension clinical trials, the present study used data available via clinicaltrials.gov (MeSHID D000006973) predating 2022 and organized using Python3.9.10. The data was organized to represent all conditions and terms related to pulmonary and respiratory conditions and risk factors alongside their respective inclusion and exclusion frequencies in hypertension clinical trials. All terms were organized and reclassified as necessary to combine similar conditions such as “apnea” and “sleep apnea”. Figure 1 represents the five most voluminous pulmonary terms collected during the analysis while Figure 2 illustrates the inclusion and exclusion frequencies of all terms individually.

Figure 1. Inclusion and exclusion frequencies of the most common pulmonary terms in hypertension clinical trials.

Term	Inclusion	Exclusion
Asthma	40	250
Apnea	75	334
Smoking	88	142
Pulmonary embolism	18	84
Ventricular dysfunction	23	54

Figure 2. Comparison of inclusion and exclusion frequencies of renal-related terms in hypertension clinical trials.

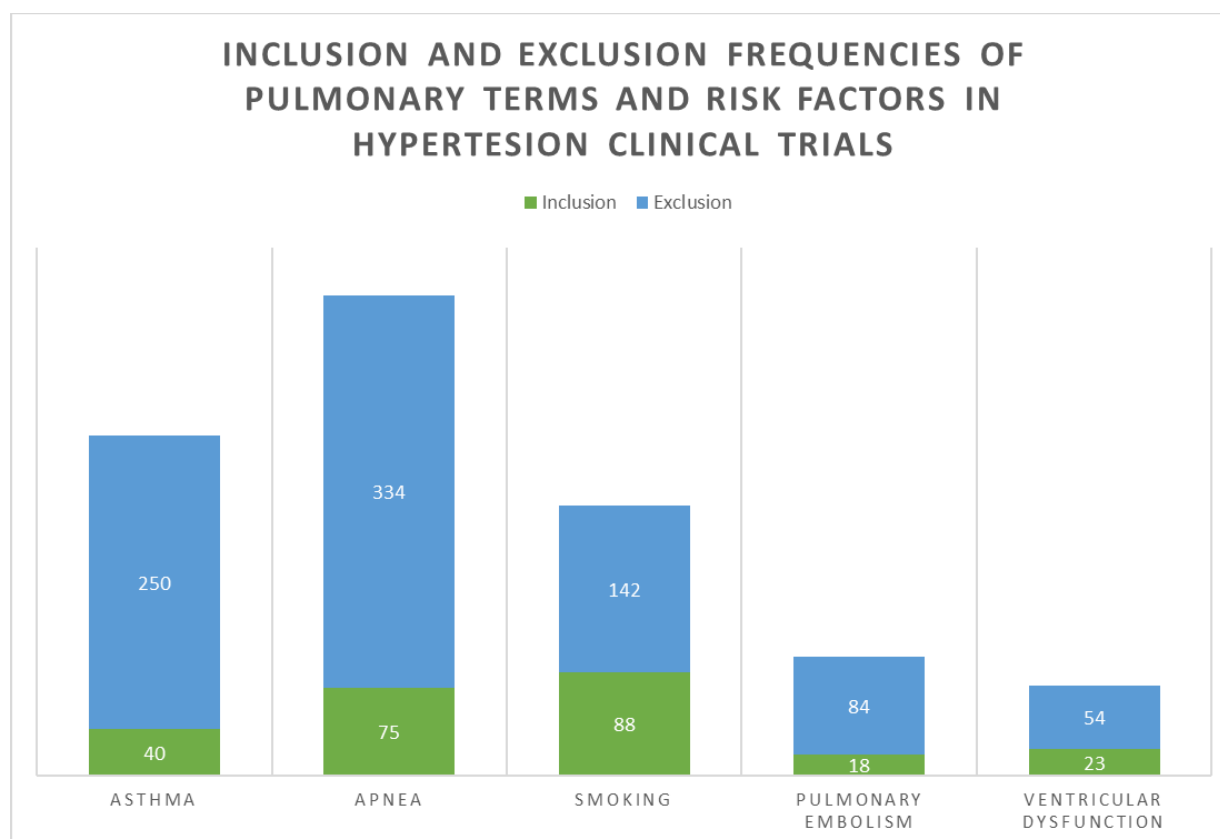


Figure 1 and Figure 2 highlight the most frequent pulmonary conditions and terms excluded in hypertension clinical trials. These five terms account for 864 of 1135 (76.12%) excluded pulmonary terms in hypertension clinical trials. An exhaustive list of terms is available in the Appendix. Collectively, there were 1455 pulmonary-related terms within the hypertension clinical trial inclusion and exclusion criteria with 1135 being excluded (78.01%). Resultantly, pulmonary conditions and risk factors, such as smoking, were 3.55 more likely to be excluded from hypertension clinical trials.

Results and Discussion

Hypertension is a common cardiovascular condition that can be a precursor to more serious conditions or diseases like cardiovascular disease. Hypertension is often coexistent with various pulmonary conditions such as asthma, COPD, and apnea which can affect the efficacy or method of treatment. Due to the relationship between hypertension and pulmonary conditions, a greater emphasis should be placed on the proportional representation of coexisting pulmonary conditions and hypertension in clinical trials.

References

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Appendix

Term	Inclusion	Exclusion
asthma	40	250
lung diseases	2	34
apnea	35	173
respiratory distress syndrome	2	3
smoking	88	142
pulmonary arterial hypertension	30	25
pulmonary fibrosis	4	16
pulmonary embolism	18	84
respiratory failure	14	28
idiopathic pulmonary fibrosis	3	3
sleep apnea	40	161
bronchopulmonary dysplasia	1	7
ventricular dysfunction	23	54
tobacco use	7	13
pulmonary diseases	4	21
lung disorder	1	2
bronchial asthma	6	66

upper respiratory tract infection	1	4
airway obstruction	1	4
respiratory insufficiency	0	6
hypertension, pulmonary	0	10
severe acute respiratory syndrome	0	3
bronchiectasis	0	11
bronchitis	0	15
Totals	320	1135