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# STABILITY ANALYSIS FOR AN MSEIR AGE-STRUCTURED EPIDEMIC MODEL

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**Abstract.** An MSEIR age-structured epidemic model with proportionate mixing and standard incidence is investigated. We determine the steady states and obtain explicitly computable threshold condition, and then we perform stability analysis.

**Keywords.** Age-structure; Epidemic; Stability; Standard incidence; Proportionate mixing assumption.

**AMS (MOS) subject classification:** This is optional. But please supply them whenever possible.

## 1 Introduction

In this paper, we study an age-structured MSEIR epidemic model, where age is assumed to be the chronological age, i.e., the elapse of time since birth. The disease causes so few fatalities that they can be neglected. We assume proportionate mixing and standard incidence for the force of infection. This model is partly analyzed in [6], where an explicitly computable threshold condition $R_0$, known as the reproduction number, is obtained. If $R_0 > 1$, then an endemic equilibrium as well as a disease-free equilibrium are possible steady states. If $R_0 \leq 1$, then the only steady state is the disease-free equilibrium.

In [6], it has been shown, via Lyapunov function, that the disease-free equilibrium is globally stable if $R_0 \leq 1$, and unstable if $R_0 > 1$.

In this paper, we study the same model as in [6] with an additional assumption that individuals have finite life span, and we use a different approach and prove the above results via integral equations. In addition, we study the local stability of the endemic equilibrium, which is not studied in [6].

The organization of this paper is as follows: in section 2 we describe the model and obtain the model equations; in section 3 we reduce the model equations to several subsystems; in section 4 we determine the steady states; in section 5 we perform stability analysis and in section 6 we conclude our results.