Improvement of GPS-attached Pocket PM2.5 Measuring Device for Personal Exposure Assessment

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Abstract: Assessment of personal exposure to particulate matter with an aerodynamic diameter less than or 2.5 µm (PM2.5) is necessary to study the association between PM exposure and health risk. Development of a personal PM2.5 sensor or device is required for the evaluation of individual exposure level. In this study, we aimed to develop a small-sized, lightweight sensor with a global positioning system (GPS) attached that can measure PM2.5 and PM10 every second to assess continuous personal exposure levels. The participants in this study were apparently healthy housewives (n = 15) and university female teaching staff (n = 15) who live in a high PM2.5 area, Yangon, Myanmar. The average PM2.5 exposure levels during 24 h were 16.1 ± 10.0 µg/m³ in the housewives and 15.8 ± 4.0 µg/m³ in the university female teaching staff. The university female teaching staff showed high exposure concentrations during commuting hours, and had stable, relatively low concentrations at work, whereas the housewives showed short-term high exposure peaks due to differences in their lifestyles. This is the first study to show that a GPS-attached standalone PM2.5 and PM10 Sensor [PRO] can be successfully used for mobile sensing, easy use, continuous measurement, and rapid data analysis.

Keywords: PM2.5, personal exposure assessment, pocket PM2.5 Sensor [PRO], microenvironment, Myanmar.

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Introduction

Epidemiological studies have demonstrated that exposure to particulate matter with an aerodynamic diameter less than or 2.5 µm (PM2.5) causes adverse health effects, especially respiratory and cardiovascular diseases [1–3]. According to the WHO, four million premature deaths and deaths from pneumonia in children under 5 years of age are due to household air pollution [4]. Pregnancy outcomes such as low birth weight, stillbirth, acute respiratory infections, premature death, perinatal death, and neonatal death are common in poor household air conditions [5–7]. Personal exposure level can be influenced by various microenvironments, such as cooking, smoking, shopping, walking, poor air circulation and using smoke-emitting household appliances. There are few reports about the personal exposure level to PM2.5 because of the difficulty in conducting them in
the various microenvironments.

Generally, PM2.5 levels are measured by fixed air quality monitor stations, which are expensive and bulky instruments that cannot be used for mobile and microenvironmental assessment. The concentration of PM varies with different emission sources, meteorology and topography [8], and the PM2.5 levels showed by fixed air quality monitor stations do not present health risk data [9]. The factors influencing personal exposure levels are the amount of time spent in indoors, outdoors and commuting time, and physical status and lifestyle or household behaviors. A recent report indicated that city dwellers in Singapore are exposed to PM that exceeded the level shown by a fixed air quality monitor station [10]. Therefore, a low-cost, mobile sensing real-time PM2.5 monitor or sensor with a global positioning system (GPS) needs to be developed to measure consecutive and accurate assessment of personal exposure level to PM2.5.

Our research group previously introduced Pocket PM2.5 Sensor (commercially available) for mobile monitoring and reported real-time PM2.5 levels in seven Townships of Yangon, Myanmar [11]. In that study, we found that PM2.5 concentrations varied within Townships with different environments, and remarkably high concentrations were observed close to busy roads and street food shops. Our previous Pocket PM2.5 Sensor (commercially available) had some limitations, such as the requirement of a smartphone, a limit of 1 h measurement, no GPS attachment, and not much capacity for data storage. Thus, we designed a GPS-attached new Pocket PM2.5 Sensor to measure personal exposure level of PM2.5 for more than 24 hours with large data storage capacity without the need of a smartphone.

The aims of the present study were to develop a GPS attached Pocket PM2.5 Sensor and to measure 24 h personal PM2.5 exposure levels in housewives and university female teaching staff in Yangon city.

Materials and Methods

Study population

Middle-aged housewives and university female teaching staff were selected for this study because they spend time in different microenvironments such as the home environment, which, for housewives, includes cooking, cleaning, and shopping outside, and the partially stable office environment for university female teaching staff. Fifteen university female teaching staff and fifteen housewives (40–60 years of age) working and living in different Townships of Yangon participated in this study. The subjects were apparently healthy, non-smoking and non-alcohol drinking. All the subjects were requested to sign in informed consent and, prior to sampling, to complete a questionnaire regarding personal information including office and residential characteristics, commuting, health, and educational status. This study was approved by the Ethical Review Committee, Department of Medical Research (Head Quarter), Ministry of Health and Sports, Myanmar. The approval number is Ethics/DMR/2017/130A/2018.

Personal exposure assessment

A new sensor that can measure PM2.5 and PM10 each second, is small, lightweight, and equipped with a GPS tip and data logger was developed by request to Yaguchi Electric Co., Ltd., Miyagi, Japan (Figure 1A). We named the sensor “Pocket PM2.5 Sensors [PRO].” We used 12 Pocket PM2.5 Sensors [PRO] in this study and named them PRO-1 to PRO-12. PRO-1 to PRO-10 were used for personal exposure measurement in housewives and university female teaching staff who live in Yangon, and PRO-11 and PRO-12 were used for calibration. Briefly, a fan inhales outside air and the flow path separates the PM2.5 from others particles. A light-emitting diode (LED) and photodiode (PD) sensor detect the pulse signals of each PM2.5 particle. Each subject was instructed to keep one Pocket PM2.5 Sensor [PRO] near their breathing zone (Figure 1B) during their routine daily activities (Figure 1C). All of the subjects were asked to have the Pocket PM2.5 Sensor [PRO] with them at all times and to place the Pocket PM2.5 Sensor [PRO] nearby while bathing or sleeping. The subjects were encouraged to do their regular daily activities during the sampling period. Personal exposure sampling was conducted for 24 h (from 8:00–10:00 a.m. to 8:00–10:00 a.m. the next morning) during September 23 to 26, 2019. Pocket PM2.5 Sensors [PRO] equipped with a GPS device and GPS receiver can trace the subject’s location and assess the accurate microenvironment during the sampling period.
Specifications of Pocket PM2.5 Sensor [PRO]

The specifications of the Pocket PM2.5 Sensor are described in our previous study [11]. The newly developed Pocket PM2.5 Sensor [PRO] is equipped with a GPS, can be used continuously for 45 h, can be connected to a computer by a USB for data analysis, and has a maximum memory storage of 400 days (Table 1).

Validity assessment of Pocket PM2.5 Sensor [PRO]

To assess the validity of our Pocket PM2.5 Sensor [PRO], the PM2.5 concentrations measured by Pocket PM2.5 Sensors PRO-11 and PRO-12 were simultaneously compared with the data from PM712, Kimoto [12], a fixed real time monitor which was set up in the Air Quality Research Station, National Institute for Environmental Studies (NIES), Tsukuba, Japan [13]. PM712, Kimoto recorded once hourly, while the Pocket PM2.5 Sensor [PRO] recorded every second. The data were calculated as the average hourly value.

Statistical Analysis

Data analysis was done by using Statistical Package for Social Science (SPSS) software version 26 (IBM Corp., Armonk, NY). The results were expressed as mean ± SD. The statistically significant level was set at $P<0.05$.

Results

Characteristics of the study population

The characteristics of the study population are presented in Table 2. The mean age was $52.5 \pm 7.4$ years in the housewives and $42.9 \pm 3$ years in university female teaching staff. All the participants were non-smokers and non-alcohol drinkers and no history of chronic disease. The education status of most of the subjects was above high school level. Mosquito coils and cleansing detergents were used in some houses. The habit of using incense sticks while praying, charcoal stove cooking, mosquito coils and insect repellents, and air fresheners in the house and office might have influenced the quality of the indoor air.

Table 1. Detail description of specification of Pocket PM2.5 Sensor [PRO].

| No. | Item                          | Parameters                                                                 |
|-----|-------------------------------|---------------------------------------------------------------------------|
| 1   | Measuring particle            | PM2.5, PM10                                                               |
| 2   | Sensing principle             | Laser scattering                                                          |
| 3   | Measurement Range             | $0 \sim 999 \mu g/m^3$ (PM2.5/PM10)                                        |
| 4   | Response time                 | 10 sec                                                                    |
| 5   | Internal modules              | GPS, Static memory                                                        |
| 6   | Memory                        | Max. 400 days (at every-second logging)                                   |
| 7   | Interface                     | Micro USB (for power supply and PC connection in USB mass storage mode)   |
| 8   | Power supply                  | USB Type-A 5V                                                             |
| 9   | Power consumption             | Max. 110 mA (5V)                                                          |
| 10  | Operation duration            | Max. 45 hours (by 5,000 mAh external battery)                             |
| 11  | File format                   | CSV (Date, Time, PM2.5/10 consumption, GPS coordinates)                   |
| 12  | Relative error                | Maximum of $\pm 15\%$ and $\pm 10 \mu g/m^3$ (25°C, 50%)                 |
| 13  | Manufacturer                  | Yaguchi Electric Corporation, Miyagi (MADE IN JAPAN)                      |
Validity assessment of Pocket PM2.5 Sensor [PRO]

A correlation was observed between PM712, Kimoto and Pocket PM2.5 Sensors [PRO] 11 and 12 (Figure 2). All the Pocket PM2.5 Sensors [PRO] were also calibrated with the constantly observed PM2.5 counter (PM712, Kimoto Electric Co., Ltd.) of Air Quality Research Station, NIES, Tsukuba, Japan. Variability between devices were performed using devices 11 and 12, and a strong correlation was observed (Figure 3).

Personal PM2.5 exposure level

The personal PM2.5 exposure level during 24h in the participants were measured by Pocket PM2.5 Sensors [PRO]. The maximum, minimum and average PM2.5 exposure levels during 24h are expressed in Table 3. PM2.5 concentrations of more than 300 µg/m³ were observed in 46% of the housewives and 20% of the university female teaching staff (Table 3A). The arithmetic mean of PM2.5 exposure level during 24h was 16.1 ± 10.0 µg/m³ in the housewives and 15.8 ± 4.0 µg/m³ in the university female teaching staff. The geographic mean of PM2.5 exposure level during 24h was 11.8 ± 1.2 µg/m³ in the housewives and 13.9 ± 1.1 µg/m³ in the university female teaching staff. In Table 3, the PM2.5 concentration 652.8 µg/m³ indicates 999.9 µg/m³, and we converted by calibration factor. Temperature and humidity might influence PM2.5 concentra-

### Table 2. Characteristics of study population

| Variables          | Housewives | University female teaching staff |
|--------------------|------------|----------------------------------|
| **Physical status**|            |                                  |
| Age (yrs)          | 52.5 ± 7.4 | 42.9 ± 3                         |
| Height (cm)        | 150 ± 4    | 160 ± 1                          |
| Weight (kg)        | 55.1 ± 7.2 | 60.5 ± 6.5                       |
| BMI (kg/m²)        | 24.0 ± 2.9 | 24.3 ± 2.6                       |
| **Clinical history**|            |                                  |
| Smoking            | Nil        | Nil                              |
| Alcohol drinking   | Nil        | Nil                              |
| Chronic disease    | Nil        | Nil                              |
| **Educational status**|        |                                  |
| High school        | 4/15       | 0/15                             |
| University degree  | 1/15       | 0/15                             |
| Graduate degree    | 10/15      | 15/15                            |
| **Indoor status**  |            |                                  |
| Good ventilation   | 15/15      | 15/15                            |
| Mosquito coil      | 5/15 (002, 008, 028, 029, 030) | 2/15 (022, 024) |
| Repellent          | 1/15 (009) | 0/15                             |
| Incense stick      | 1/15 (029) | 2/15 (011, 023)                  |
| Air fresher        | 1/15 (009) | 1/15 (021)                       |
| Cleaning detergent | 1/15 (002) | 4/15 (011, 021, 023, 026)        |

BMI: Body mass index

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**Figure 2. Validity assessment of Pocket PM2.5 Sensor [PRO]: correlation between PM712, Kimoto and Pocket PM2.5 Sensor [PRO] 11 and 12.** Comparison of the data from PM712, Kimoto [Ref. 12], a fixed real-time monitor which was set up in Air Quality Research Station, NIES, Tsukuba, Japan [Ref. 13] and Pocket PM2.5 Sensor [PRO] simultaneously. PM712, Kimoto recorded once hourly while Pocket PM2.5 Sensor [PRO] recorded every second, and we calculated the average hourly value.
tion, so those were measured at 6:00 h, 12:00 h and 6:00 h during the 24 h sampling period; no significant difference was observed between the housewives and the university female teaching staff (Table 3B).

The distribution of PM2.5 concentration during 24 h in the participants are expressed in Figure 4. Our results show that a large peak was observed in the housewives between 21:00 and 0:00. According to our questionnaire, using mosquito coils and insect repellent during the study period and incense sticks and candles while praying were the major sources of PM2.5 between 21:00 and 0:00. Regarding individual assessment, personal PM2.5 exposure levels varied with different microenvironments in the housewives according to their daily routine activities, and were partially stable during working hours in the university female teaching staff. Representative data of the daily microenvironments and locations on Google map of the housewives (Pro-001) is expressed in Figure 5.

![Variability assessment between devices](image)

**Figure 3. Variability assessment between devices.** A: PM2.5 concentrations measured by PRO-11 and PRO-12, and B: PM10 concentrations measured by PRO-11 and PRO-12.

**Table 3.** A: Maximum, minimum and average PM2.5 exposure levels every sec during 24 h in housewives and university female teaching staff and B: temperature and relative humidity. Red color indicates PM2.5 concentration more than 300 mg/m³.

| Sensor number | Code number | PM2.5 [µg/m³] | Geographic mean | Geometric mean | Geometric std |
|---------------|-------------|----------------|-----------------|---------------|--------------|
| PRO-1         | 1           | 166.3          | 1.0             | 11.2          | 9.3          | 1.8          |
| PRO-2         | 2           | 395.1          | 0.7             | 9.9           | 7.5          | 1.8          |
| PRO-3         | 3           | 278.7          | 1.4             | 13.9          | 10.3         | 1.9          |
| PRO-4         | 4           | 652.8          | 2.1             | 9.8           | 9.1          | 1.5          |
| PRO-5         | 5           | 529.4          | 3.4             | 10.1          | 8.4          | 1.6          |
| PRO-6         | 6           | 618.6          | 0.8             | 12.0          | 8.0          | 2.3          |
| PRO-7         | 7           | 163            | 1.4             | 16.3          | 9.0          | 2.4          |
| PRO-8         | 8           | 100.8          | 2.2             | 6.1           | 5.3          | 1.6          |
| PRO-9         | 9           | 222.8          | 6.6             | 21.1          | 19.2         | 1.6          |
| PRO-9         | 10          | 255            | 0.0             | 0.6           | 0.6          | –            |
| PRO-10        | 10          | 652.8          | 2.3             | 22.2          | 17.6         | 2.4          |
| PRO-10        | 20          | 188.8          | 4.9             | 18.6          | 17.5         | 1.4          |
| PRO-10        | 30          | 481.5          | 3.0             | 43.2          | 31.6         | 2.2          |

| Sensor number | Code number | PM2.5 [µg/m³] | Geographic mean | Geometric mean | Geometric std |
|---------------|-------------|----------------|-----------------|---------------|--------------|
| PRO-1         | 11          | 35.5           | 5.3             | 14.1          | 13.4         | 1.4          |
| PRO-1         | 21          | 39.8           | 3.3             | 19.3          | 18.0         | 1.5          |
| PRO-2         | 12          | 68.9           | 2.5             | 12.0          | 11.5         | 1.4          |
| PRO-2         | 22          | 68.3           | 4.1             | 19.0          | 17.5         | 1.5          |
| PRO-3         | 13          | 470.6          | 3.6             | 17.1          | 16.1         | 1.4          |
| PRO-3         | 23          | 551.2          | 3.1             | 21.3          | 19.8         | 1.5          |
| PRO-4         | 14          | 18.4           | 4.2             | 9.0           | 8.8          | 1.2          |
| PRO-4         | 24          | 652.8          | 6.9             | 22.8          | 18.6         | 1.7          |
| PRO-5         | 15          | 107.1          | 4.2             | 14.2          | 13.3         | 1.4          |
| PRO-5         | 25          | 38.5           | 5.1             | 16.7          | 15.6         | 1.5          |
| PRO-6         | 16          | 144.6          | 3.5             | 13.6          | 10.9         | 1.8          |
| PRO-6         | 26          | 46.2           | 3.4             | 19.0          | 17.7         | 1.5          |
| PRO-7         | 17          | 197.4          | 1.0             | 15.8          | 12.4         | 1.8          |
| PRO-8         | 18          | 55             | 2.2             | 11.4          | 10.3         | 1.6          |
| PRO-9         | 19          | 277.3          | 1.6             | 12.0          | 11.0         | 1.6          |

| Sensor number | Code number | PM2.5 [µg/m³] | Geographic mean | Geometric mean | Geometric std |
|---------------|-------------|----------------|-----------------|---------------|--------------|
| PRO-10        | 1           | 166.3          | 1.0             | 11.2          | 9.3          | 1.8          |
| PRO-10        | 2           | 395.1          | 0.7             | 9.9           | 7.5          | 1.8          |
| PRO-10        | 3           | 278.7          | 1.4             | 13.9          | 10.2         | 1.9          |
| PRO-10        | 4           | 652.8          | 2.1             | 9.8           | 9.1          | 1.5          |
| PRO-10        | 5           | 529.4          | 3.4             | 10.1          | 8.4          | 1.6          |
| PRO-10        | 6           | 618.6          | 0.8             | 12.0          | 8.0          | 2.3          |
| PRO-10        | 7           | 163            | 1.4             | 16.3          | 9.0          | 2.4          |
| PRO-10        | 8           | 100.8          | 2.2             | 6.1           | 5.3          | 1.6          |
| PRO-10        | 9           | 222.8          | 6.6             | 21.1          | 19.2         | 1.6          |
| PRO-10        | 10          | 255            | 0.0             | 0.6           | 0.6          | –            |
| PRO-10        | 10          | 652.8          | 2.3             | 22.2          | 17.6         | 2.4          |
| PRO-10        | 20          | 188.8          | 4.9             | 18.6          | 17.5         | 1.4          |
| PRO-10        | 30          | 481.5          | 3.0             | 43.2          | 31.6         | 2.2          |

**A** | **B** | **C**

| Variables | Housewives | Career women | University female teaching staff |
|-----------|------------|--------------|----------------------------------|
| Temperature (°C) | 29.3 ± 1.6 | 29.6 ± 1.2 | 28.4 ± 0.7 |
| Relative humidity (%) | 71.7 ± 11 | 72 ± 4.8 | 77.9 ± 7.8 |

| Average [µg/m³] | Arithmetic mean | Geographic mean |
|-----------------|-----------------|-----------------|
| Housewife (15)  | 16.1 ± 10.0     | 11.8 ± 1.2      |
| University female teaching staff (15) | 15.8 ± 4.0 | 13.9 ± 1.1 |

**Table 3B.** Temperature and relative humidity for each microenvironment in housewives and university female teaching staff.
Discussion

There are few studies regarding the measurement of household or indoor air pollution because of the lack of easy-to-use and mobile sensing equipment. Generally, assessment of PM2.5 concentration is done by fixed station monitors and it cannot represent individual personal exposure conditions. Lacking personal exposure assessment can lead to misinterpretation of actual health effects due to air pollution. Recently, many researchers have paid close attention to the evaluation of the association between personal exposure level of PM2.5 and specific health outcomes. It was reported that assessment of personal exposure to PM2.5 is es-
sential for exposure-response estimation [14]. We have shown in previous animal studies that the constituents of PM2.5 such as diesel exhaust particles (DEP) and diesel exhaust derived secondary organic aerosols (DE-SOA) affect spatial learning ability, novel object recognition ability, and social behaviors [15–19]. Recently, we focused on the effects of exposure to PM2.5 on human health because of rapid urbanization and industrialization leading to the emission of pollutants into our environment. As mentioned above, the assessment of PM2.5 concentration is mostly measured by fixed station monitors and cannot estimate accurate individual exposure level. Therefore, personal exposure assessment is critical to estimate what health problems are due to air pollution.

Our research group introduced the Pocket PM2.5 Sensor (ordinary) for mobile monitoring and reported real-time PM2.5 levels in seven Townships of Yangon, Myanmar [11]. There were some limitations in our previous Pocket PM2.5 Sensor, such as the requirement of a smartphone, a limit of 1 h measurement, no GPS attachment and not much capacity for data storage, etc., so we designed a new, GPS-attached Pocket PM2.5 Sensor [PRO] to measure personal exposure level of PM2.5 in microenvironments for more than 24 hours with a large data storage capacity and without the need of a smartphone. Our newly designed Pocket PM2.5 Sensor [PRO] can be set in the breathing zone, can measure for 45 h continuously, has a quiet fan, can store data for a maximum of 400 days, and can easily analyze data using a CVS file via a USB.

In this study, we selected fifteen middle-aged housewives and fifteen university female teaching staff because they spend more time in indoor environments such as the home or office and are prone to get environment-related lifestyle diseases like hypertension, obesity, metabolic diseases, diabetes and cardiopulmonary diseases. We measured 24 h personal PM2.5 exposure levels with the Pocket PM2.5 Sensor [PRO], and found that there were no differences in the average levels between the housewives (16.1 ± 10.0 µg/m³) and the university female teaching staff (15.8 ± 4.0 µg/m³). The PM concentrations in households increased during gas or charcoal stove cooking and while using mosquito coils and incense sticks, suggesting that lifestyle and routine daily activities of individuals may influence household and office environmental air pollution. We previously studied indoor and outdoor air quality in Yangon city and showed that the outdoor air was contaminated with pollutants emitted from motor vehicles and that the indoor air quality varied with the indoor characteristics of buildings [20].

Regarding other personal exposure devices, it was reported from a person who traveled from the USA to Southeast Asian countries using a low-cost monitor with a Plantower PMS 3003 PM2.5 sensor that the 1 h mean PM2.5 at airports and stations were 32.8 µg/m³, at cafés and public restaurants they were 29.6 µg/m³, and in passenger cars it was 2.3 µg/m³ [21]. However, that report represented only one traveler and the sensor was on the back of the subject. Another report also indicated that the mean 24 h personal exposure was 43.8 µg/m³ for men and 39.7 µg/m³ for women in peri-urban India, assessed by wearing a device that included a MicroPEM (RTI International, Research Triangle Park, NC), camera, GPS device and gravimetric monitor [22]. The researchers mentioned high PM exposure during food preparation, cooking, smoking, and in the industries for men, and particularly in cooking time for women. Using a web-based real-time personal PM2.5 exposure monitoring system for big data for researchers and decision makers was also reported [23], but this system also had some limitations, such as insufficient time and spatial resolution, inaccurate indoor concentration and internet usage timing.

What constituents are contained in PM2.5 is important. Polycyclic aromatic hydrocarbons (PAHs), including benzo [a] pyrene (BaP), [24–26] and nitro-PAHs, and dioxins [27] are carcinogenic compounds detected in PM2.5 We recently developed a sampling method combining a high-volume air sampler (HV) with a PM2.5 impactor for collecting large amounts of PM2.5, and demonstrated that the HV could detect carcinogenic or mutagenic compounds which were not detected by a low volume sampler [28]. As our next step, we plan to collect PM2.5 with the HV sampler and detect the constituents of PM2.5.

The major strength of this study is that our Pocket PM2.5 Sensor [PRO] is equipped with a GPS, is a small and very light device, and can measure PM2.5 concentration continuously for 45 h; it does not need a smartphone, the fan is not noisy, and it can be placed
in the breathing zone at all times except during bathing and sleeping; the concentration level is displayed by changing color; it is easy to use by ordinary people; and the data can be easily analyzed by a CSV file via a USB. Data from our Pocket PM2.5 Sensor [PRO] was calibrated with the fixed station monitor at the National Institute for Environmental Studies, Japan, and a variability assessment was performed between devices. Generally, most PM2.5 data are 24 h average data, but our Pocket PM2.5 Sensor [PRO] can measure every 1 sec and we can assess detailed information such as time, location and activity of individuals. We can also know the maximum level of PM2.5 individually, thus we can take caution to prevent and protect against exposure. The limitations of the Pocket PM2.5 Sensor [PRO] are that it can measure up to only 999.9 µg/m³, cannot detect wind speed and direction, cannot see real PM2.5 concentration as our previous Pocket Sensor (ordinary), and needs to be recalibrated at the local area, Yangon City fixed station PM2.5 monitor.

**Conclusion**

In conclusion, the level of personal exposure to PM2.5 may be influenced by the activities of specific population groups in microenvironments [29]. Many researchers have tried to develop a personal PM2.5 sensor or a device that is low-cost, easy to use, has no technical requirement, and has accurate data analysis. Such an efficient device or sensor would be helpful for exposure-response assessment before and after intervention. Our study indicates that the Pocket PM2.5 Sensor [PRO] can be used for continuous assessment of personal exposure level with mobile sensing, is easy to use, and has rapid data analysis. In future, we plan to reduce indoor air pollution by giving health education to the public regarding lifestyle in microenvironments.

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**Conflict of Interest**

The authors declare that there is no conflict of interest.

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