Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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The effectiveness of quarantine and isolation determine the trend of the COVID-19 epidemics in the final phase of the current outbreak in China

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ABSTRACT

Objectives: Since January 23rd 2020, stringent measures for controlling the novel coronavirus epidemics have been gradually enforced and strengthened in mainland China. The detection and diagnosis have been improved as well. However, the daily reported cases staying in a high level make the epidemics trend prediction difficult.
Methods: Since the traditional SEIR model does not evaluate the effectiveness of control strategies, a novel model in line with the current epidemics process and control measures was proposed, utilizing multisource datasets including cumulative number of reported, death, quarantined and suspected cases.
Results: Results show that the trend of the epidemics mainly depends on quarantined and suspected cases. The predicted cumulative numbers of quarantined and suspected cases nearly reached static states and their inflection points have already been achieved, with the epidemics peak coming soon. The estimated effective reproduction numbers using model-free and model-based methods are decreasing, as well as new infections, while new reported cases are increasing. Most infected cases have been quarantined or put in suspected class, which has been ignored in existing models.
Conclusions: The uncertainty analyses reveal that the epidemics is still uncertain and it is important to continue enhancing the quarantine and isolation strategy and improving the detection rate in mainland China.

Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig. 6 Fig. 7 Fig. 8

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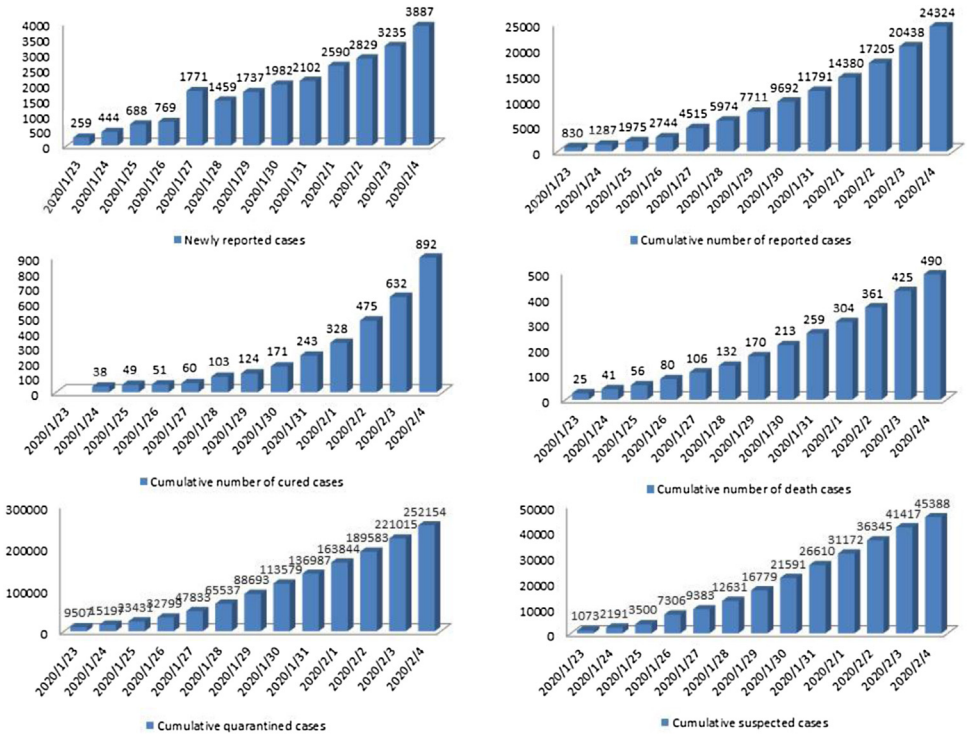

Fig. 1. The datasets related to the COVID-19 epidemics including newly reported cases, cumulative number of reported cases, cumulative number of cured cases, cumulative number of death cases, cumulative quarantined cases and cumulative suspected cases.

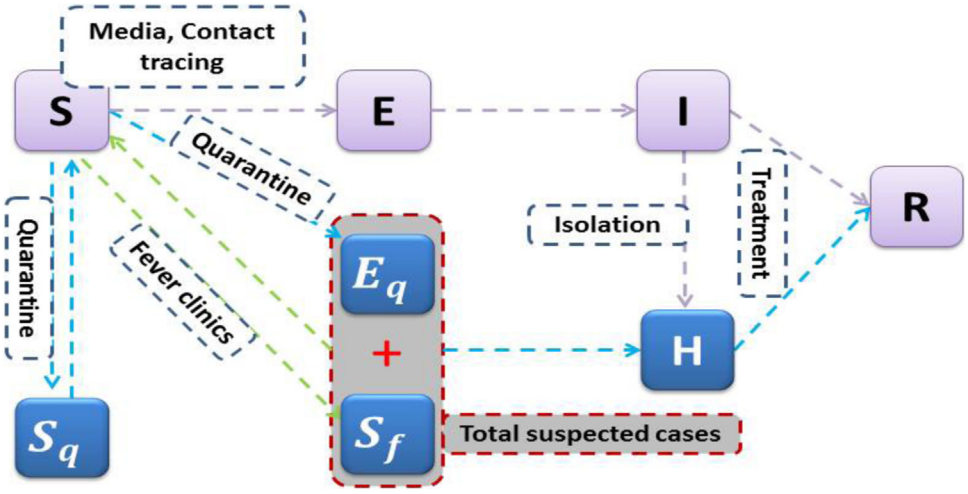

Fig. 2. Diagram of the model adopted in the study for simulating the COVID-19 infection. Interventions including intensive contact tracing followed by quarantine and isolation are indicated. The gray compartment means suspected case compartment consisting of contact tracing Eq and fever clinics.

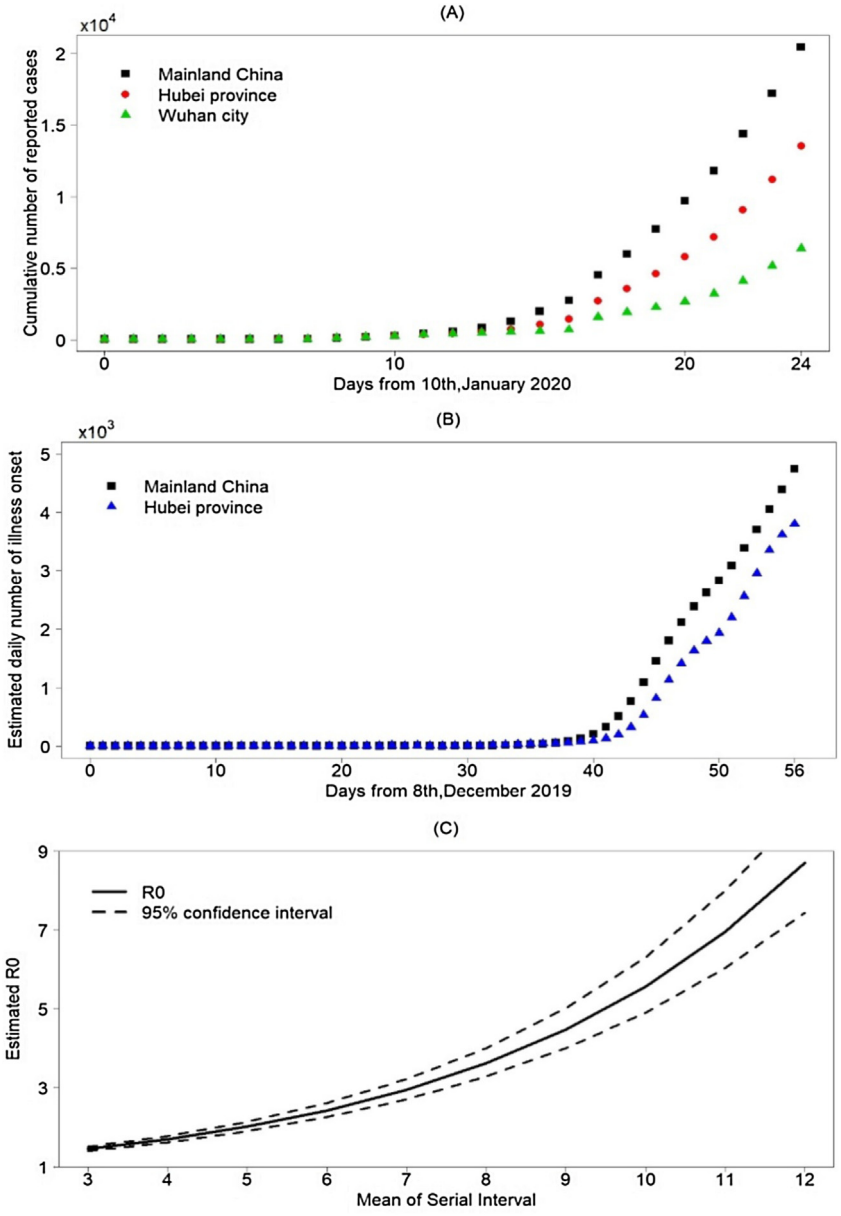

Fig. 3. (A) Cumulative number of confirmed reported cases for mainland China, Hubei province and Wuhan city, (B) Estimated number of illness onset cases for mainland China, Hubei province and Wuhan city, (C) Estimated basic reproduction number R_0.

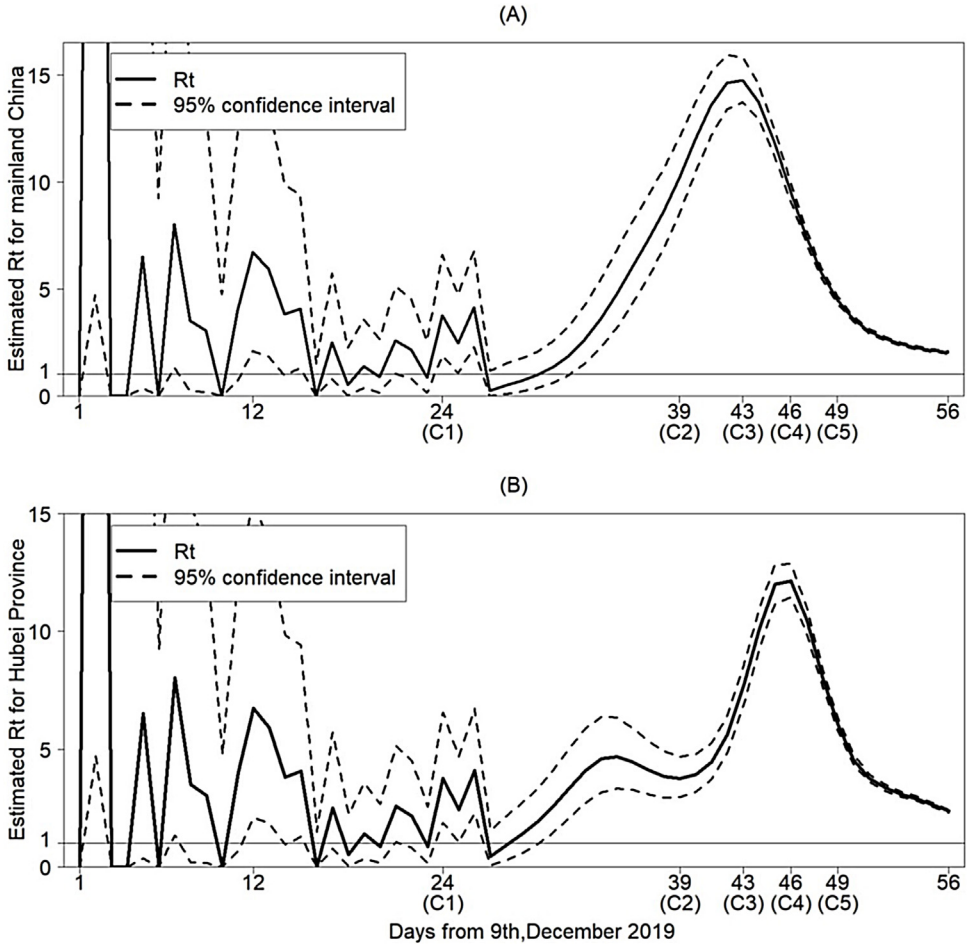

Fig. 4. Estimated effective reproduction number R_t for mainland China in (A) and for Hubei province in (B). The timings of strategies implemented are as follows: (C1): Huanan Seafood Wholesale Market closed on January 1st 2020; (C2): Detection kits for COVID-19 firstly used on January 16th 2020; (C3): The Chinese government amended the Law on the Prevention and Treatment of Infectious Diseases to include the COVID-19 as class-B infection but manage it as a class-A infection due to its severity on January 20th 2020; (C4): Lock-down strategy in Wuhan implemented on January 23rd 2020; (C5): Spring festival holiday extended and self-quarantine measures kept on January 26th 2020.

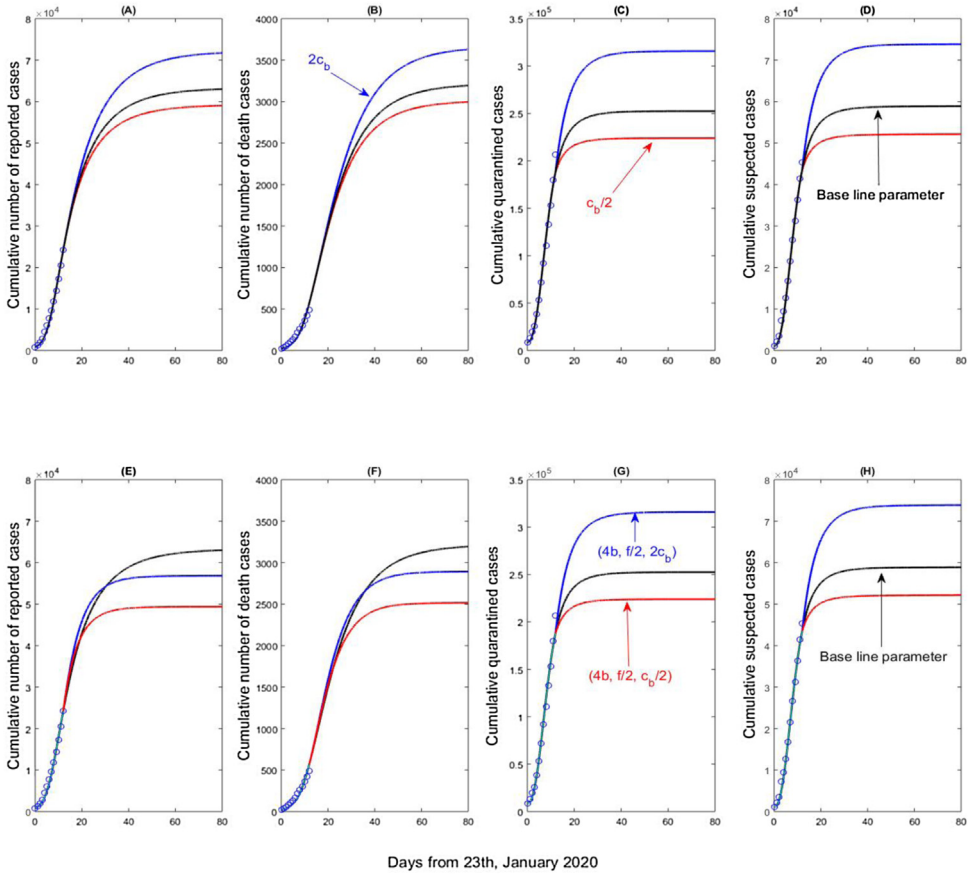

Fig. 5. Goodness of fit (black curve) and variation in cumulative number of reported cases, cumulative number of death cases, cumulative quarantined cases and cumulative suspected cases with the minimum contact rate (c_b), detection rate (b) and the confirmation ratio (f).

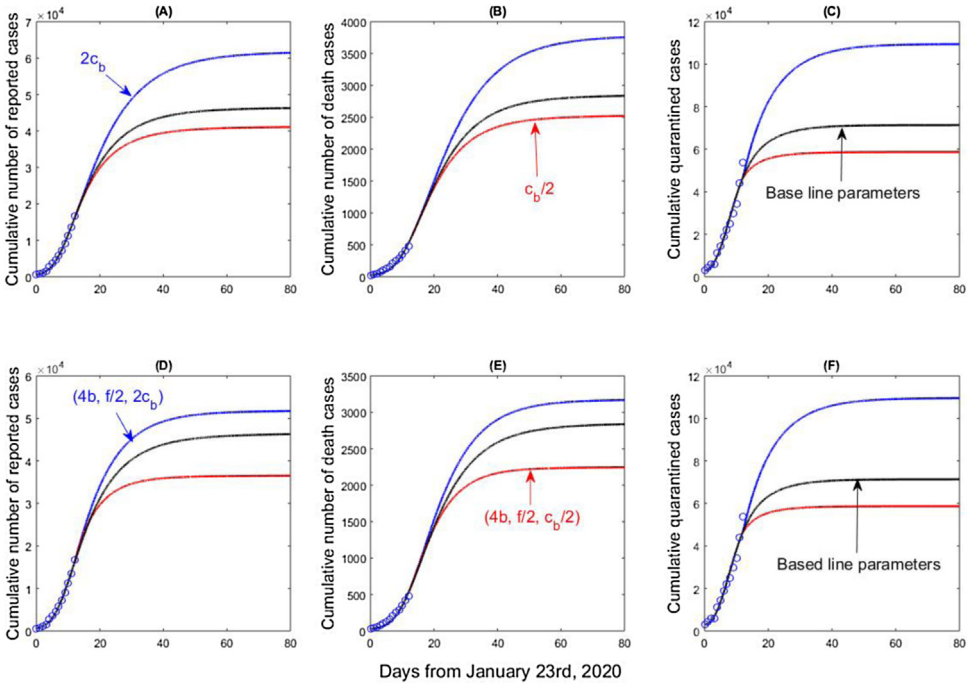

Fig. 6. Goodness of fit (black curve) and variation in cumulative number of reported cases, cumulative number of death cases, and cumulative quarantined cases with the minimum contact rate (c_b), detection rate (b) and the confirmation ratio (f) for Hubei Province.

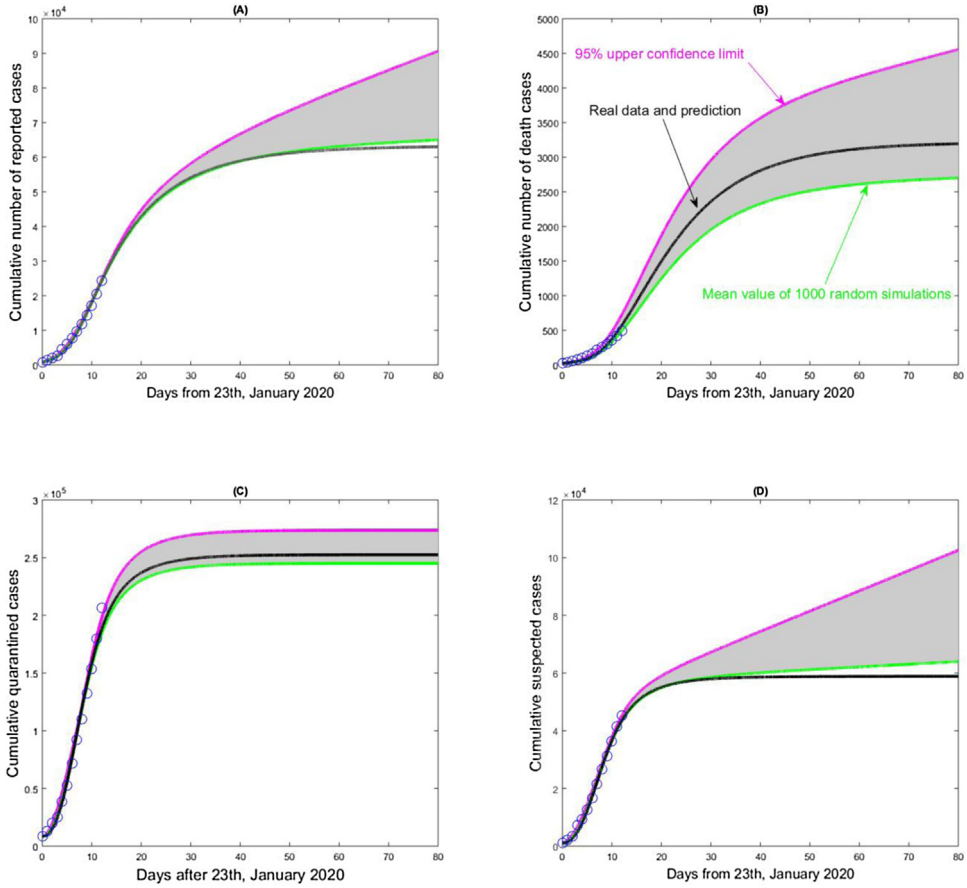

Fig. 7. The impact of the randomness of the cumulative reporting data sets including cumulative number of reported cases, cumulative number of death cases, cumulative quarantined cases and cumulative suspected cases on the 2019nCov epidemic in mainland China. The unilateral 95% confidence intervals (here 95% upper confidence limits) have been given, and the mean curve and estimated curve based on the real data sets are marked in each subplot.

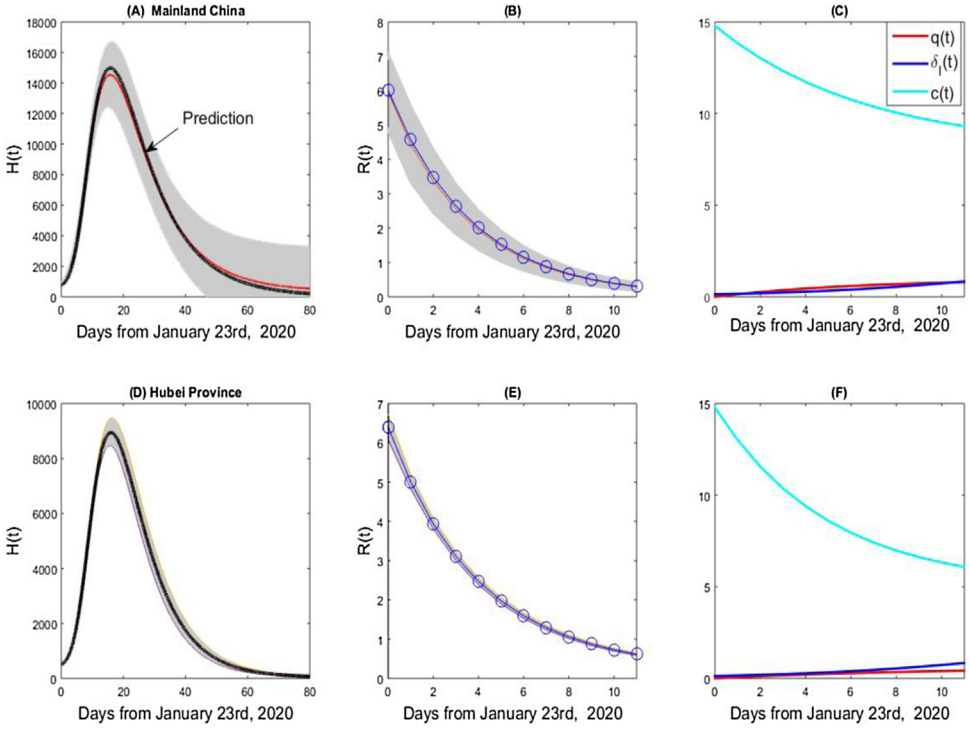

Fig. 8. The hospital notifications, effective reproduction numbers, and estimated contact rate, quarantined rate and diagnose rate curves for mainland China (A-C) and the Hubei province (D-F)