

Supplementary materials

Table S1. Univariate analysis of COVID-19 incidence rate per 100,000 population.

| | HH(4 provinces) | HL | LL(6 provinces) | LH(2 provinces) |
|-------------------------|---|--|--|---|
| 1 st Wave | Krabi Narathiwat Pattani Samut Prakan | | Roi Et Sing Buri Suphan Buri Kalasin Lop Buri Nakhon Sawan | Nakhon Pathom Phangnga |
| 2 nd Wave | HH(4 provinces) Chon Buri Phetchaburi Samut Prakan Samut Songkhram | HL | LL(4 provinces) Nong Khai Surin UbonRatchathani Uttradit | LH(4 provinces) Nakhon Pathom Phra Nakhon Si Ayutthaya Rachaburi Trat |
| 3 rd Wave | HH(7 provinces) Bangkok Metropolis Chon Buri Nonthaburi Pathum Thani Phra Nakhon Si Ayutthaya Samut Prakan Samut Sakhon | HL(1 province) Nakhon Phanom | LL(10 provinces) Amnat Charoen Kalasin MahaSarakham Nong Kai Roi Et Si Sa Ket Surin UbonRatchathani Udon Thani Yasothon | LH(2 provinces) Nakhon Pathom Ratchaburi |
| 4 th Wave | HH(8 provinces) Chachoengsao Chon Buri Narathiwat Pattani Phetchaburi Ratchaburi Samut Songkhram Yala | HL(1 province) Nakhon Phanom | LL(16 provinces) Chiang Mai Chiang Rai Kalasin KhonKaen Lampang Lamphun Mae Hong Son MahaSarakham Nan Nong Bua Lam Phu Phayao Phrae Roi Et Udon Thani Uttraradit Yasothon | LH(1 province) Nakhon Pathom |

| | HH(7 provinces) | HL(1 province) | LL(15 provinces) | LH(1 province) |
|-------------------------|--|-----------------------|--|-----------------------|
| 5 th Wave | Bangkok Metropolis Chachoengsao Chon Buri Krabi Phangnga Phetchaburi Ratchaburi | Nakhon Phanom | Chiang Mai Chiang Rai Kalasin Lampang Lamphun Mae Hong Son Nakhon Sawan Nan Nongkhai Phayao Phitsanulok Phrae Tak UbonRatchathani Udon Thani | Nakhon Pathom |

Table S2. Bivariate analysis of COVID-19 incidence rate and population density per km² in phases of different waves.

| | | | | |
|----------------------------|--|-----------------------|---|-----------------------------------|
| | HH(3 provinces) | HL(1 province) | LL(5 provinces) | LH(3 provinces) |
| 1st Wave | Nakhon Pathom Pattani Samut Prakan | Sing Buri | Kalasin Lop Buri Nakhon Sawan Roi Et Suphan Buri | Krabi Narathiwat Phangnga |
| | HH(5 provinces) | HL | LL(4 provinces) | LH(3 provinces) |
| 2nd Wave | Chon Buri Nakhon Pathom Phra Nakhon Si Ayutthaya Samut Prakan Samut Songkhram | | Nong Khai Surin Ubon Ratchathani Uttaradit | Phetchaburi Ratchaburi Trat |
| | HH(8 provinces) | HL | LL(11 provinces) | LH(1 province) |
| 3rd Wave | Bangkok Metropolis Chon Buri Nakhon Pathom Nonthaburi Pathum Thani Phra Nakhon Si Ayutthaya Samut Prakan Samut Sakhon | | Amnat Charoen Kalasin Maha Sarakham Nakhon Phanon Nong Khai Roi Et Si Sa Ket Surin Ubon Ratchathani Udon Thani Yasothon | Ratchaburi |
| | HH(4 provinces) | HL | LL(17 provinces) | LH(5 provinces) |

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|----------------------------|---|-----------|--|---|
| 4th Wave | Chon Buri Nakhon Pathom Pattani Samut Songkhram | | Chiang Mai Chiang Rai Kalasin Khon Kaen Lampang Lamphun Mae Hong Son Maha Sarakham Nakhon Phanom Nan Nong Bua Lamphu Phayao Phrae Roi Et Udon Thani Uttaradit Yasothon | Chachoengsao Narathiwat Phetchaburi Ratchaburi Yala |
| | HH(3 provinces) | HL | LL(16 provinces) | LH(5 provinces) |
| 5th Wave | Bangkok Metropolis Chon Buri Nakhon Pathom | | Chiang Mai Chiang Rai Kalasin Lampang Lamphun Mae Hong Son Nakhon Phanom Nakhon Sawan Nan Nong Khai Phayao Phitsanulok Phrae Tak Ubon Ratchathani Udon Thani | Chachoengsao Krabi Phangnga Phetchaburi Ratchaburi |

Table S3. Bivariate analysis of COVID-19 incidence rate with household density per km² in phases of different waves.

| | HH(2 provinces) | HL | LL(6 provinces) | LH(4 provinces) |
|----------------------------|--|-----------|---|--|
| 1st Wave | Nakhon Pathom Samut Prakan | | Kalasin Lop Buri Nakhon Sawan Roi Et Sing Buri Suphan Buri | Krabi Narathiwat Pattani Phangnga |
| | HH(5 provinces) | HL | LL(4 provinces) | LH(3 provinces) |
| 2nd Wave | Chon Buri Nakhon Pathom Phra Nakhon Si Ayutthaya Samut Prakan Samut Songkhram | | Nong Khai Surin Ubon Ratchathani Uttaradit | Phetchaburi Ratchaburi Trat |
| | HH(8 provinces) | HL | LL(11 provinces) | LH(1 province) |
| 3rd Wave | Bangkok Metropolis Chon Buri Nakhon Pathom Nonthaburi Pathum Thani Phra Nakhon Si Ayutthaya Samut Prakan Samut Sakhon | | Amnat Charoen Kalasin Maha Sarakham Nakhon Phanon Nong Khai Roi Et Si Sa Ket Surin Ubon Ratchathani Udon Thani Yasothon | Ratchaburi |
| | HH(3 provinces) | HL | LL(17 provinces) | LH(6 province) |

| | | | | |
|--------------------------------|---|-----------|--|--|
| 4th Wave | Chon Buri Nakhon Pathom Samut Songkhram | | Chiang Mai Chiang Rai Kalasin Khon Kaen Lampang Lamphun Mae Hong Son Maha Sarakham Nakhon Phanom Nan Nong Bua Lamphu Phayao Phrae Roi Et Udon Thani Uttaradit Yasothon | Chachoengsao Narathiwat Phetchaburi Pattani Ratchaburi Yala |
| | HH(3 provinces) | HL | LL(16 provinces) | LH(5 provinces) |
| 5th Wave | Bangkok Metropolis Chon Buri Nakhon Pathom | | Chiang Mai Chiang Rai Kalasin Lampang Lamphun Mae Hong Son Nakhon Phanom Nakhon Sawan Nan Nong Khai Phayao Phitsanulok Phrae Tak Ubon Ratchathani Udon Thani | Chachoengsao Krabi Phangnga Phetchaburi Ratchaburi |

Table S4. Bivariate analysis of COVID-19 incidence rate with percentage of urban population in phases of different waves.

| | | | | |
|----------------------------|--|---|--|---|
| | HH(2 provinces) | HL(1 province) | LL(5 provinces) | LH(4 provinces) |
| 1st Wave | Nakhon Pathom Samut Prakan | Kalasin | Lop Buri Nakhon Sawan Roi Et Sing Buri Suphan Buri | Krabi Narathiwat Pattani Phangnga |
| | HH(6 provinces) | HL(1 province) | LL(3 provinces) | LH(2 provinces) |
| 2nd Wave | Chon Buri Nakhon Pathom Phetchaburi Phra Nakhon Si Ayutthaya Ratchaburi Samut Prakan | Uttaradit | Nong Khai Surin Ubon Ratchathani | Samut Songkhram Trat |
| | HH(9 provinces) | HL(2 provinces) | LL(9 provinces) | LH |
| 3rd Wave | Bangkok Metropolis Chon Buri Nakhon Pathom Nonthaburi Pathum Thani Phra Nakhon Si Ayutthaya Ratchaburi Samut Prakan Samut Sakhon | Kalasin Udon Thani | Amnat Charoen Maha Sarakham Nakhon Phanom Nong Khai Roi Et Si Sa Ket Surin Ubon Ratchathani Yasothon | |
| | HH(4 provinces) | HL(9 provinces) | LL(8 provinces) | LH(5 province) |
| 4th Wave | Chon Buri Nakhon Pathom Phetchaburi Racharaburi | Chiang Mai Chiang Rai Kalasin Khon Kaen Lampang Lamphun Phayao Udon Thani Uttaradit | Mae Hong Son Maha Sarakham Nakhon Phanom Nan Nong Bua Lamphu Phrae Roi Et Yasothon | Chachoengsao Narathiwat Pattani Samut Songkhram Yala |
| | HH(5 provinces) | HL(7 provinces) | LL(9 provinces) | LH(3 provinces) |

| | | | | |
|----------------------------|--|---|---|-----------------------------------|
| 5th Wave | Bangkok Metropolis Chon Buri Nakhon Pathom Phetchaburi Racharburi | Chiang Mai Chiang Rai Kalasin Lampang Lamphun Phayao Udon Thani | Mae Hong Son Nakhon Phanom Nakhon Sawan Nan Nong Khai Phitsanulok Phrae Tak UbonRatchathani | Chachoengsao Krabi Phangnga |
|----------------------------|--|---|---|-----------------------------------|

Table S5. Bivariate analysis of COVID-19 incidence rate with hospital density per km² in phases of different waves.

| | HH(1 province) | HL(2 provinces) | LL(4 provinces) | LH(5 provinces) |
|----------------------------|--|------------------------|---|--|
| 1st Wave | Samut Prakan | Lop Buri Sing Buri | Kalasin Nakhon Sawan Roi Et Suphan Buri | Krabi Nakhon Pathom Narathiwat Pattani Phangnga |
| | HH(4 provinces) | HL | LL(4 provinces) | LH(4 provinces) |
| 2nd Wave | Chon Buri Phra Nakhon Si Ayutthaya Samut Prakan Trat | | Nong Khai Surin Ubon Ratchathani Uttaradit | Nakhon Pathom Phetchaburi Ratchaburi Samut Songkram |
| | HH(5 provinces) | HL | LL(9 provinces) | LH(4 province) |
| 3rd Wave | Chon Buri Nonthaburi Pathum Thani Phra Nakhon Si Ayutthaya Samut Prakan | | Amnat Charoen Kalasin Maha Sarakham Nakhon Phanom Nong Khai Roi Et Si Sa Ket Surin Ubon Ratchathani Udon Thani Yasothon | Bangkok Metropolis Nakhon Pathom Ratchaburi Samut Sakhon |
| | HH(2 provinces) | HL | LL(17 provinces) | LH(6 provinces) |
| 4th Wave | Chachoengsao Chon Buri | | Chiang Mai Chiang Rai Kalasin Khon Kaen Lampang Lamphun Mae Hong Son Maha Sarakham Nakhon Phanom Nan Nong Bua Lamphu Phayao Phrae Roi Et Udon Thani Uttaradit Yasothon | Nakhon Pathom Narathiwat Pattani Phetchaburi Ratchaburi Samut Songkhram Yala |

| | HH(2 provinces) | HL | LL(16 provinces) | LH(6 provinces) |
|----------------------------|---------------------------|-----------|---|---|
| 5th Wave | Chachoengsao Chon Buri | | Chiang Mai Chiang Rai Kalasin Lampang Lamphun Mae Hong Son Nakhon Phanom Nakhon Sawan Nan Nong Khai Phayao Phitsanulok Phrae Tak Ubon Ratchathani Udon Thani | Bangkok Metropolis Krabi Nakhon Pathom Phangnga Phetchaburi Ratchaburi |

Table S6. Bivariate analysis of COVID-19 incidence rate with hospital and medical establishments with beds per 10,000 population in phases of different waves.

| | HH(2 provinces) | HL(3 provinces) | LL(3 provinces) | LH(4 provinces) |
|----------------------------|---|--------------------------------------|---|--|
| 1st Wave | Nakhon Pathom Samut Prakan | Lop Buri Sing Buri Suphan Buri | Kalasin Nakhon Sawan Roi Et | Krabi Narathiwat Pattani Phangnga |
| | HH(6 provinces) | HL(2 provinces) | LL(2 provinces) | LH(2 provinces) |
| 2nd Wave | Chon Buri Nakhon Pathom Phetchaburi Ratchaburi Samut Prakan Trat | Nong Khai Ubon Ratchathani | Surin Uttaradit | Phra Nakhon Si Ayutthaya Samut Songkram |
| | HH(8 provinces) | HL(2 provinces) | LL(9 provinces) | LH(1 province) |
| 3rd Wave | Bangkok Metropolis Chon Buri Nakhon Pathom Nonthaburi Pathum Thani Ratchaburi Samut Prakan Samut Sakhon | Nong Khai Ubon Ratchathani | Amnat Charoen Kalasin Maha Sarakham Nakhon Phanon Roi Et Si Sa Ket Surin Udon Thani Yasothon | Phra Nakhon Si Ayutthaya |
| | HH(4 provinces) | HL(3 provinces) | LL(14 provinces) | LH(5 provinces) |
| 4th Wave | Chon Buri Nakhon Pathom Phetchaburi Ratchaburi | Chaing Mai Khon Kaen Nan | Chiang Rai Kalasin Lampang Lamphun Mae Hong Son Maha Sarakham Nakhon Phanom Nong Bua Lamphu Phayao Phrae Roi Et Udon Thani Uttaradit Yasothon | Chachoengsao Narathiwat Pattani Samut Songkhram Yala |
| | HH(5 provinces) | HL(5 provinces) | LL(11 provinces) | LH(3 provinces) |

| | | | | |
|----------------------------|--|--|--|-----------------------------------|
| 5th Wave | Bangkok Metropolis Chon Buri Nakhon Pathom Phetchaburi Ratchaburi | Chiang Mai Nan Nong Khai Phitsanulok Ubon Ratchathani | Chiang Rai Kalasin Lampang Lamphun Mae Hong Son Nakhon Phanom Nakhon Sawan Phayao Phrae Tak Udon Thani | Chachoengsao Krabi Phangnga |
|----------------------------|--|--|--|-----------------------------------|

Table S7. Bivariate analysis of COVID-19 incidence rate with physician per 10,000 population in phases of different waves.

| | HH(2 provinces) | HL(1 province) | LL(5 provinces) | LH(4 provinces) |
|----------------------------|---|---|---|--|
| 1st Wave | Nakhon Pathom Samut Prakan | Nakhon Sawan | Kalasin Lop Buri Roi Et Sing Buri Suphan Buri | Krabi Narathiwat Pattani Phangnga |
| | HH(6 provinces) | HL(1 province) | LL(3 provinces) | LH(2 provinces) |
| 2nd Wave | Chon Buri Nakhon Pathom Phetchaburi Ratchaburi Samut Prakan Trat | Uttaradit | Nong Khai Surin Ubon Ratchathani | Phra Nakhon Si Ayutthaya Samut Songkhram |
| | HH(8 provinces) | HL | LL(11 provinces) | LH(1 province) |
| 3rd Wave | Bangkok Metropolis Chon Buri Nakhon Pathom Nonthaburi Pathum Thani Ratchaburi Samut Prakan Samut Sakhon | | Amnat Charoen Kalasin Maha Sarakham Nakhon Phanom Nong Khai Roi Et Si Sa Ket Surin Ubon Ratchatani Udon Thani Yasothon | Phra Nakhon Si Ayutthaya |
| | HH(5 provinces) | HL(5 provinces) | LL(12 provinces) | LH(4 provinces) |
| 4th Wave | Chachoengsao Chon Buri Nakhon Pathom Phetchaburi Ratchaburi | Chaing Mai Lampang Lamphum Phayao Uttaradit | Chiang Rai Kalasin Khon Kaen Mae Hong Son Maha Sarakham Nakhon Phanom Nan Nong Bua Lamphu Phrae Roi Et Udon Thani Yasothon | Narathiwat Pattani Samut Songkhram Yala |
| | HH(6 provinces) | HL(6 provinces) | LL(10 provinces) | LH(2 provinces) |

| | | | | |
|----------------------------|--|---|--|-------------------|
| 5th Wave | Bangkok Metropolis Chachoengsao Chon Buri Nakhon Pathom Phetchaburi Ratchaburi | Chaing Mai Lampang Lamphun Nakhon Sawan Phayao Phitsanulok | Chiang Rai Kalasin Mae Hong Son Nakhon Phanom Nan Nong Khai Phrae Tak Ubon Ratchathani Udon Thani | Krabi Phangnga |
|----------------------------|--|---|--|-------------------|