# Supplementary material

# Feasibility study on the use of $NO_2$ and $PM_{2.5}$ sensors for exposure assessment and indoor source apportionment at fixed locations

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**Table S1. Dates of AQSS installation, checks, and collection for each patient.**

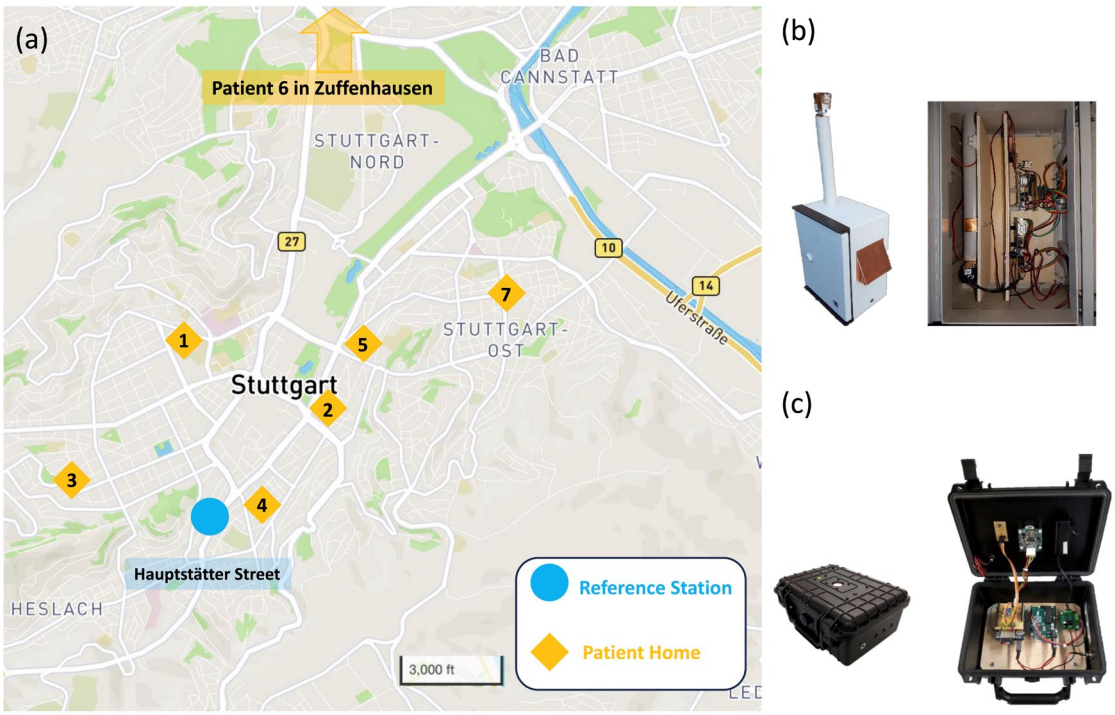
| | | Patient ID | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **Indoor** | Start | Jan. 8, 2020 | Jan. 17, 2020 | Mar. 9, 2020 | Mar. 9, 2020 | Dec. 20, 2019 | Apr. 3, 2020 | Apr. 29, 2020 |
| | Mid-way Check | - | - | Mar. 24, 2020 | - | - | Apr. 11, 2020 | May 12, 2020 |
| | End | Feb. 6, 2020 | Feb. 14, 2020 | Apr. 7, 2020 | Mar. 27, 2020 | Jan. 15, 2020 | Apr. 30, 2020 | May 28, 2020 |
| | Total days | 30 | 29 | 30 | 19 | 27[a)] | 28 | 30 |
| **Outdoor** | Start | Jan. 13, 2020 | Jan. 24, 2020 | Mar. 9, 2020 | Mar. 13, 2020 | - | Apr. 3, 2020 | Apr. 29, 2020 |
| | Mid-way Check | - | - | Mar. 24, 2020 | - | - | Apr. 11, 2020 | May 12, 2020 |
| | End | Feb. 6, 2020 | Feb. 14, 2020 | Apr. 7, 2020 | Mar. 27, 2020 | - | Apr. 30, 2020 | May 28, 2020 |
| | Total days | 25 | 22[b)] | 30 | 15[c)] | - | 28 | 30 |

[a)] Patient disconnected the AQSS from the power so that only 9 days were recorded.
[b)] All data was lost due to a storm.
[c)] Two AQSS were installed, one in the garden and the other at the street side.

**Table S2. Participant demographics.**

| Patient ID | Age Group | Sex | Diagnosis |
|---|---|---|---|
| 1 | 71 - 80 | M | COPD II/B |
| 2 | 71 - 80 | F | Asthma |
| 3 | 61 - 70 | M | COPD II/B |
| 4 | 41 - 50 | F | Asthma |
| 5 | 41 - 50 | F | Asthma |
| 6 | 21 - 30 | M | Asthma |
| 7 | 51 - 60 | F | Asthma |

M: Male, F: Female.




Map source: AllTrails

**Figure S1. (a) Map of Stuttgart showing locations of the outdoor air quality monitoring station (blue circle) and participants' homes where sensors were deployed (yellow diamonds), (b) outdoor AQSS and (c) indoor AQSS.**

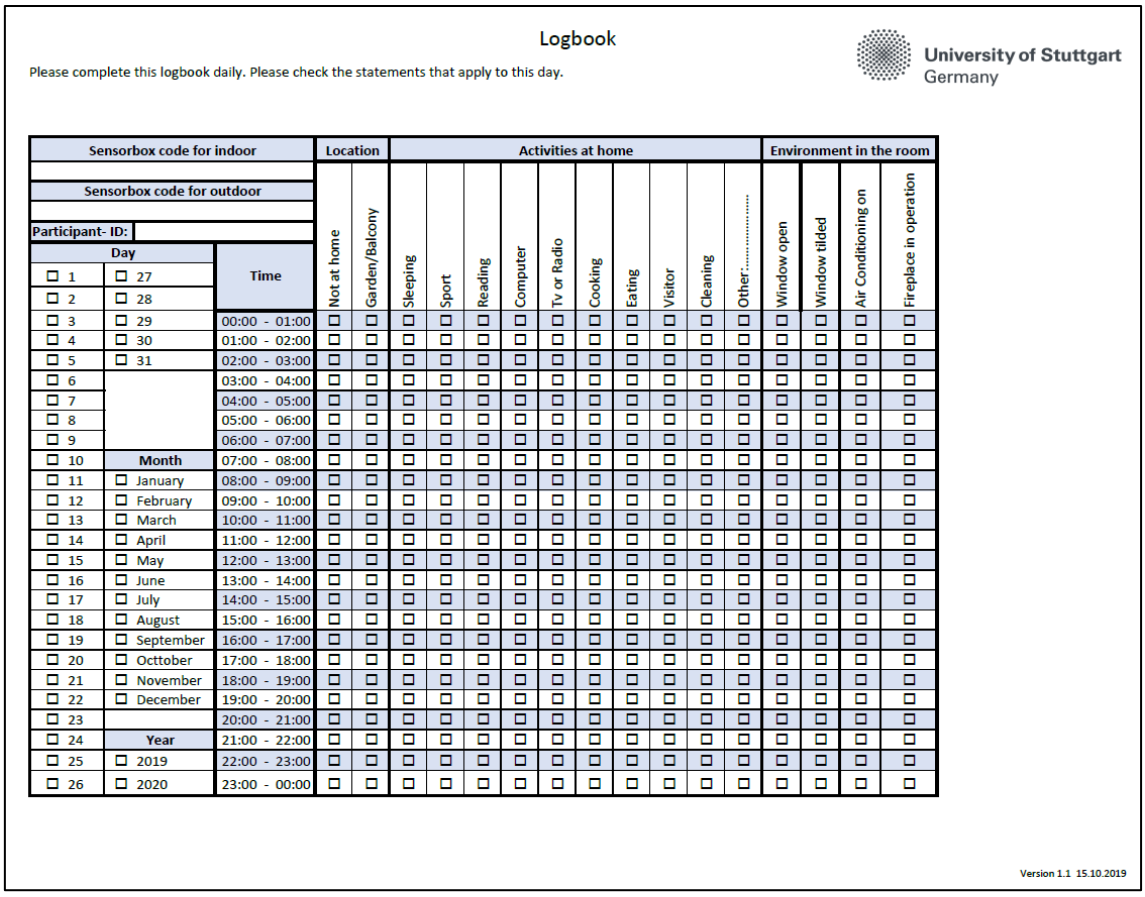
**Table S3. Data collected for each participant.**

| Pat. ID | Type of Data | | | | | |
|---|---|---|---|---|---|---|
| | Indoor AQSS | Outdoor AQSS | Logbook | Health Questionnaire | Environmental Survey | Feedback |
| 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 2 | ✓ | X [a] | ✓ | X [b] | ✓ | ✓ |
| 3 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 4 | ✓ | ✓ [c] | ✓ | ✓ | ✓ | ✓ |
| 5 | ✓ | X [d] | X [b] | X [b] | ✓ | ✓ |
| 6 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 7 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

[a] Outdoor sensor data lost due to storm.
[b] Insufficient data recorded by the participant.
[c] Two outdoor sensor systems on opposite sides of the house (street and garden).
[d] No outdoor sensor was installed.

**Table S4. Selected results of the environmental questionnaire filled out by patients.**

| | | Patient ID | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| Surrounding Area | Landscape Surrounding House | in a valley | in a valley | on a hillside | on a hillside | in a valley | in a depression | in a depression |
| | Type of Street (side/main) | side | side | main | side | side | side | side |
| | Distance to Busy Road (m) | 870 | 80 | 16 | 433 | 60 | 100 - 500 | > 500 |
| | Construction Near | Yes | Yes | No | No | Yes | No | No |
| Apartment Layout | Floor Level | 2 | 3 | 1 | Basement | Ground floor and 1 | Ground floor | 1 |
| | Garden or Balcony | No | Yes | Yes Balcony | Yes Balcony | Yes Garden | Yes Garden | Yes Garden and Balcony |
| | Apartment Area (m²) | 50 | 53 | 90 | 60 | 87 | 75 | 89 |
| | Area of Room where Sensor is Placed (m²) | 28 | 36 | 36 | 55 | 15 | 16 | 15-20 |
| | Open Kitchen | No | Yes | No | No | No | No | No |
| Utilities | Type of Stove | Electric | Electric | Gas | Electric | Electric | Electric | Electric |
| | Air Conditioning | No | No | No | No | Yes | No | No |
| | Type of Heating | District Heating | Oil | Gas - Single Boilers | District Heating | Gas - Central Heating | Central Heating | Central Heating |
| | Number of Additional Residents | 0 | 0 | 1 | 0 | 3 | 1 | 1 |



Logbook

Please complete this logbook daily. Please check the statements that apply to this day.

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Germany

| Sensorbox code for indoor | | Location | | Activities at home | | | | | | | | | | Environment in the room | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sensorbox code for outdoor | | | | | | | | | | | | | | | | | |
| Participant- ID: | | | | | | | | | | | | | | | | | |
| Day | | Time | Not at home | Garden/Balcony | Sleeping | Sport | Reading | Computer | Tv or Radio | Cooking | Eating | Visitor | Cleaning | Other:..... | Window open | Window tilded | Air Conditioning on | Fireplace in operation |
| ☐ 1 | ☐ 27 | 00:00 - 01:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 2 | ☐ 28 | 01:00 - 02:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 3 | ☐ 29 | 02:00 - 03:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 4 | ☐ 30 | 03:00 - 04:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 5 | ☐ 31 | 04:00 - 05:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 6 | | 05:00 - 06:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 7 | | 06:00 - 07:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 8 | | 07:00 - 08:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 9 | | 08:00 - 09:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 10 | Month | 09:00 - 10:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 11 | ☐ January | 10:00 - 11:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 12 | ☐ February | 11:00 - 12:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 13 | ☐ March | 12:00 - 13:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 14 | ☐ April | 13:00 - 14:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 15 | ☐ May | 14:00 - 15:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 16 | ☐ June | 15:00 - 16:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 17 | ☐ July | 16:00 - 17:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 18 | ☐ August | 17:00 - 18:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 19 | ☐ September | 18:00 - 19:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 20 | ☐ Octtober | 19:00 - 20:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 21 | ☐ November | 20:00 - 21:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 22 | ☐ December | 21:00 - 22:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 23 | | 22:00 - 23:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 24 | Year | 23:00 - 00:00 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ☐ 25 | ☐ 2019 | | | | | | | | | | | | | | | | | |
| ☐ 26 | ☐ 2020 | | | | | | | | | | | | | | | | | |

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**Figure S2. Logbook.**

**Table S5. Data completeness after cleaning steps, presented as a percentage.**

| | $PM_{2.5}$ | | $NO_2$ | | Symptom severity | |
|---|---|---|---|---|---|---|
| **Patient ID** | **Indoor** | **Outdoor** | **Indoor** | **Outdoor** | **Health Score** | **PEF** |
| 1 | 100 | 80 | 97 | 94 | 100 | 0 |
| 2 | 100 | - | 99 | - | 0 | 0 |
| 3 | 99 | 99 | 86 | 91 | 99 | 99 |
| 4 | 100 | 100 / 100[a)] | 78 | 94 / 83 [a)] | 94 | 94 |
| 5 | 92 | - | 82 | - | 0 | 0 |
| 6 | 100 | 100 | 94 | 92 | 91 | 91 |
| 7 | 99 | 100 | 93 | 76 | 99 | 92 |

[a)] For patient 4 two outdoor AQSS are reported: Garden / Street.

**Table S6. Correction parameters for each $PM_{2.5}$ sensor.**

| Location | Patient ID | AQSS ID | Correction Factor, *m* | Offset, *b* (µg $m^{-3}$) |
|---|---|---|---|---|
| INDOOR | 1 | B02 | 1.15 | -0.14 |
| | 2 | B04 | 0.89 | 0.42 |
| | 3 | B04 | 2.34 | -1.38 |
| | 5 | B01 | 0.97 | 0.20 |
| | 6 | B02 | 1.01 | 3.24 |
| | 7 | B03 | 0.93 | 2.33 |
| | 4 | B01 | 1.06 | 1.74 |
| OUTDOOR | 1 | B03 | 0.83 | 4.66 |
| | 2[a)] | B05 | 0.37 | 8.96 |
| | 3 | B03 | 0.93 | 2.33 |
| | 5[b)] | - | - | - |
| | 6 | B08 | 0.86 | 1.40 |
| | 7 | B06 | 0.79 | 2.92 |
| | 4 (Garden) | B05 | 0.96 | 1.04 |
| | 4 (Street) | B06 | 0.55 | 1.15 |

[a)] An outdoor AQSS was deployed for patient 2, but data was lost due to a storm.

[b)] No outdoor sensor was installed.

## Patient Diary

Dear patient,

Please complete this short questionnaire every evening. Check the statements that apply to this day.

**DATE**.....**Patient-ID**.....

| Parameter | Please mark with a cross where applicable | Points |
|---|---|---|
| Did you feel a tightness in your chest today? | 0 none not at all<br>1 mild only once and for a short time<br>2 moderate multiple short-term<br>3 strong several times longer lasting<br>4 very strong lasting for hours | |
| How difficult was it for you to breathe today?? | 0 none no breathing difficulties at all<br>1 mild shortness of breath only with exceptional exertion (e.g. sport)<br>2 moderate short of breath with little exertion (short flight of stairs)<br>3 Strong short of breath even with light physical activity (walking on level ground)<br>4 very strong constantly short of breath, even at rest | |
| How was your cough today? | 0 none not coughed<br>1 hardly coughed once briefly<br>2 occasionally coughed briefly several times<br>3 frequently coughing almost every hour<br>4 constantly coughed all the time or felt the urge to cough | |
| How annoying was your sputum today? | 0 no mucus formation at all<br>1 hardly any mucus, coughed up once<br>2 Slightly rarely coughed up, mucus perceived as annoying<br>3 very frequent, unpleasant mucus production<br>4 very strong bothered me the whole day | |
| Have you noticed a whistling breathing noise? | 0 none not noticed any breathing noises<br>1 hardly once and for a short time<br>2 occasionally several times a day<br>3 frequently several times and over a longer period<br>4 constantly for most of the day | |
| Has your lung disease prevented you from doing as much as usual at work, at university or at home? | 0 none no impairment at all<br>1 hardly only particularly strenuous activities (e.g. sport)<br>2 occasionally some activities required a little more time<br>3 frequently most activities were carried out more slowly, strenuous activities were postponed<br>4 constantly very limited, only the bare essentials done | |
| How often have you used your on-demand spray today? | 0 none not needed<br>1 hardly needed once a day<br>2 rarely needed 2 times a day<br>3 often needed 3 times a day<br>4 very often needed more than 3 times a day | |
| Please enter your evening peak flow value (before the evening dose of your spray or powder) | ---------- | **Total** |

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**Figure S3. Health questionnaire.**

**Table S7. Inhalation rates for each intensity level, categorised by associated activities, age and gender.**

| Intensity Level | Activities | Age Range (Years) | Inhalation Rate (L $min^{-1}$) | |
|---|---|---|---|---|
| | | | Male | Female |
| RESTING | Sleeping | 20-30 | 4.7 | 3.9 |
| | | 40-50 | 5.7 | 4.4 |
| | | 50-60 | 5.8 | 4.6 |
| | | 60-70 | 6.0 | 4.5 |
| | | 70-80 | 6.1 | 4.5 |
| SEDENTARY | Reading<br>Computer<br>Television<br>Radio<br>Eating<br>Smoking | 20-30 | 5.1 | 4.3 |
| | | 40-50 | 6.1 | 4.8 |
| | | 50-60 | 6.3 | 5.0 |
| | | 60-70 | 6.5 | 4.9 |
| | | 70-80 | 6.7 | 5.0 |
| LIGHT | Cooking<br>Cleaning | 20-30 | 13.0 | 10.6 |
| | | 40-50 | 14.4 | 11.8 |
| | | 50-60 | 14.6 | 12.0 |
| | | 60-70 | 14.1 | 10.8 |
| | | 70-80 | 13.9 | 10.8 |
| MODERATE | Sport /Exercising | 20-30 | 29.2 | 22.9 |
| | | 40-50 | 31.6 | 24.5 |
| | | 50-60 | 32.7 | 25.2 |
| | | 60-70 | 29.8 | 21.4 |
| | | 70-80 | 29.3 | 21.1 |
| GENERIC | Unknown | 20-30 | 12.1 | 9.3 |
| | | 40-50 | 11.3 | 8.5 |
| | | 50-60 | 11.3 | 8.5 |
| | | 60-70 | 9.9 | 7.8 |
| | | 70-80 | 9.0 | 6.8 |

Note: Activity adjusted inhalation rates are provided in the Exposure Factors Handbook (2011) [41], Table 6-17 (for males), and 6-19 (for females). Generic inhalation rates for males and females are provided in Table 6-5.

**Table S8. Median $NO_2$ and $PM_{2.5}$ concentrations and uncertainties associated with each AQSS.**

| Pollutant | Patient ID | AQSS ID | Location | Median concentration (µg $m^{-3}$) | Relative expanded uncertainty at the median (µg $m^{-3}$) |
|---|---|---|---|---|---|
| $NO_2$ | 1 | B02 | Indoor | 28 | 14 |
| | 2 | B04 | Indoor | 9 | 1 |
| | 3 | B04 | Indoor | 13 | 1 |
| | 4 | B01 | Indoor | 5 | 1 |
| | 5 | B01 | Indoor | 13 | 1 |
| | 6 | B02 | Indoor | 6 | 4 |
| | 7 | B03 | Indoor | 19 | 6 |
| | 1 | B03 | Outdoor | 23 | 4 |
| | 2 | B05 | Outdoor | - | - |
| | 3 | B03 | Outdoor | 21 | 6 |
| | 4 | B05 | Garden | 35 | 13 |
| | 4 | B06 | Street | 29 | 7 |
| | 5 | - | - | - | - |
| | 6 | B08 | Outdoor | 20 | 5 |
| | 7 | B06 | Outdoor | 14 | 6 |
| $PM_{2.5}$ | 1 | B02 | Indoor | 3 | 12 |
| | 2 | B04 | Indoor | 2 | 8 |
| | 3 | B04 | Indoor | 5 | 1 |
| | 4 | B01 | Indoor | 4 | 11 |
| | 5 | B01 | Indoor | 2 | 12 |
| | 6 | B02 | Indoor | 6 | 11 |
| | 7 | B03 | Indoor | 57 | 7 |
| | 1 | B03 | Outdoor | 11 | 7 |
| | 2 | B05 | Outdoor | - | - |
| | 3 | B03 | Outdoor | 11 | 7 |
| | 4 | B05 | Garden | 6 | 7 |
| | 4 | B06 | Street | 7 | 2 |
| | 5 | - | - | - | - |
| | 6 | B08 | Outdoor | 5 | 21 |
| | 7 | B06 | Outdoor | 7 | 2 |

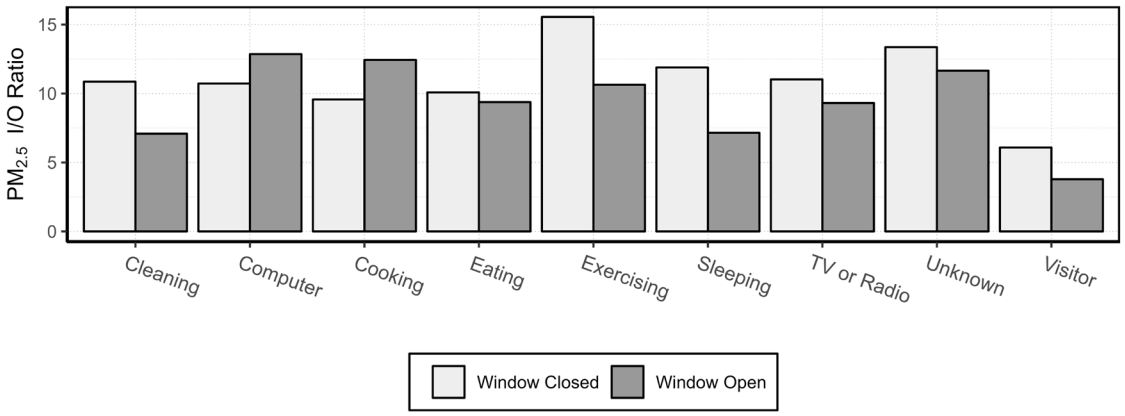



**Figure S4. I/O ratios for $PM_{2.5}$ associated with individual activities, grouped by window status for patient 7.**

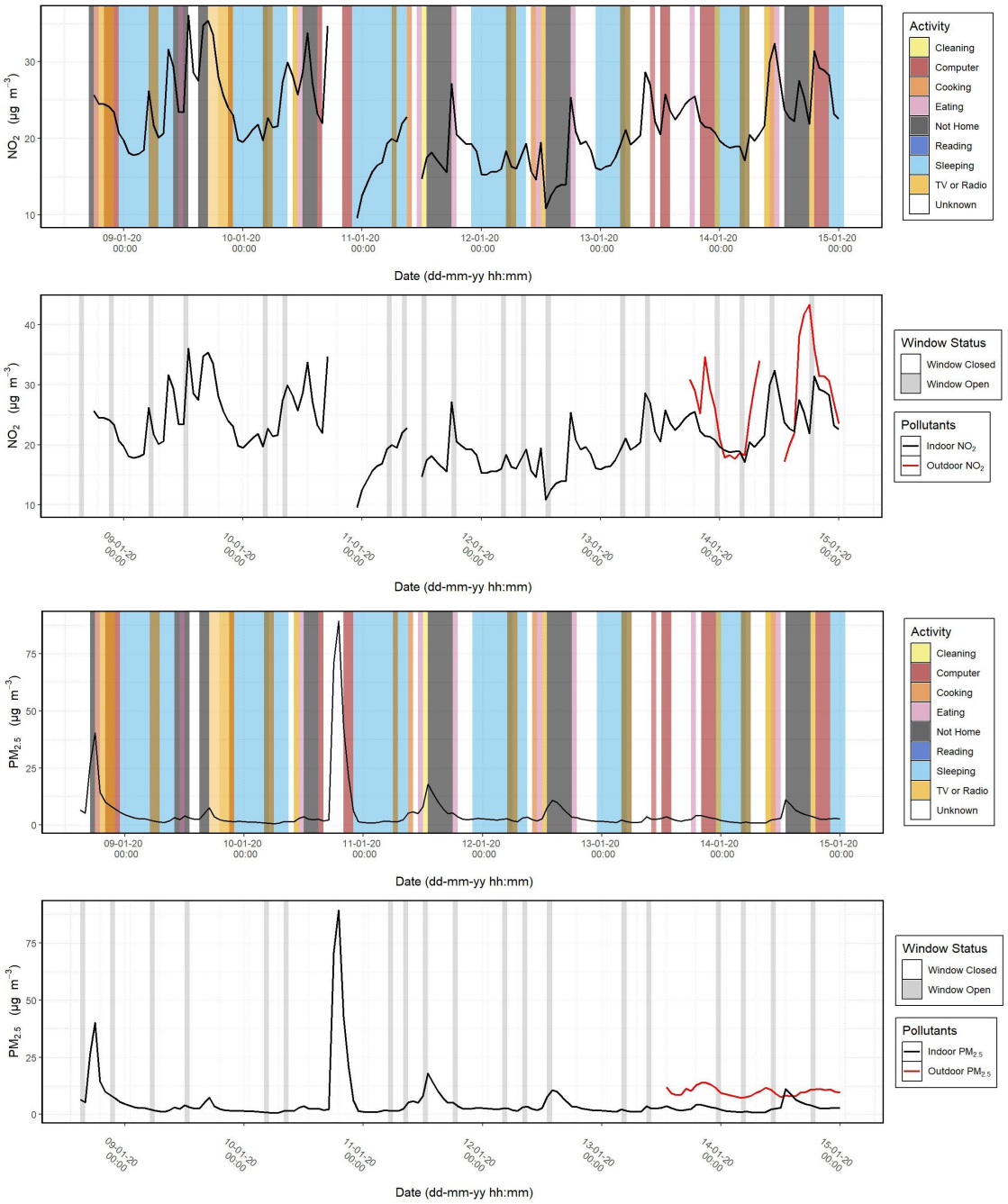



**Figure S5. Time series of pollutant concentration combined with logged activities and window status, for patient 1, week 1.**

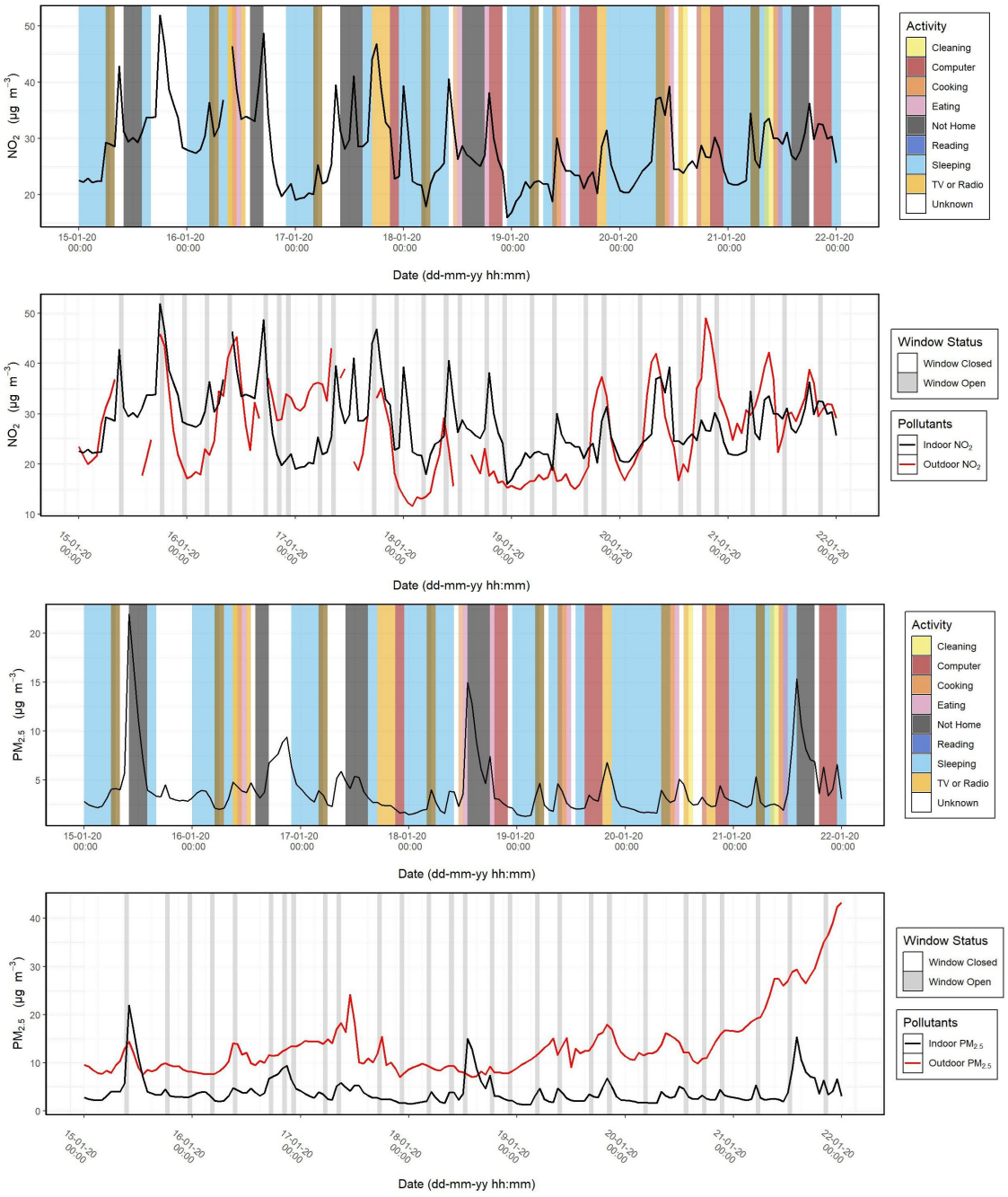



**Figure S6. Time series of pollutant concentration combined with logged activities and window status, for patient 1, week 2.**

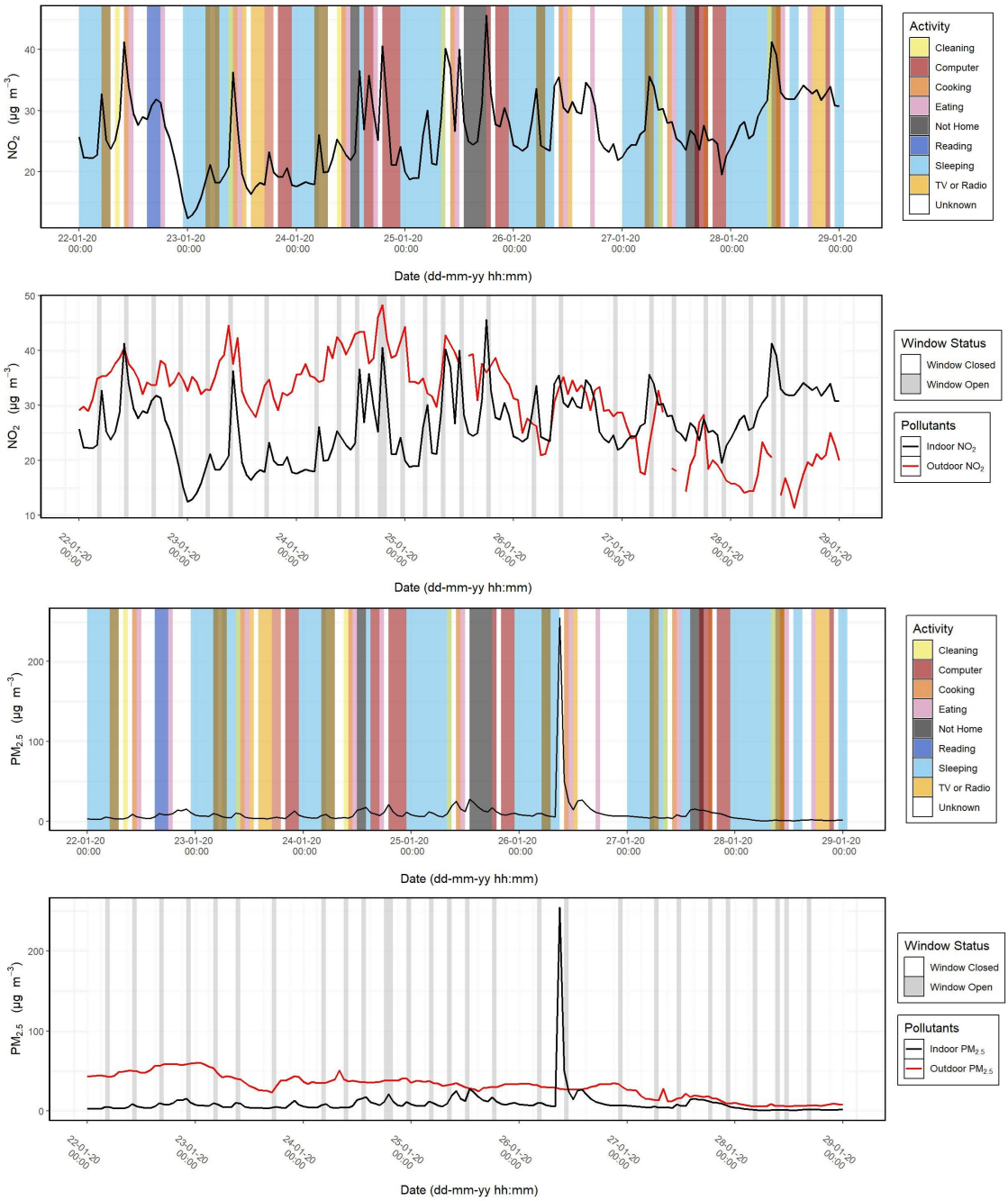



**Figure S7. Time series of pollutant concentration combined with logged activities and window status, for patient 1, week 3.**

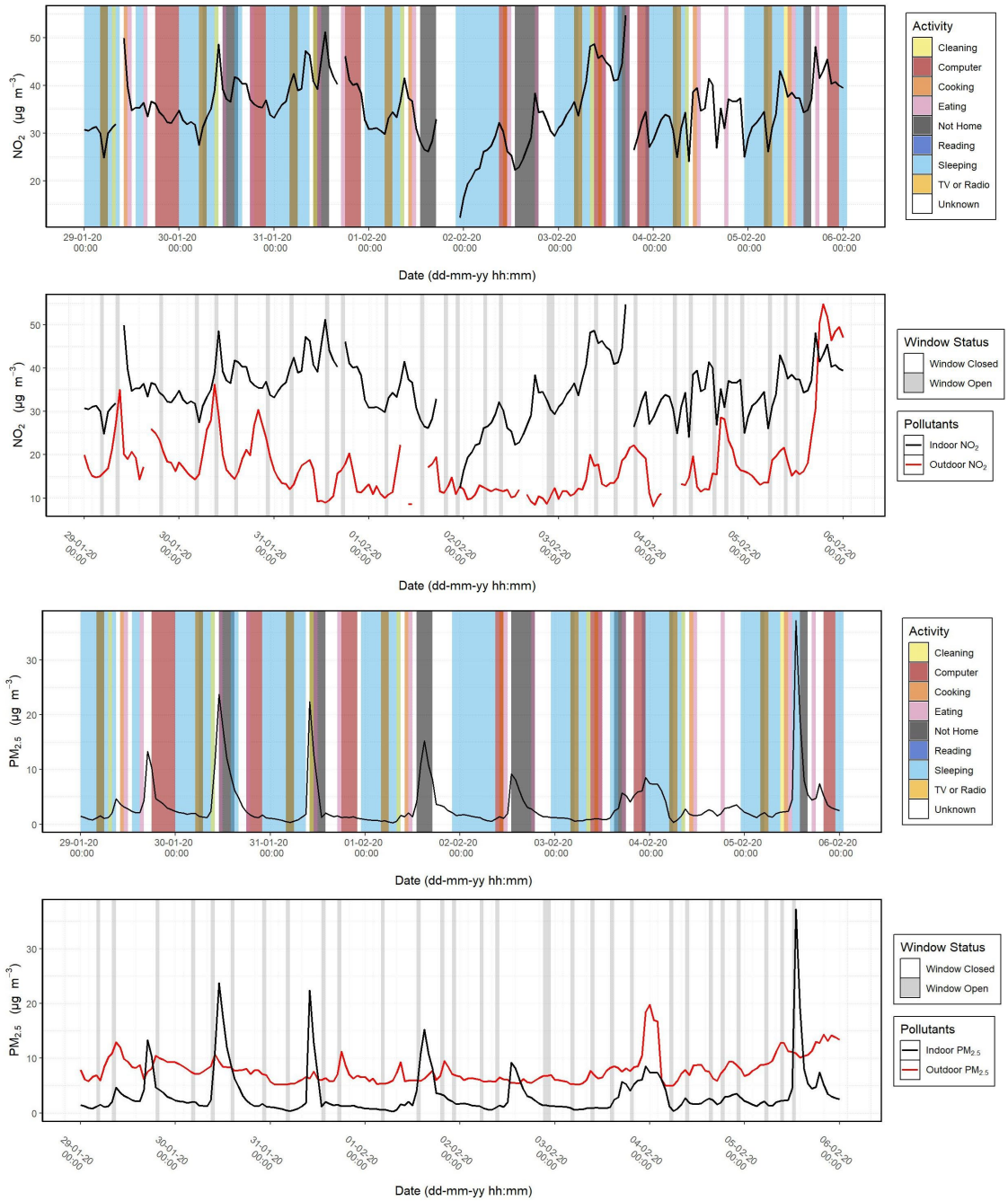



**Figure S8. Time series of pollutant concentration combined with logged activities and window status, for patient 1, week 4.**

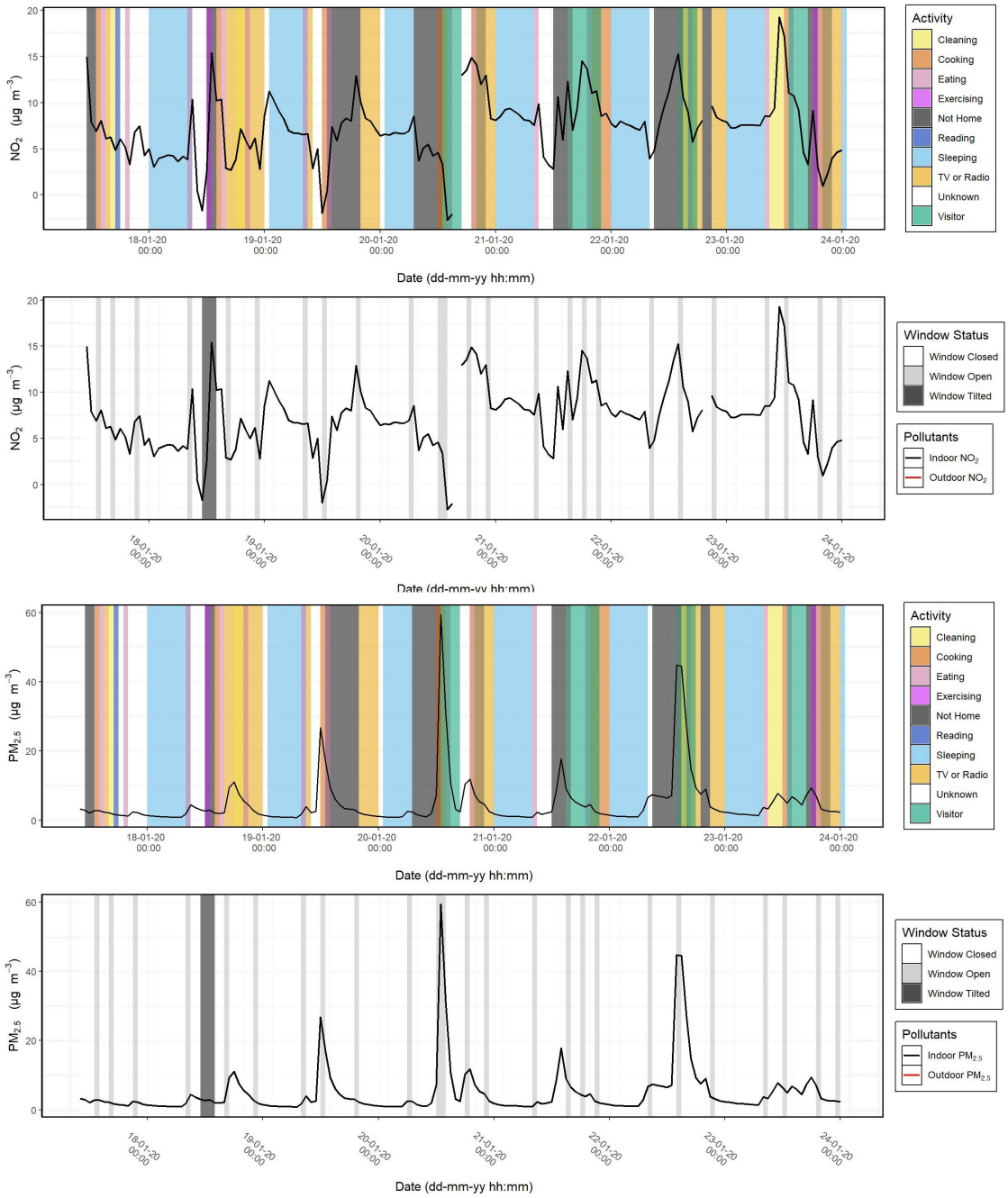



**Figure S9. Time series of pollutant concentration combined with logged activities and window status, for patient 2, week 1.**

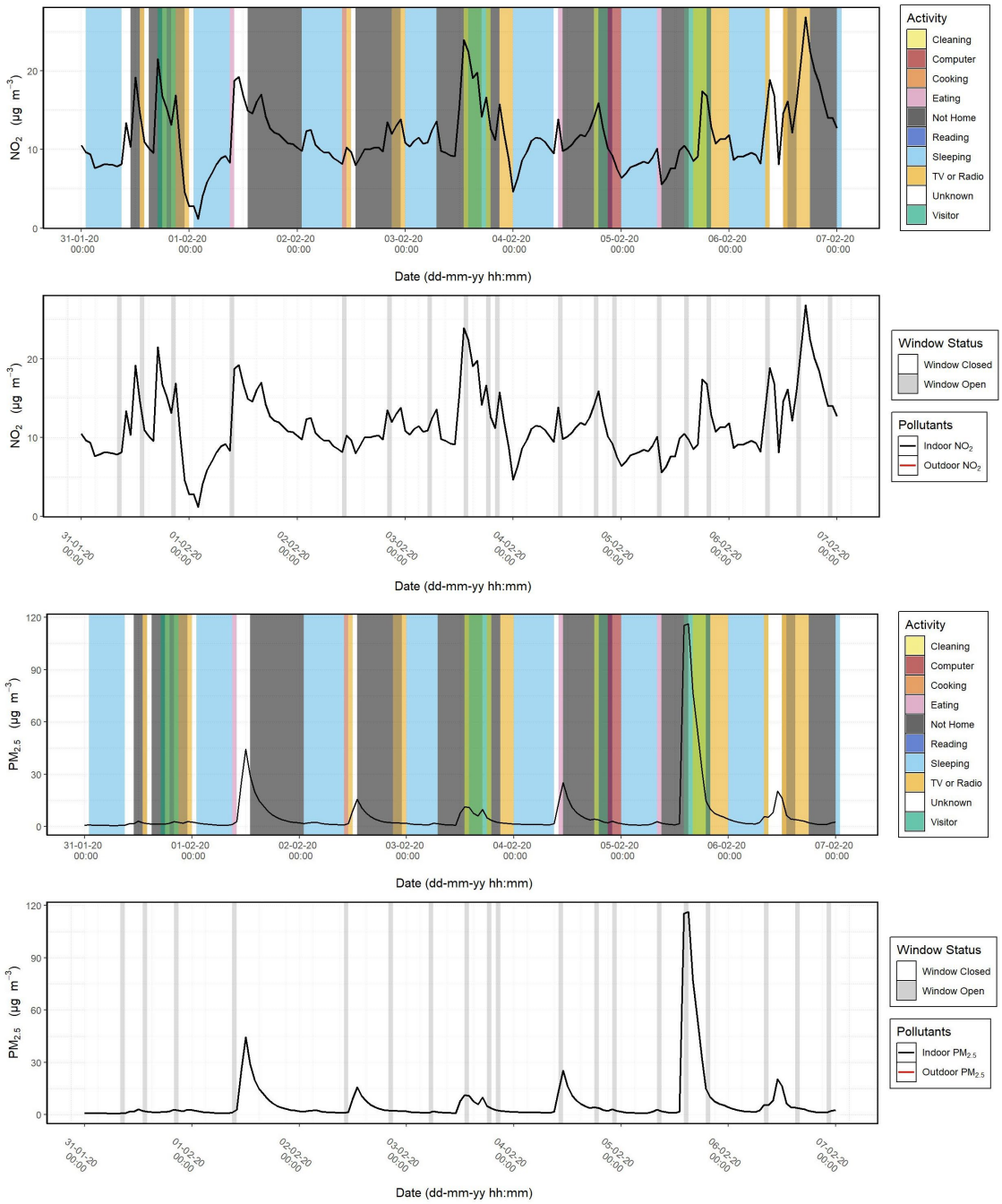



**Figure S10. Time series of pollutant concentration combined with logged activities and window status, for patient 2, week 3.**

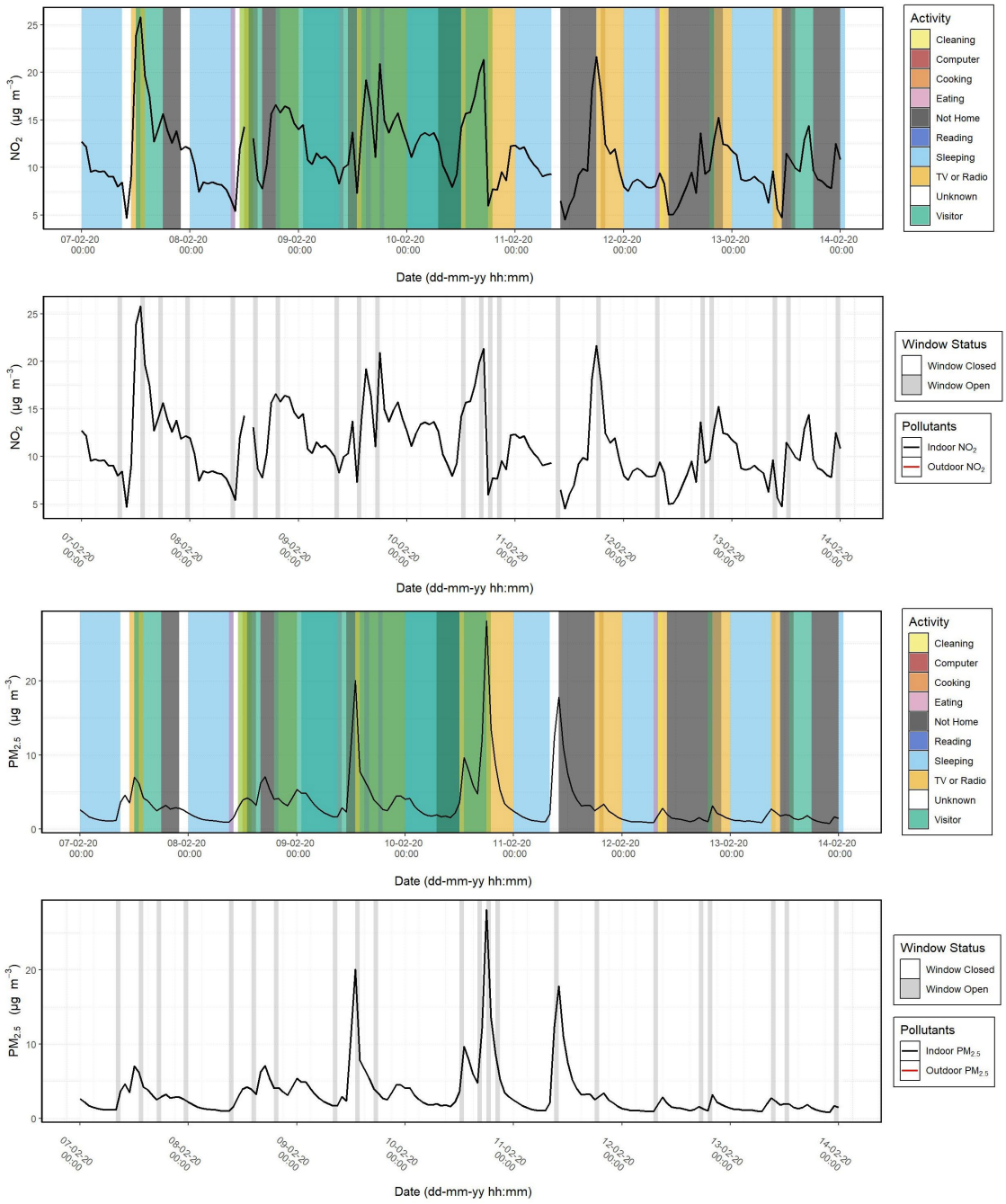



**Figure S11. Time series of pollutant concentration combined with logged activities and window status, for patient 2, week 4.**

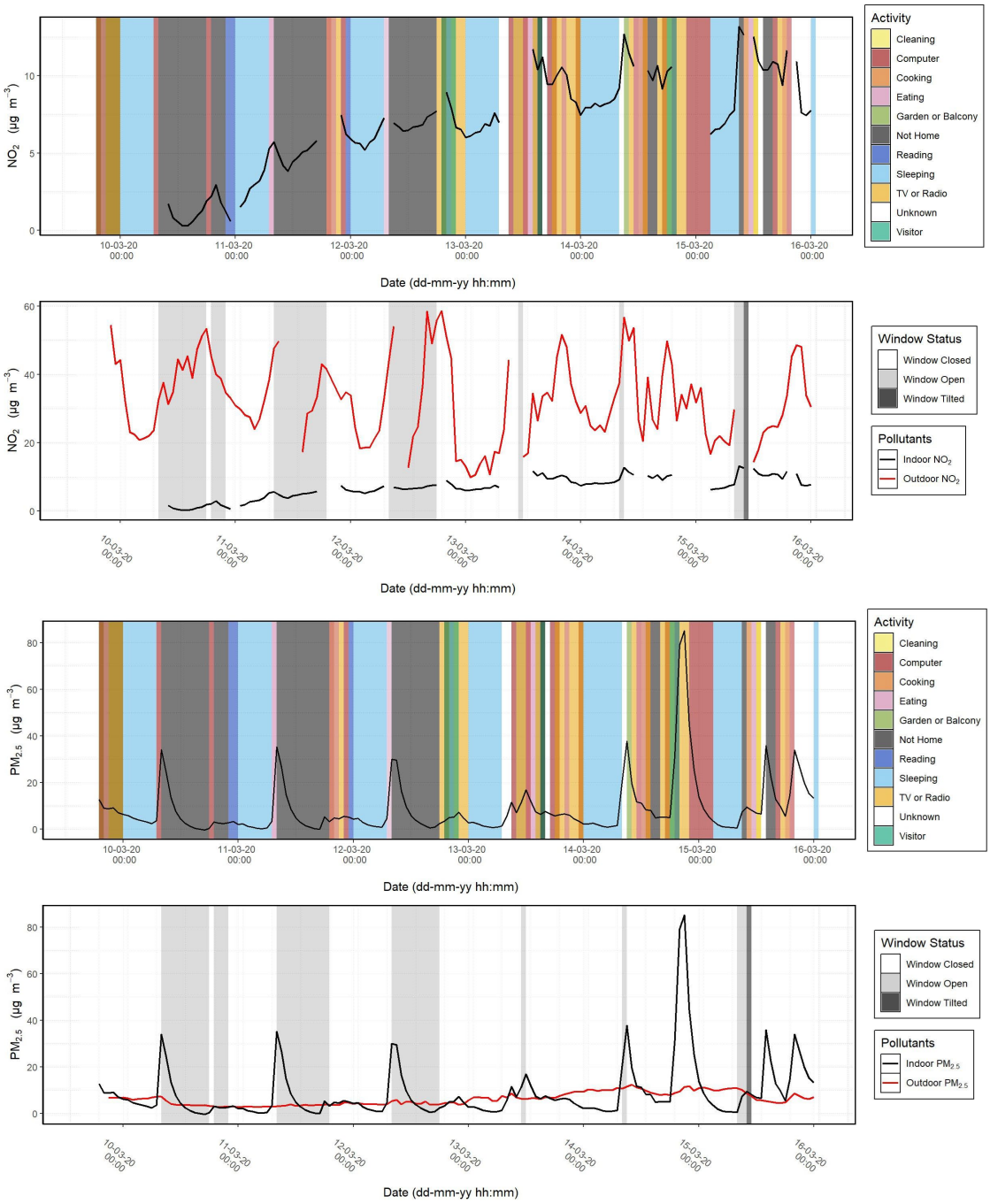



**Figure S12. Time series of pollutant concentration combined with logged activities and window status, for patient 3, week 1.**

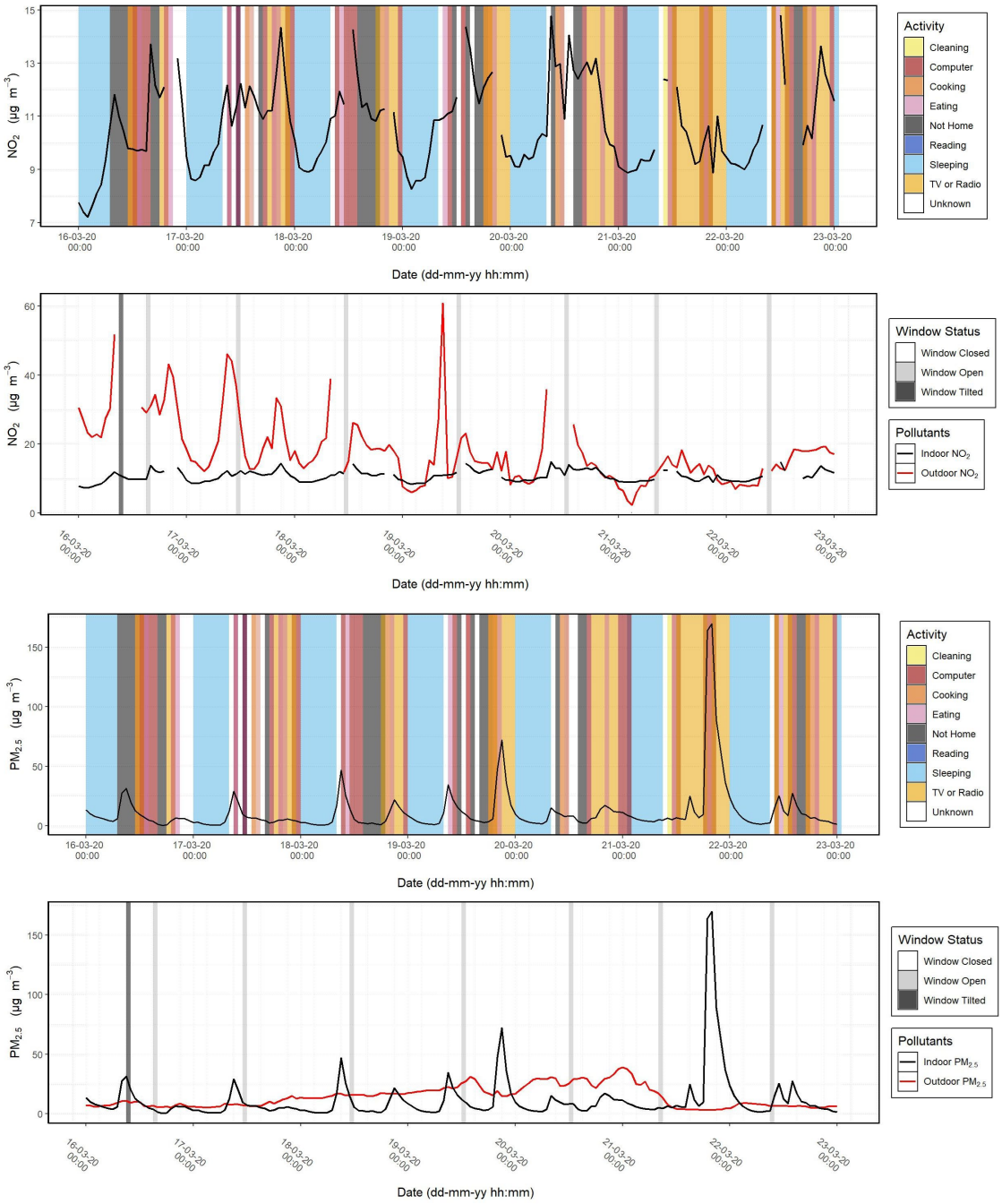



**Figure S13. Time series of pollutant concentration combined with logged activities and window status, for patient 3, week 2.**

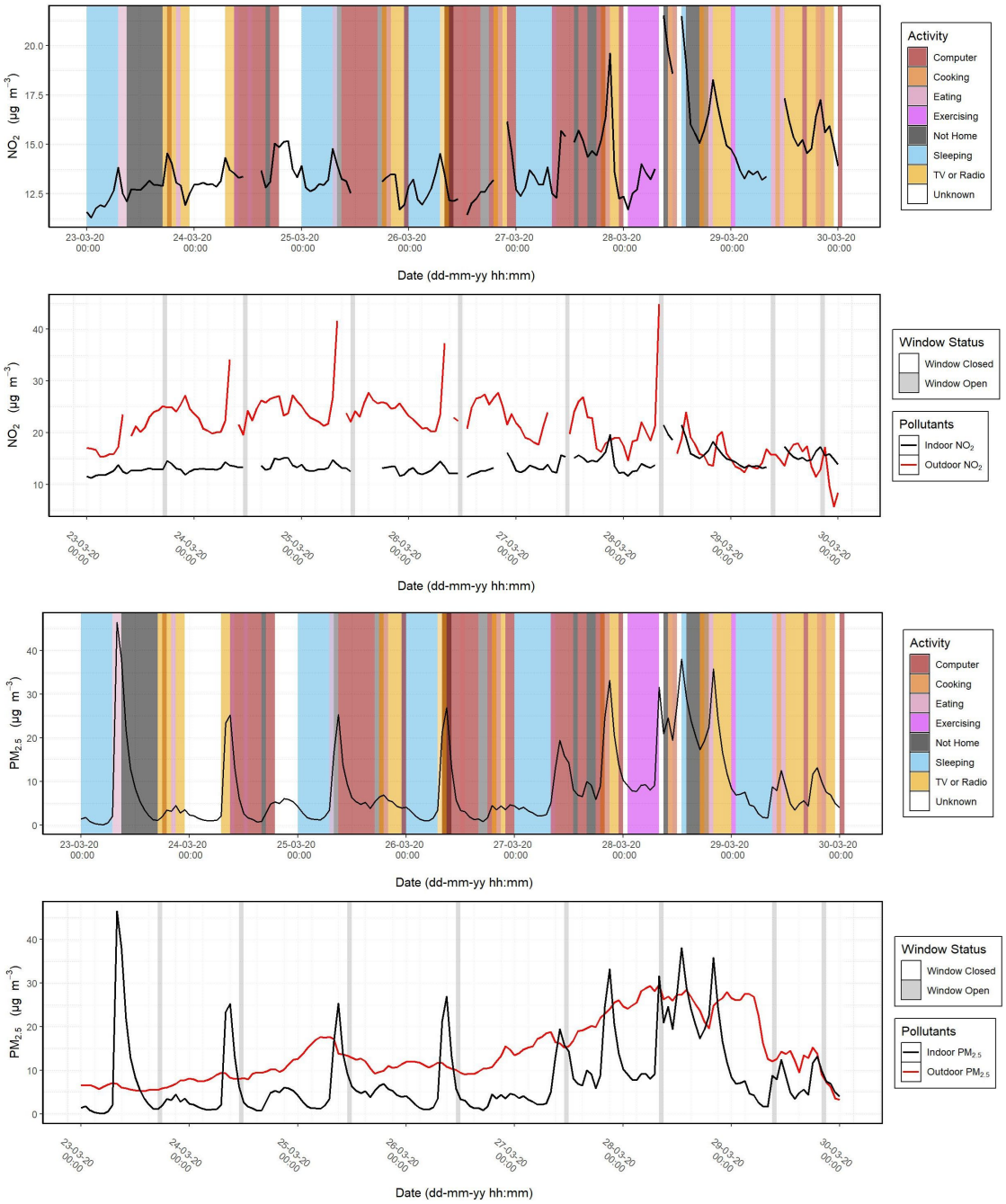



**Figure S14. Time series of pollutant concentration combined with logged activities and window status, for patient 3, week 3.**

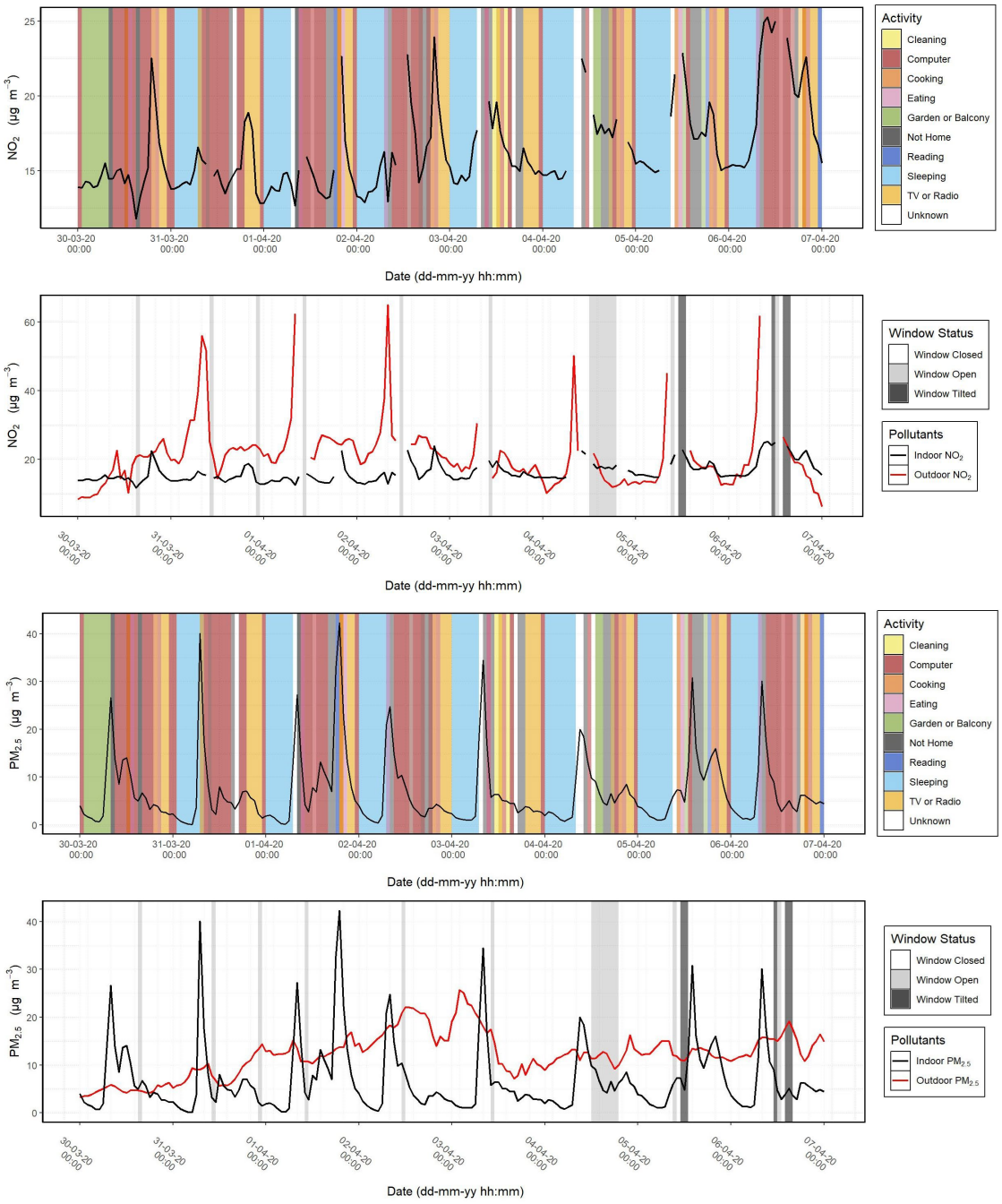



**Figure S15. Time series of pollutant concentration combined with logged activities and window status, for patient 3, week 4.**

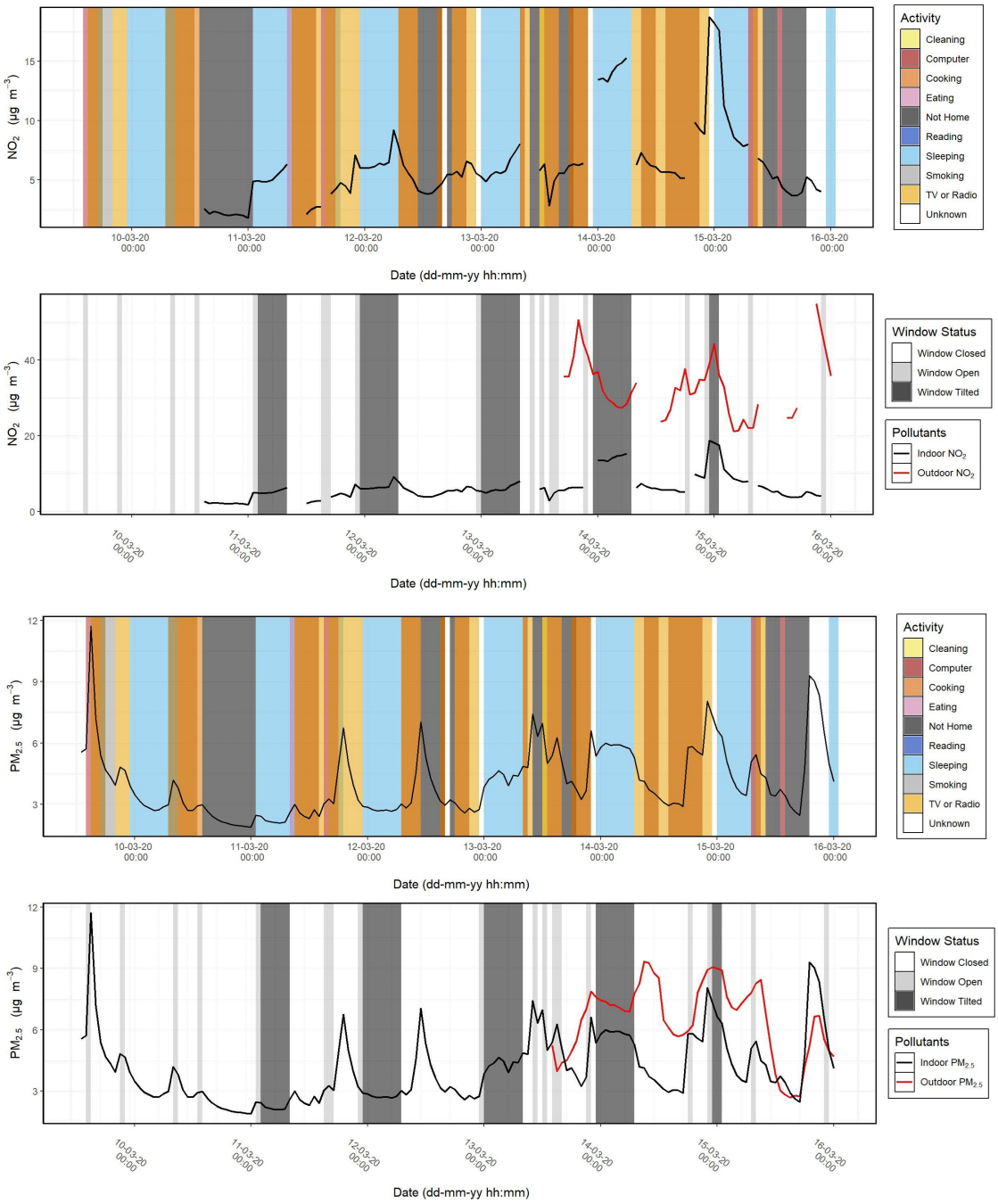



**Figure S16. Time series of pollutant concentration combined with logged activities and window status, for patient 4, week 1.**

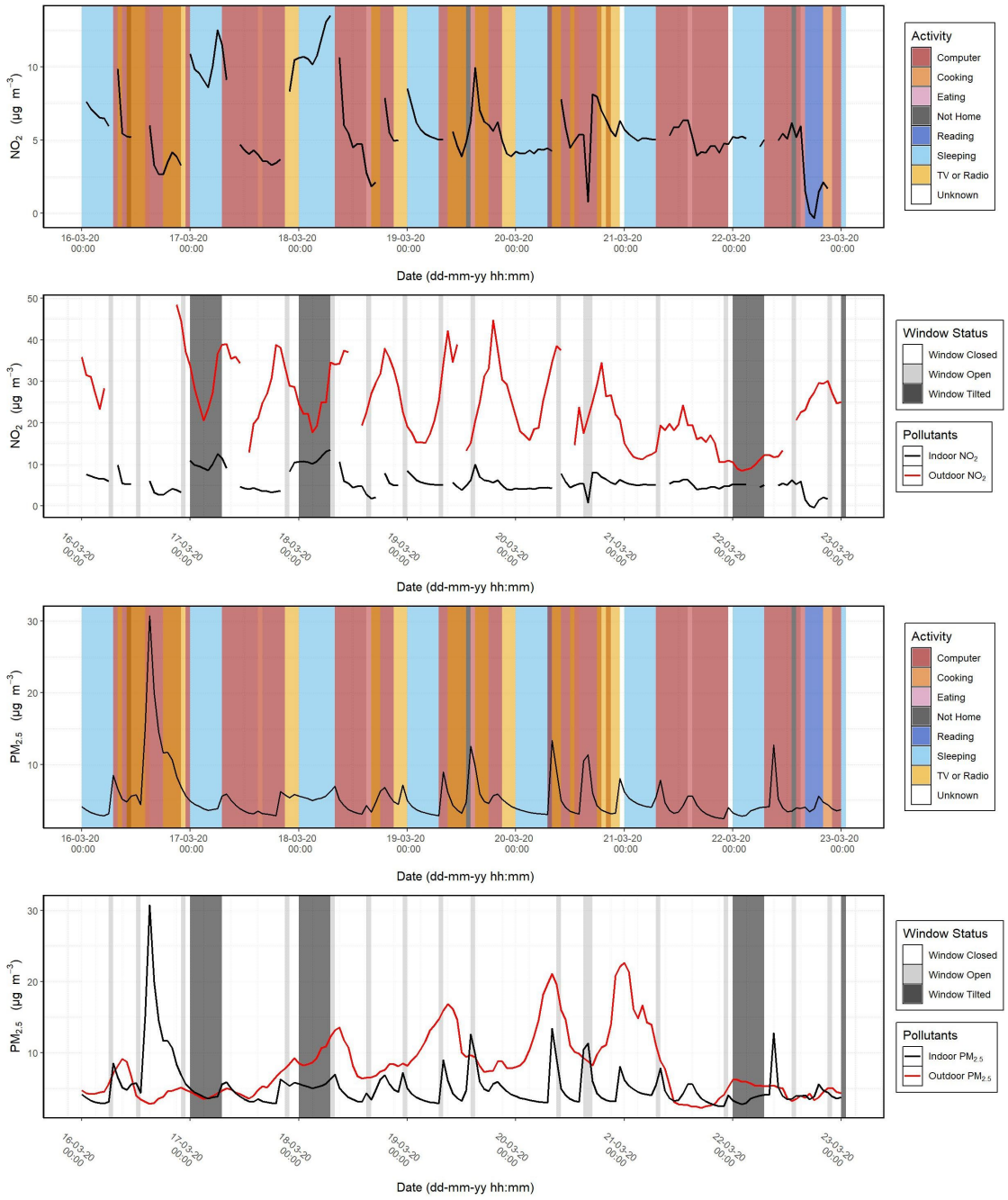



**Figure S17. Time series of pollutant concentration combined with logged activities and window status, for patient 4, week 2.**

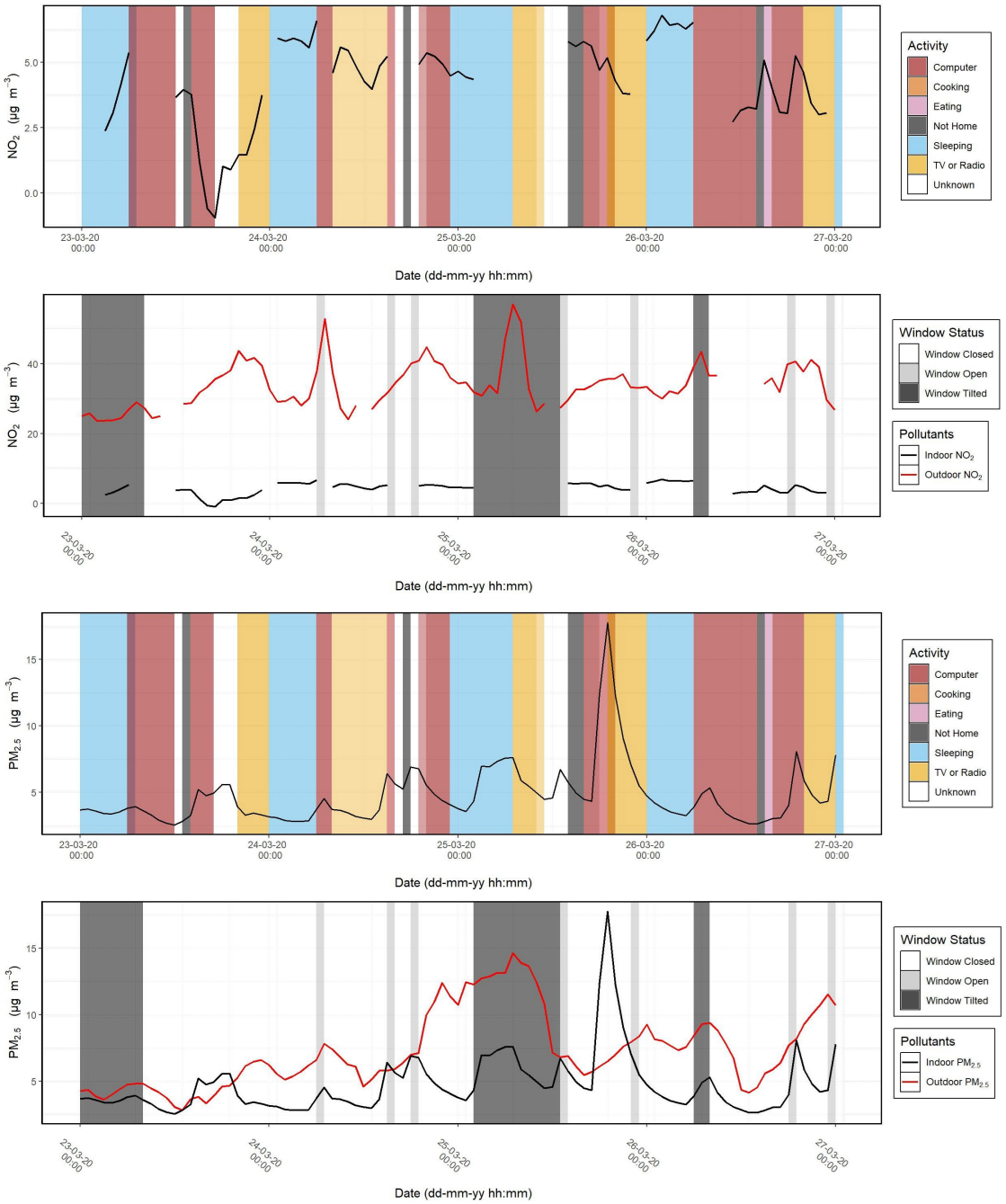



**Figure S18. Time series of pollutant concentration combined with logged activities and window status, for patient 4, week 3.**

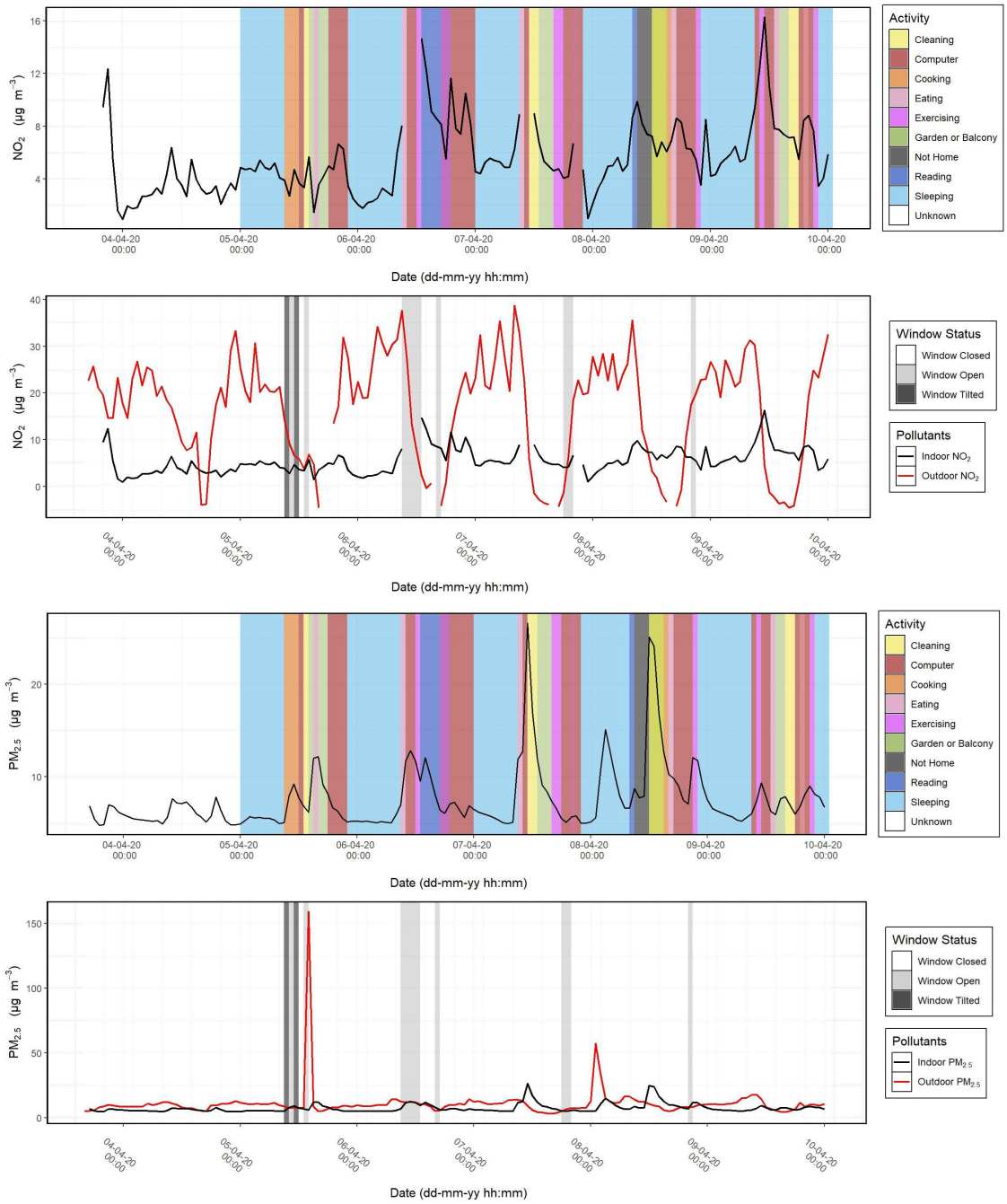



**Figure S19. Time series of pollutant concentration combined with logged activities and window status, for patient 6, week 1.**

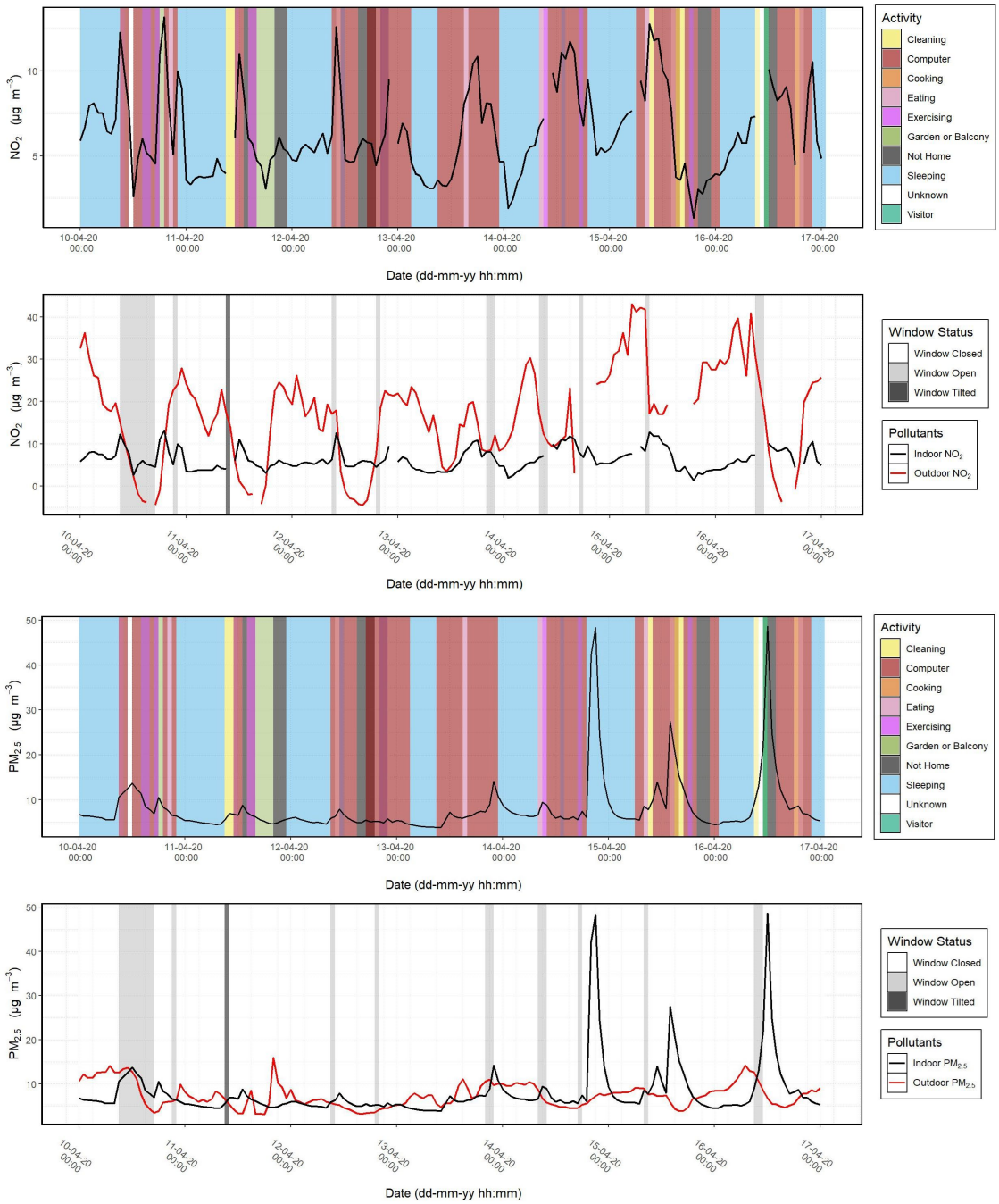



**Figure S20. Time series of pollutant concentration combined with logged activities and window status, for patient 6, week 2.**

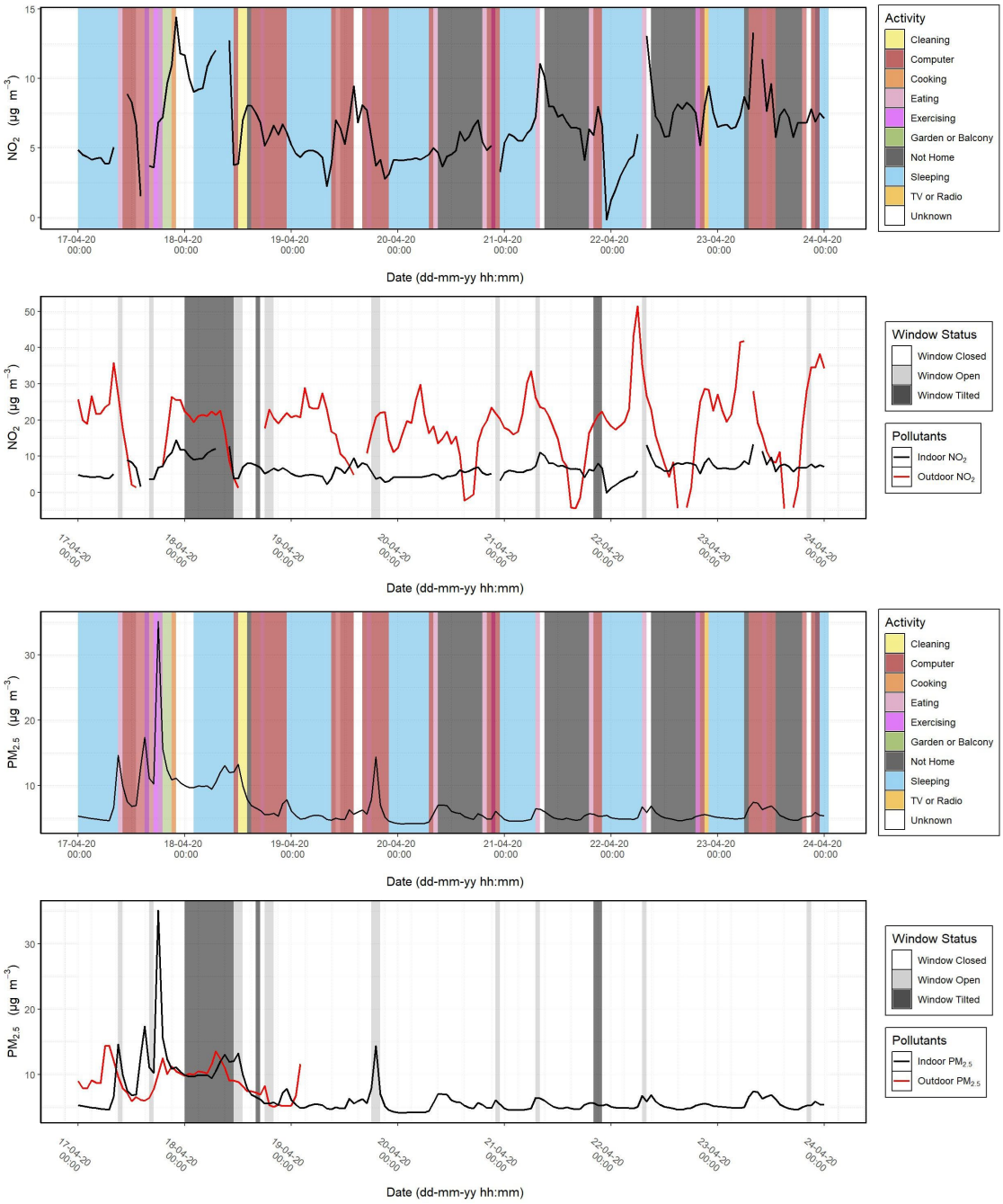



**Figure S21. Time series of pollutant concentration combined with logged activities and window status, for patient 6, week 3. Note that the outdoor sensor stopped working on 19 April 2020 at 3:00 am.**

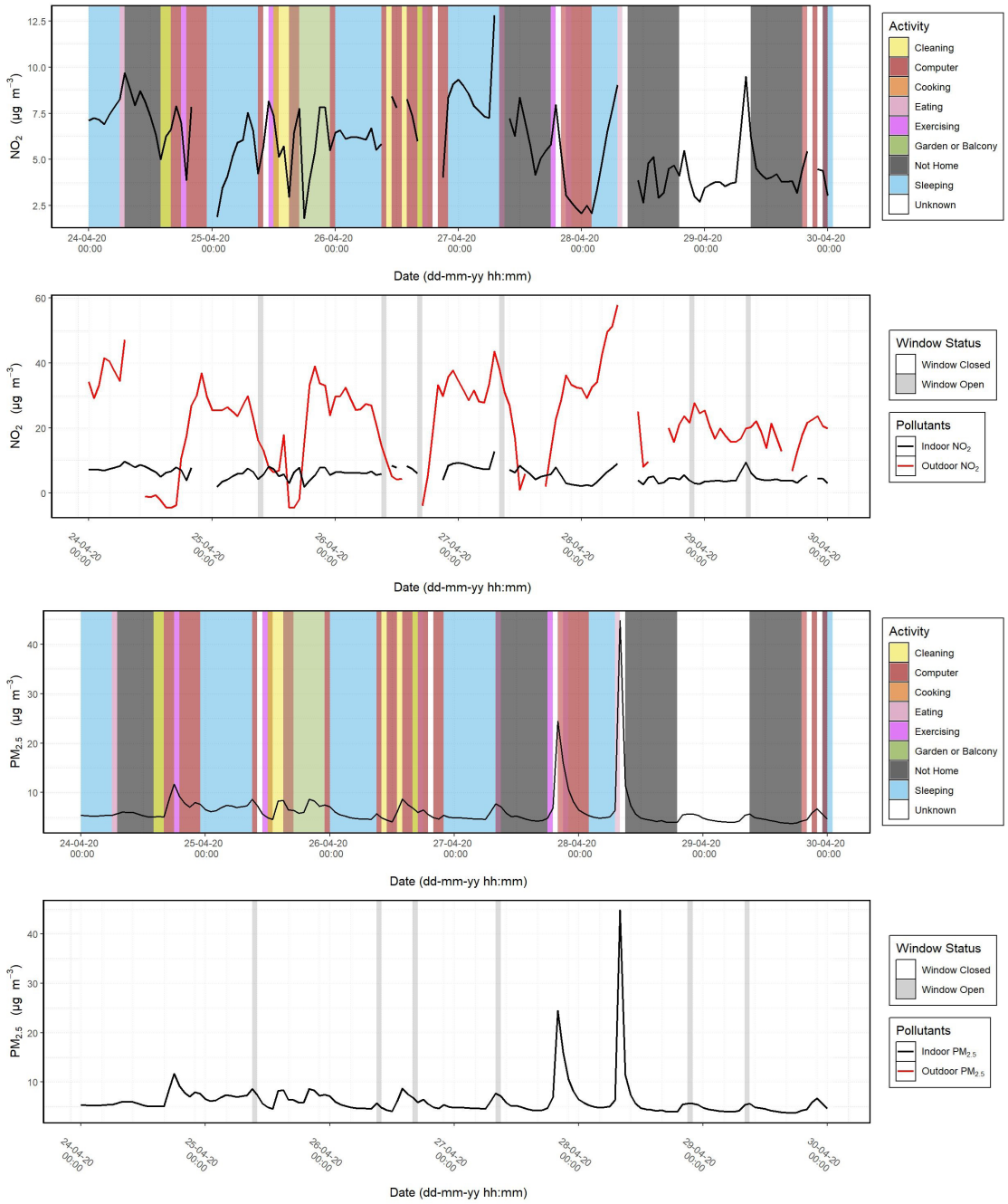



**Figure S22. Time series of pollutant concentration combined with logged activities and window status, for patient 6, week 4.**

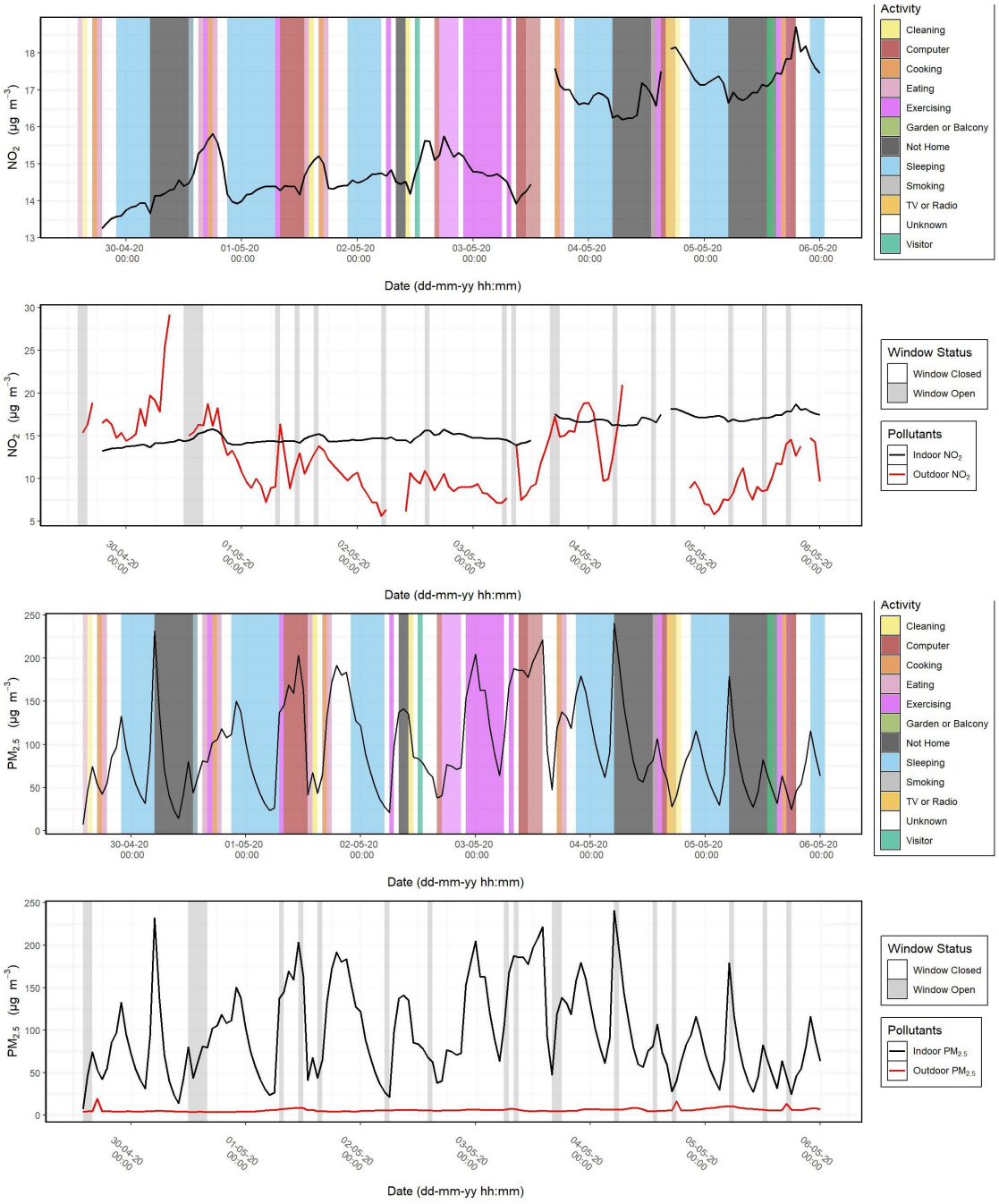



**Figure S23. Time series of pollutant concentration combined with logged activities and window status, for patient 7, week 1.**

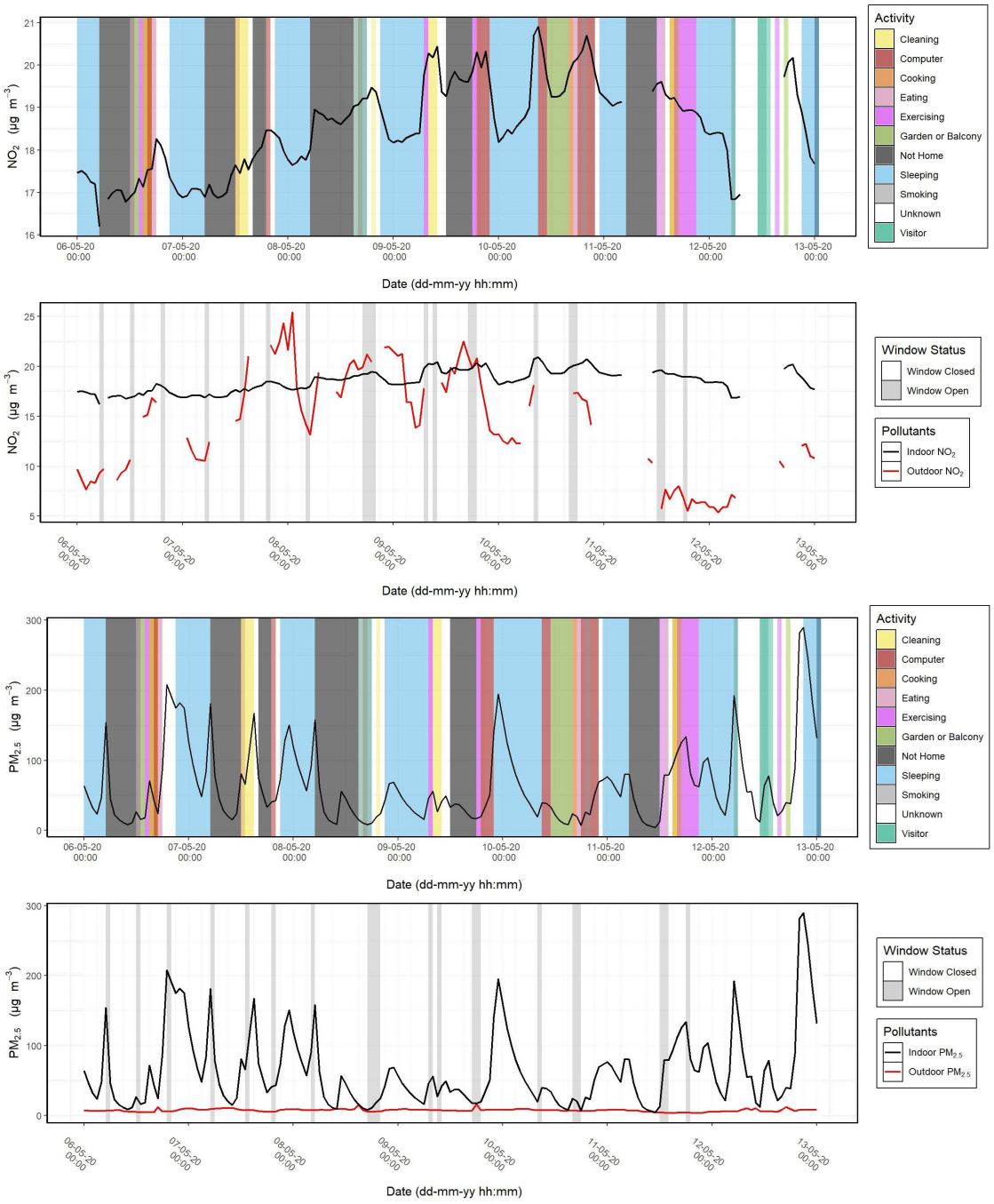



**Figure S24. Time series of pollutant concentration combined with logged activities and window status, for patient 7, week 2.**

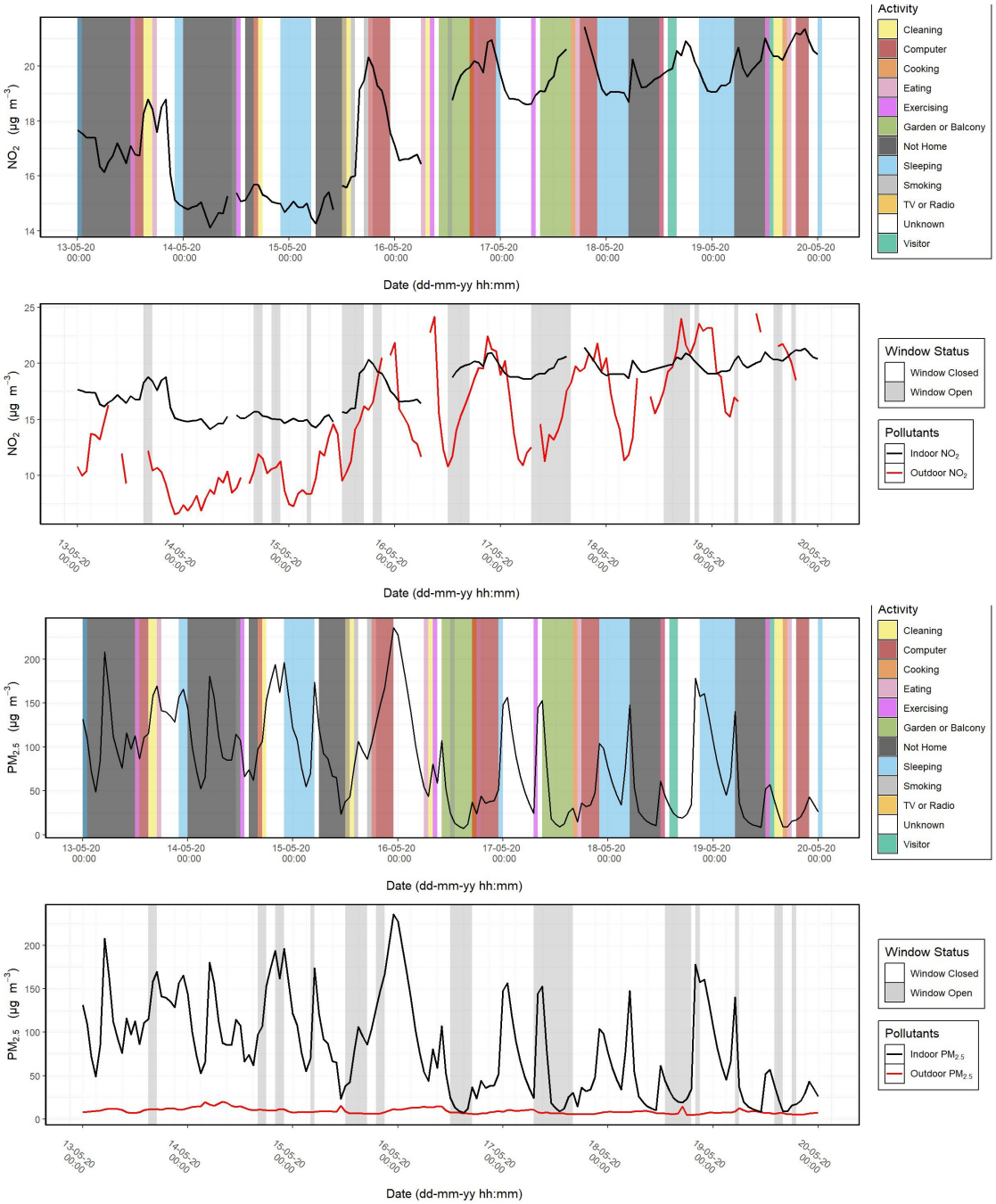



**Figure S25. Time series of pollutant concentration combined with logged activities and window status, for patient 7, week 3.**

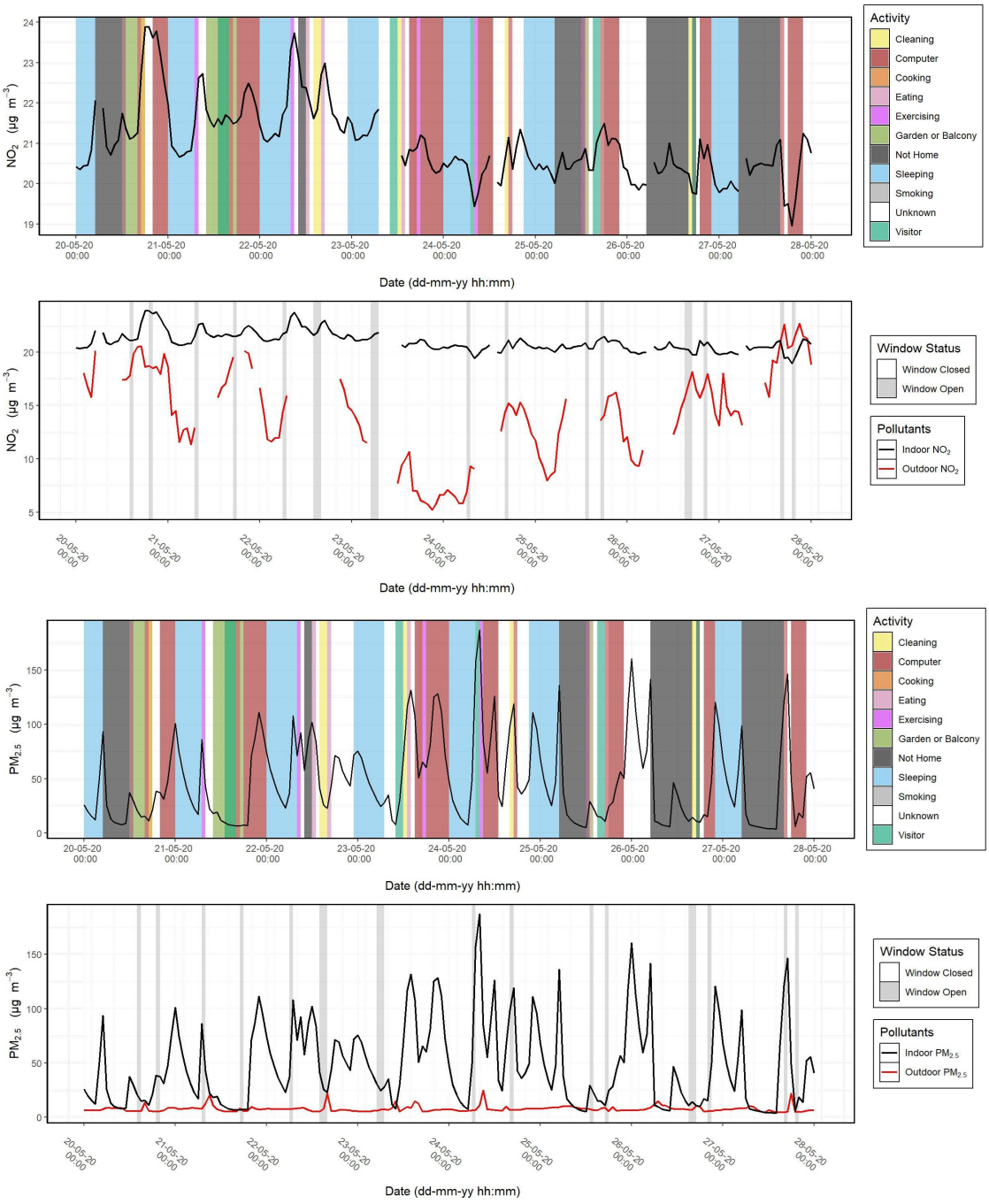



**Figure S26. Time series of pollutant concentration combined with logged activities and window status, for patient 7, week 4.**

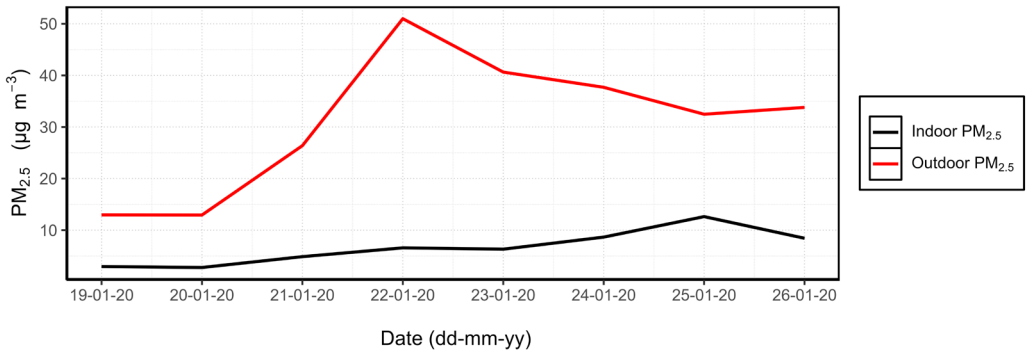



**Figure S27. Daily indoor and outdoor $PM_{2.5}$ concentrations during PM alert (from 21st January to 26th January 2020) during the measurement campaign in the home of patient 1.**

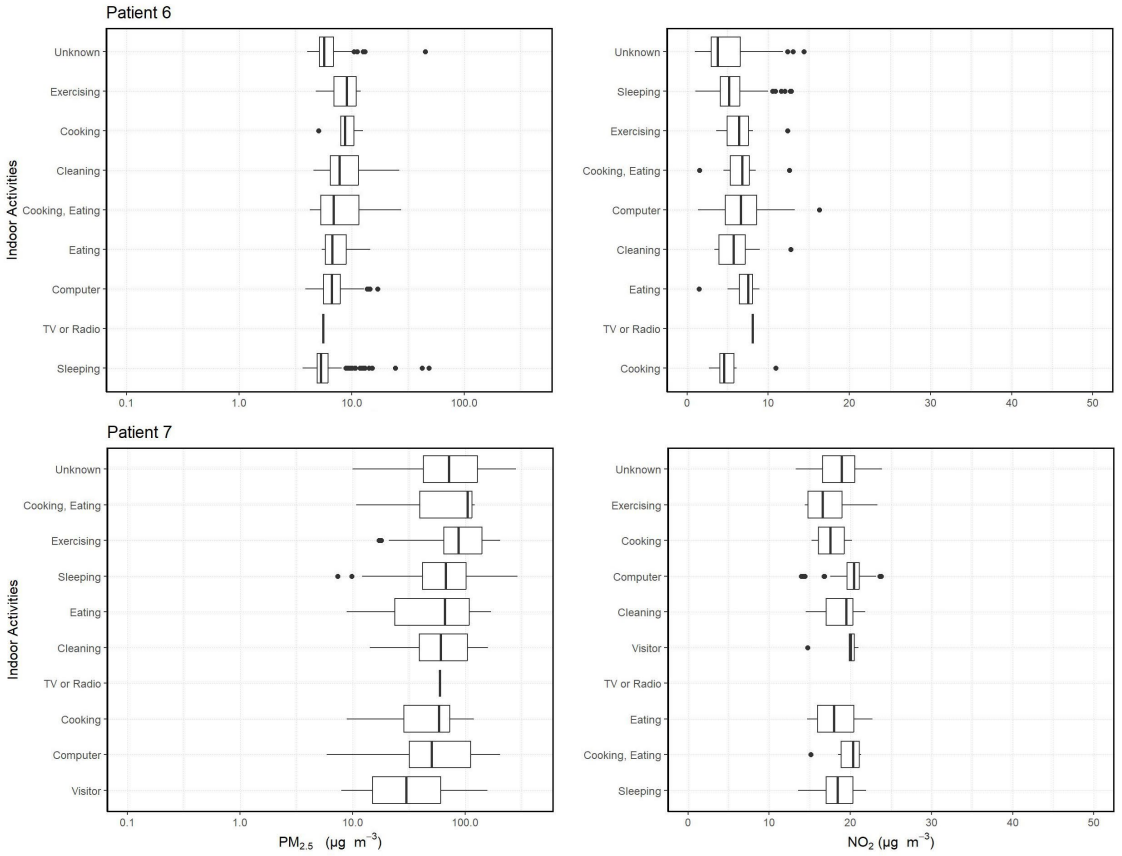



**Figure S28. Individual activity specific $PM_{2.5}$ (left) and $NO_2$ (right) concentrations, for patients 6 and 7. Note that the $PM_{2.5}$ concentrations are on a logarithmic scale.**

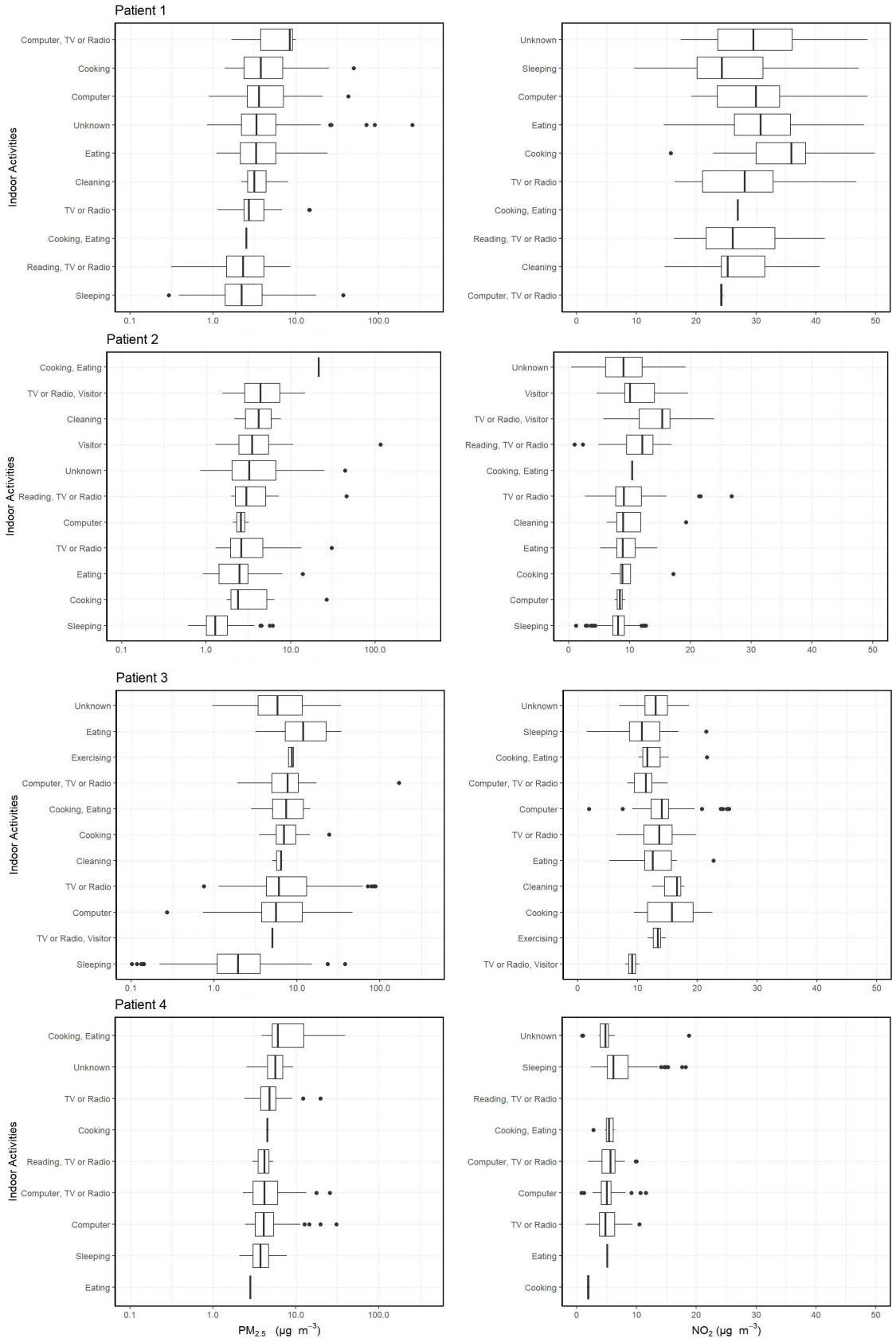



**Figure S29. Individual activity specific $PM_{2.5}$ (left) and $NO_2$ (right) concentrations, for patients 1, 2, and 3 and 4. Note that the $PM_{2.5}$ concentrations are on a logarithmic scale.**

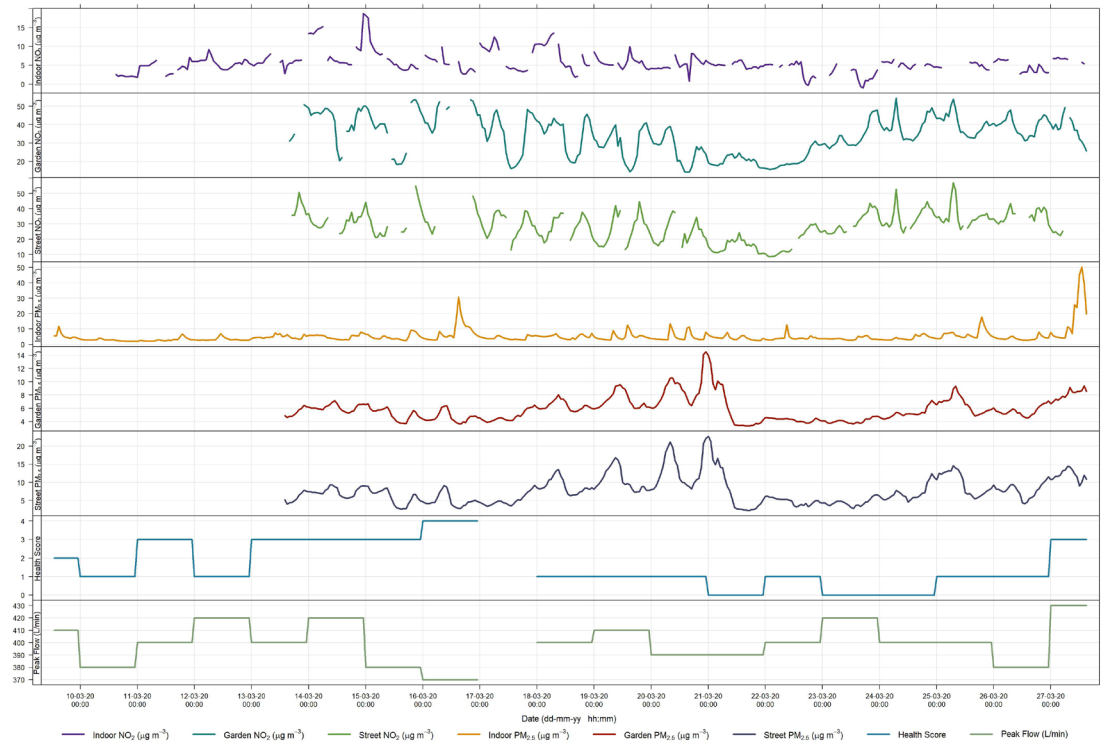



**Figure S30. Hourly indoor and outdoor (garden and street) $PM_{2.5}$ and $NO_2$ concentrations, self-reported health score and PEF for patient 4.**

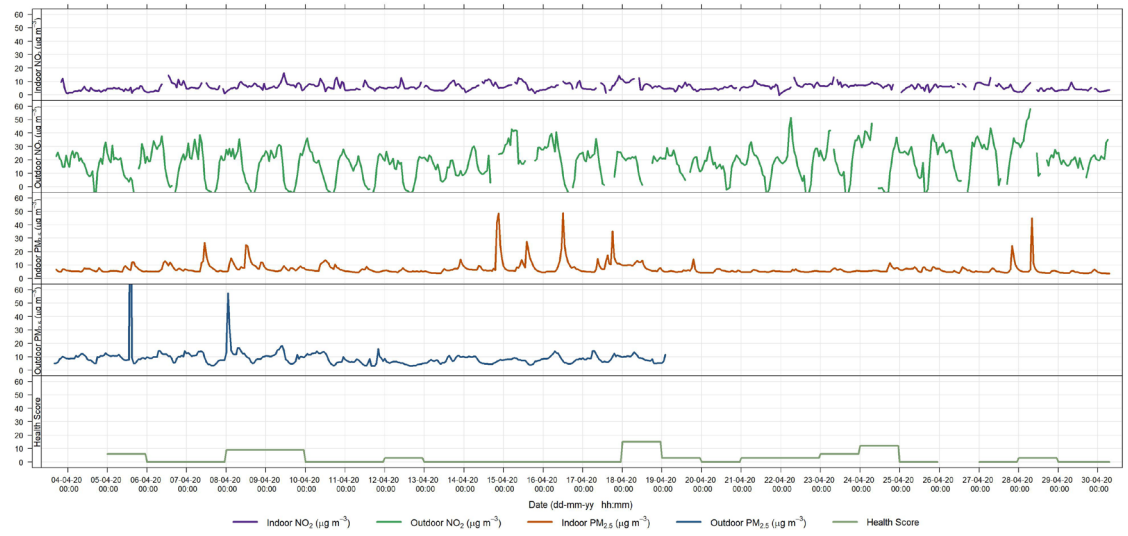



**Figure S31. Hourly indoor and outdoor $PM_{2.5}$ and $NO_2$ concentrations, self-reported health score and PEF for patient 6. Note that the outdoor sensor stopped working on 19 April 2020 at 3:00 am.**

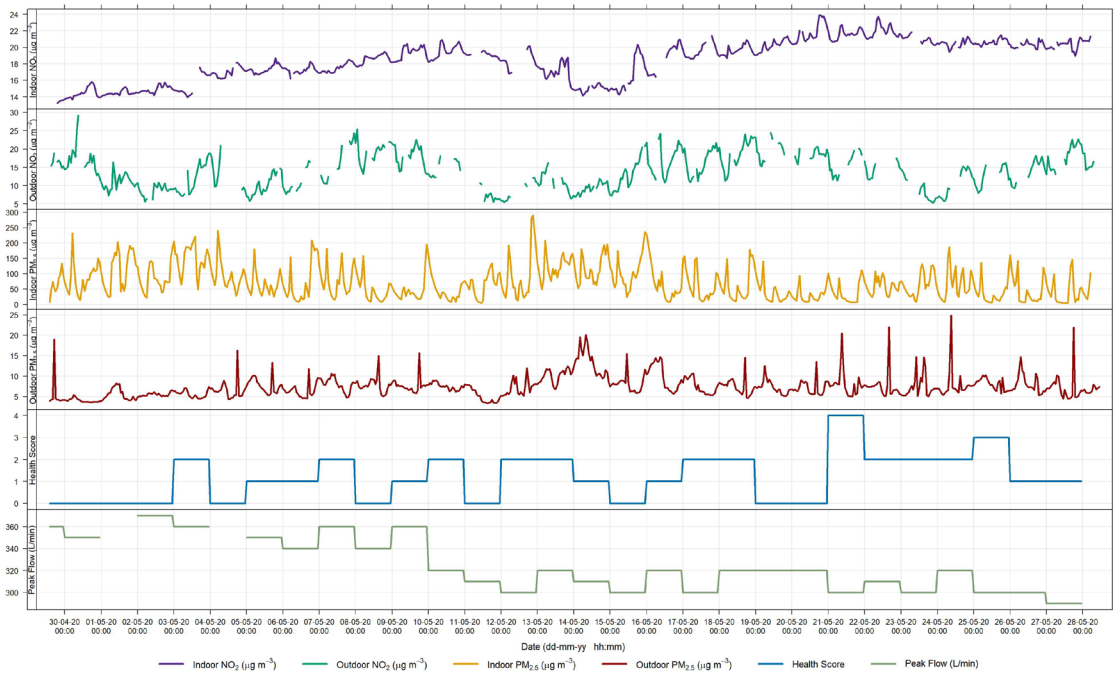



**Figure S32. Hourly indoor and outdoor $PM_{2.5}$ and $NO_2$ concentrations, self-reported health score and PEF for patient 7.**