# Prevalence of Bacterial Coinfection and Patterns of Antibiotics Prescribing in Patients with COVID-19: A Systematic review and Meta-Analysis

Faisal Alshaikh, *MSc CliniPharm (UK), MPharm (UK), ARPharmS*

Dr Amanj Kurdi, *BSc, MSc (Clini.Pharm), PhD, FHEA, PG Diploma Academic Practice*

## Introduction

Evidence around prevalence of bacterial coinfection and pattern of antibiotic use in COVID-19 is controversial although high prevalence rates of bacterial coinfection have been reported in previous similar global viral respiratory pandemics[1,2]. Early data on the prevalence of antibiotic prescribing in COVID-19 indicates conflicting low and high prevalence of antibiotic prescribing which challenges antimicrobial stewardship programmes and increases risk of antimicrobial resistance (AMR)[3-5,].

Prior meta-analyses suggest a bacterial coinfection prevalence of <4% - 8% in patients with COVID-19, nonetheless, these studies included a small number of patients[3].

The prevalence of antibiotic prescribing in patients with COVID-19 was 74.6%, reported in a prior meta-analysis, which included literature mostly from Asia[6].

This review aims at building on these publications through identifying the prevalence of bacterial co-infection, and the prevalence of antibiotic use in patients with COVID-19 across multiple countries and regions to guide future prescribing

## Method

Systematic review and meta-analysis. Proportion (prevalence) data was pooled using random effects meta-analysis approach; and stratified based on region and study design.

Data Source: OVID MEDLINE, OVID EMBASE, Cochrane and MedRxiv between January 2020 and June 2021.

Study Eligibility: English language studies of laboratory-confirmed COVID-19 patients which reported (a) prevalence of bacterial coinfection and/or (b) prevalence of antibiotic prescribing with no restrictions to study designs or healthcare setting

Participants: Adults (aged ≥ 18 years) with RT-PCR confirmed diagnosis of COVID-19, regardless of study setting.

## Results

A total of 1058 studies were screened, of which 22, hospital-based studies were eligible, compromising 76,176 of COVID-19 patients.

Pooled estimates for the prevalence of bacterial co-infection and antibiotic use were 5.62% (95% CI 2.26 – 10.31) and 61.77% (CI 50.95 – 70.90), respectively.

Sub-group analysis by region demonstrated that bacterial co-infection was more prevalent in North American studies (7.89%, 95% CI 3.30-14.18), in addition antibiotic prescribing by region demonstrated that North America had reported the highest antibiotic use in COVID-19 patients (68.84%, 95% CI 62.27 – 75.05).

The funnel plots generated *(See fig below)*, demonstrates that there was no evidence of publication bias. This is further supported by the objective results (p-values) obtained through Egger's asymmetry test for studies in both prevalence of bacterial coinfection and antibiotic use, p-values were 0.43 and 0.59
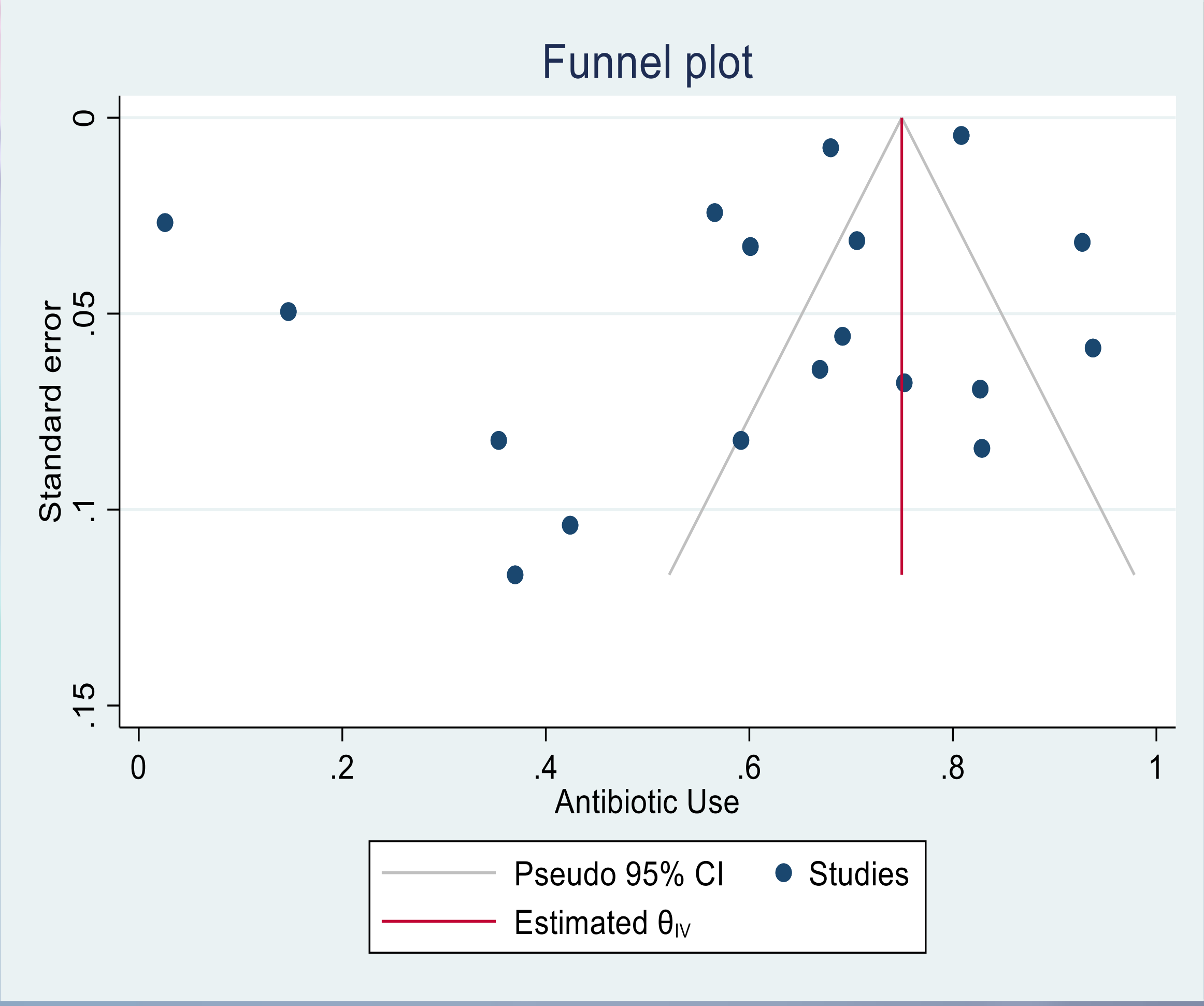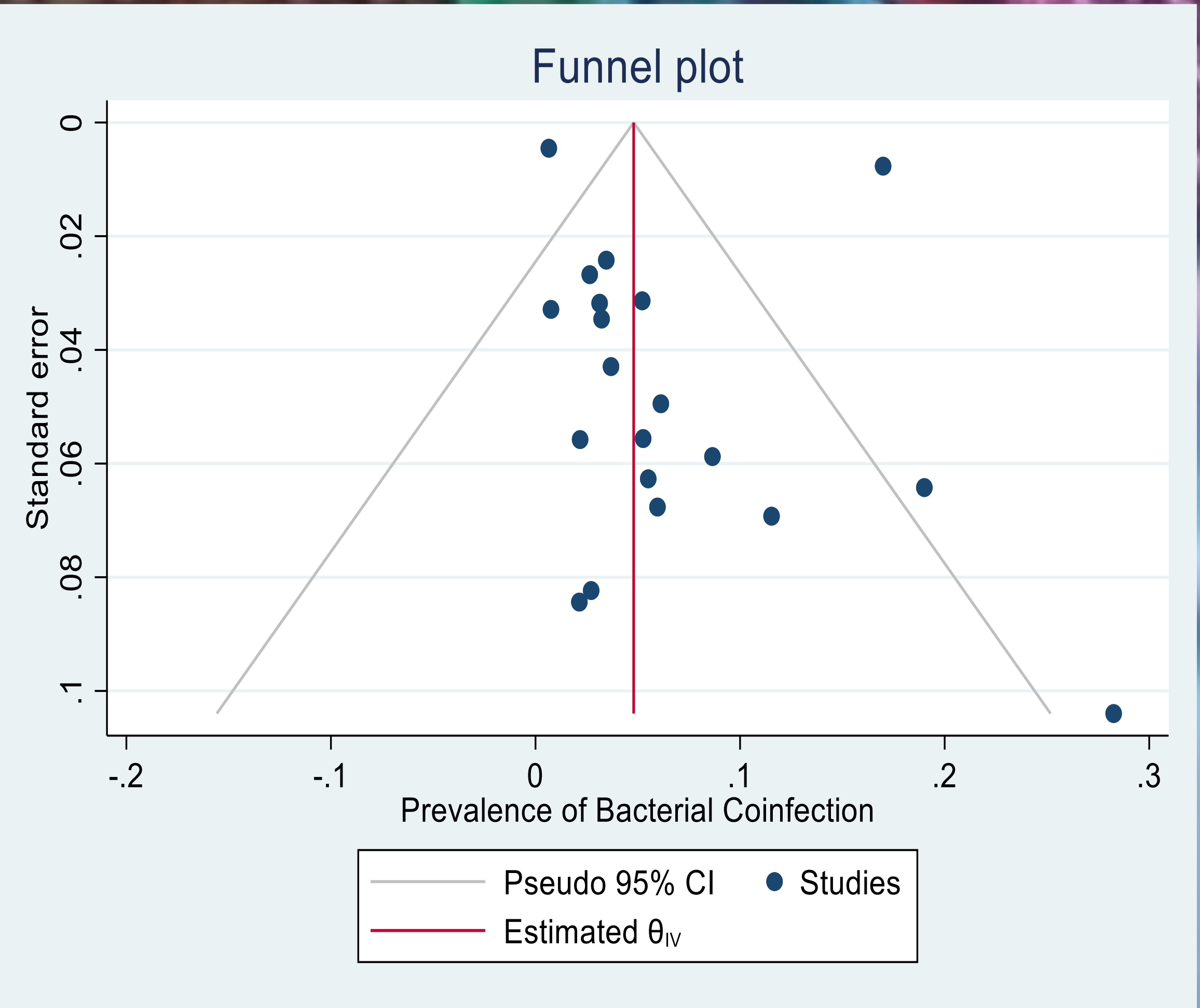




## Discussion and Conclusion

Bacterial coinfection in COVID-19 patients, the findings in this review is consistent with those of previously published studies and smaller systematic reviews addressing this issue (Range <4% - 8%)[3]. Bacterial coinfection prevalence were low across all included studies, with the exception to Contou et al, Neto et al and Puzniak et al in which the reported prevalence rates were 28%, 19% and 16% respectively.

This review also identified very high antibiotic use in COVID-19 patients, which is consistent with previous reviews including those of Langford et al (2021)[6], which reported a prevalence of 74.6% (95% CI 68.3-80.0%)

The increase in antibiotic use observed during this pandemic might have impacted and setback antimicrobial stewardship (AMS) efforts globally, especially in regions where AMS programmes are just starting as seen in Africa with previous knowledge and resource issues

In this review, investigating regional distribution of co-infection and antibiotic use was key. Its significance is directly correlated to the fact that antimicrobial use varies considerably across regions, albeit some convergence

*Conclusion:* This study demonstrates that the prevalence of bacterial coinfection amongst COVID-19 patients was low, 5.62%, nevertheless, antibiotics use amongst COVID-19 patients was high (61.77%). The findings of this study encourage a more rational approach to antibiotics prescribing in COVID-19 patients, an approach based on laboratory-confirmed diagnosis of coinfection, rather than clinical, advocating for more antimicrobial stewardship (AMS).

## References

1. Morens DM, Taubenberger JK, Fauci AS. Predominant role of bacterial pneumonia as a cause of death in pandemic influenza: implications for pandemic influenza preparedness. The Journal of infectious diseases. 2008;198(7):962-70.
2. Joseph C, Togawa Y, Shindo N. Bacterial and viral infections associated with influenza. Influenza and other respiratory viruses. 2013;7:105-13.
3. Lansbury L, Lim B, Baskaran V, Lim WS. Co-infections in people with COVID-19: a systematic review and meta-analysis. Journal of Infection. 2020;81(2):266-75.
4. Founou RC, Blocker AJ, Noubom M, Tsayem C, Choukem SP, Dongen MV, et al. The COVID-19 pandemic: a threat to antimicrobial resistance containment. Future Science OA. 2021(0):FSO736.
5. Hsu J. How covid-19 is accelerating the threat of antimicrobial resistance. Bmj. 2020;369.
6. Langford BJ, So M, Raybardhan S, Leung V, Soucy J-PR, Westwood D, et al. Antibiotic prescribing in patients with COVID-19: rapid review and meta-analysis. Clinical Microbiology and Infection. 2021.
7. Puzniak L, Finelli L, Kalvin CY, Bauer KA, Moise P, De Anda C, et al. A multicenter analysis of the clinical microbiology and antimicrobial usage in hospitalized patients in the US with or without COVID-19. BMC infectious diseases. 2021;21(1):1-9.
8. Contou D, Claudinon A, Pajot O, Micaëlo M, Flandre PL, Dubert M, et al. Bacterial and viral co-infections in patients with severe SARS-CoV-2 pneumonia admitted to a French ICU. Annals of intensive care. 2020;10(1):1-9.
9. Goncalves Mendes Neto A, Lo KB, Wattoo A, Salacup G, Pelayo J, DeJoy III R, et al. Bacterial infections and patterns of antibiotic use in patients with COVID-19. Journal of medical virology. 2021;93(3):1489-95.