

1 **Title Page**

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4 **Negligible Risk of the COVID-19 Resurgence Caused by Work Resuming in**
5 **China (outside Hubei): a Statistical Probability Study**

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7 Kedong Zhao ^{1,#}, Cheng Long ^{2,#}, Yan Wang ^{1,*}, Tiejong Zeng ³ and Xinmiao Fu ^{1,*}

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10 ¹ Provincial University Key Laboratory of Cellular Stress Response and Metabolic Regulation, College of
11 Life Sciences, Fujian Normal University, Fuzhou City, Fujian Province 350117, China

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13 ² Department of Orthopaedic, Sichuan University West China Hospital, Chengdu City, Sichuan Province
14 610041, China

15

16 ³ Department of Mathematics, The Chinese University of Hong Kong, Shatin, NT, Hong Kong 99999, China

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18 Running title: Risk of COVID-19 resurgence in China upon working resuming

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20 # These authors contributed to this work equally.

21 * To whom correspondence should be addressed to Professor Xinmiao Fu (xmfu@fjnu.edu.cn)
22 and Dr. Yan Wang (wangyan@fjnu.edu.cn).

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24 **Keywords:** COVID-19, SARS-CoV-2, coronavirus, COVID-19 resurgence, risk assessment,
25 work resuming

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28 **Abstract:**

29 **The COVID-19 outbreak in China appears to reach the late stage since late February 2020,**
30 **and a stepwise restoration of economic operations is implemented. Risk assessment for**
31 **such economic restoration is of significance. Here we estimated the probability of**
32 **COVID-19 resurgence caused by work resuming in typical provinces/cities, and found that**
33 **such probability is very limited (<5% for all the regions except Beijing). Our work may**
34 **inform provincial governments to make risk level-based, differentiated control measures.**

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36 The outbreak of 2019 novel coronavirus diseases (COVID-19) has dramatically impacted on
37 China and also starts to hit the world ^{1, 2}. Along with a significant decrease of daily new
38 confirmed cases from over 3000 to less than 100 (19 on 9 March 2020) ³, China (outside Hubei)
39 has entered a new stage of epidemic prevention and control coupled with a stepwise restoration
40 of social and economic operations. The rapid return to full productivity is critical to China and
41 also to the world that urgently needs the material goods including personal protective equipment
42 against COVID-19 infection ⁴. Rational risk assessment for the COVID-19 resurgence upon
43 such economic restoration is of significance. Here we estimated the probability of COVID-19
44 resurgence caused by work resuming in typical provinces/cities (refer to **Table 1**) that were
45 most affected by the outbreaks and/or are most economically important in China.

46
47 Risk assessment for work resuming is based on several assumptions as follows. First, a period
48 of the past 14 days was set as a reference for calculation, given that the incubation period of
49 COVID-19 ranges from 1-14 days with the mean period of 5-6 days ⁴. Second, potential
50 infection in the coming week is proportional to the number of newly confirmed COVID-19
51 cases in the past 14 days. Third, only locally generated cases in the past 14 days are counted
52 while imported cases are omitted (Note: all passengers entering China from foreign countries
53 are required to be quarantined for 14 days, and would be subjected to COVID-19 test if
54 necessary ⁵). Forth, the secondary attack rate of COVID-19 in enterprise clusters from an
55 infected but not yet identified case to healthy persons, if not less, is comparable with that in
56 family clusters, which ranges from 3%-10% ⁴. Fifth, there is one cluster of health event in each
57 enterprise every day and the average cluster size is assumed as 10 persons.

58
59 Under the above assumptions, we collected the data of new COVID-19 cases in the past 14 days
60 (from 28 February to 12 March; refer to **Table S1**) in each area and also the population size and
61 numbers of enterprises in 2019. Estimation of the probability of COVID resurgence was
62 performed step by step, as detailed in **Table S2**. Results (**Table 1**) indicate that i) under mild
63 and strict protective conditions, probability of COVID-19 resurgence in the coming week (from
64 13 March to 19 March) ranges from 0.6%-6.8% and from 0.2%-2.4%, respectively; ii) In
65 several areas (e.g., Zhejiang, Jiangsu and Shenzhen) probability is zero due to the absence of
66 new cases in the past 14 days.

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68 In summary, the probability of COVID-19 resurgence upon working resuming is very limited or
69 even negligible. The probability may be updated weekly or daily by referring to the new cases
70 in the past 14 days. Our work may provide guidance for provincial governments to make risk
71 level-based, differentiated control measures, by which economic operations are effectively
72 restored and the potential risk of COVID-19 resurgence is strictly controlled.

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Table 1 Probability of COVID-19 resurgence after working resuming and school reopening^a

Province /cities	New cases	No. of cumulative cases	Population (10 ⁴)	No. of Enterprises (10 ⁴)	Probability (%)	
					mild ^b	strict ^b
Guangdong	2	1353	11346	535.1	3.8	1.1
Henan	0	1272	9605	154.2	0.0	0.0
Zhejiang ^b	0	1215	5737	224.5	0.0	0.0
Hunan	1	1018	6898	83.5	0.6	0.2
Jiangxi	0	935	4647	83.8	0.0	0.0
Anhui	0	990	6323	141.1	0.0	0.0
Shandong	3	759	10047	261.3	3.2	1.0
Jiangsu ^b	0	631	8050	347.9	0.0	0.0
Fujian	0	296	3973	138.8	0.0	0.0
Beijing ^c	3	429	2153	161.6	6.8	2.0
Shanghai	1	344	2423	220.8	3.7	1.1
Guangzhou	1	347	1490	127.7	3.5	1.0
Shenzhen ^b	0	419	1302	201.9	0.0	0.0

97 ^a Steps for probability calculation are presented in **Table S2**.
 98 ^b There were no newly confirmed COVID-19 cases in these regions from 25 February to 9
 99 March such that the final probability of resurgence is zero. NA: not available
 100 ^c The secondary attack rate was set as 10% and 3% under mild and strict personal protection
 101 conditions, respectively, by referring to the estimates on family clusters⁴.
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