Community Education on Air Pollution–Related Skin Health Integrated with a Micellar Water Workshop in Jakarta

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| Abstract | Jakarta is one of the most polluted cities in Indonesia, which often exceeds safe health standards. Despite growing evidence linking air pollution to dermatological conditions, public knowledge and preventive behavior in urban communities remain limited and poorly addressed in community health programs. The objective of this program is to increase community knowledge about the effects of air pollution on skin health through a community-based education model that integrates pre-test and post-test assessments with practical activities. The program was conducted in three phases: pre-implementation, including material preparation and pretest-posttest assessment design; implementation, including a health education session and a practical workshop on micellar water formulation; and post-implementation, through evaluation and reporting. The activity was held on October 15, 2025, with 30 participants. Results showed a statistically significant improvement in participant knowledge, as measured by a paired t-test (p<0,05), with average scores increasing from 53.0 to 65.67. The assessment was conducted using a 10-question questionnaire before and after the activity. This activity highlights the potential of integrated educational and practical approaches to improve community understanding of environmental health risks and support the adoption of preventive self-care practices. |

1.   INTRODUCTION

Air pollution is an escalating public health issue in many urban centers, including Jakarta. Concentrations of airborne pollutants such as fine particulate matter (PM2.5), carbon monoxide, and nitrogen dioxide frequently exceed safe limits, as reported by the World Health Organization (Anandari et al., 2024). In fact, Jakarta ranks as the most polluted city in Indonesia, with consistently high PM2.5 levels (Syuhada et al., 2023). While the respiratory consequences of air pollution, such as asthma, chronic obstructive pulmonary disease (COPD), and other pulmonary conditions, are well documented (Manisalidis et al., 2020)Its impact on skin health remains underrecognized (Fahmi et al., 2023; Kambira et al., 2024). Exposure to airborne pollutants and oxidative stress from free radicals has been linked to dermatological conditions, including acne, hyperpigmentation, atopic dermatitis, and psoriasis (Roberts, 2021).

The skin, as the body's first line of defence, serves both protective and aesthetic roles. Maintaining skin health is therefore essential not only for physical appearance but also for overall physiological well-being (Institute for Quality and Efficiency in Health Care (IQWiG), 2006). However, public awareness of the relationship between environmental factors and skin health remains relatively low (Haykal et al., 2025; Ramírez et al., 2019; Saptutyningsih & Kamiel, 2021). Contributing aspects such as diet, stress, and lifestyle are often overlooked in daily health practices (Sahawneh, 2024; Saptutyningsih & Kamiel, 2021). Community service has been a highly effective means of increasing public awareness (Mahmudatun Nabila et al., 2021). However, there is still very limited community engagement that integrates air pollution issues with practical skin care. The *Ruang Publik Terpadu Ramah Anak* (RPTRA), or Child-Friendly Integrated Public Space, serves as an ideal platform to reach urban populations. Designed to support community activities and aligned with the Family Empowerment and Welfare program, RPTRA attracts diverse community groups, including women and children who are particularly vulnerable to environmental risks (Budi, 2016). RPTRA Sutra Indah 3 was selected as the program site due to its location in an urban area with high exposure to air pollution, which may increase the risk of environment-related skin health issues. The objective of this program is to increase community knowledge about the effects of air pollution on skin health through a community-based education model that integrates pre-test and post-test assessments with practical activities. This approach builds upon the success of previous community-based initiatives, such as school outreach and women's group programs, which

demonstrated measurable improvements in health-related knowledge (Fahmi et al., 2023; Kambira et al., 2024).

To strengthen engagement and promote practical understanding, the program also includes a complementary hands-on session. Micellar water formulation workshops are still very limited in community service programs; thus, this novel workshop may enhance the value of this program. In this session, participants are introduced to the formulation of natural micellar water using safe, readily accessible ingredients. While not the primary focus, the workshop serves as an effective medium for reinforcing theoretical concepts and encouraging active participation. By combining scientific education with practical application, this initiative seeks to foster increased awareness, community involvement, and sustainable skin health practices among urban residents in Jakarta. It is expected that the program will support behavioural change by equipping participants with both knowledge and applicable skills.

2. METHODS

This community service program applied a community-based education model that integrated pre-test and post-test assessments with practical activities. The implementation method is generally divided into three stages: pre-implementation, implementation, and post-implementation (Figure 1). During the pre-implementation stage, activities include technical and non-technical preparations, such as material procurement, testing the micellar water formulation, and developing educational materials and assessments. The assessment was conducted in Indonesian, as per our community target, and is shown in Table 1. It consists of 10 questions, each worth 10 points, for a total of 100 points. The questions are based on the educational material and the workshop process. Questions 1 to 3 focus on participants' understanding of air pollution sources, their effects on skin health, and basic preventive measures. Questions 4 to 6 assess general knowledge about micellar water, including its function and role in daily skincare routines. Meanwhile, questions 7 to 10 test familiarity with the ingredients and formulation steps introduced during the hands-on workshop.

Table 1. Assessment of respondent knowledge of air pollution, skin health, and micellar water

No	Questions	Answer	
1	Salah satu sumber polusi udara berasal dari polusi rumah tangga.	o **Benar**	o Salah
2	Salah satu dampak dari polusi udara pada	o Benar	o **Salah**

kesehatan kulit adalah infeksi jamur.

3	Perlindungan kulit dari polusi udara dapat dilakukan dengan menggunakan tabir surya dan produk dengan antioksidan.	○ **Benar**	○ Salah
4	Micellar water merupakan larutan pembersih berbasis air.	○ **Benar**	○ Salah
5	Penggunaan micellar water harus dibilas dengan air setelah digunakan.	○ Benar	○ **Salah**
6	Micellar water dapat mendukung perawatan kulit sehari-hari	○ **Benar**	○ Salah
7	Bahan aktif dalam sediaan micellar water adalah larutan cocoamidopropyl betaine.	○ Benar	○ **Salah**
8	DMDM Hydantoin dalam micellar water berfungsi sebagai pelarut.	○ Benar	○ **Salah**
9	Salah satu bahan dari micellar water adalah gliserin yang berfungsi untuk humektan.	○ **Benar**	○ Salah
10	Langkah pertama dalam pembuatan micellar water adalah mengambil 15 mL cocoamidopropil betaine dan dimasukkan ke dalam labu erlenmeyer.	○ Benar	○ **Salah**

The implementation stage includes an initial assessment through a pre-test. Prior to participation, all individuals provided informed consent to participate in the activity and to complete the assessment voluntarily. The pre-test was administered immediately before the educational session began, and the post-test was conducted after both the lecture and the hands-on workshop. Each assessment lasted approximately 10 minutes and was delivered in paper-based questionnaires. Participants completed the tests individually under supervision to ensure consistency and minimize external influence. A similar procedure was followed for the post-test section. After that, a lecture on pollution and its hazards, particularly its effects on facial skin health, was delivered. This stage continues with a Q&A session and a post-test. Finally, the micellar water formulation workshop was done. The practical stage consisted of a hands-on workshop in which participants formulated micellar water using basic cosmetic ingredients. Materials used included cocamidopropyl betaine, glycerin, DMDM hydantoin, bilberry extract, and distilled water. Tools provided for each participant included a beaker, a stirring rod, a measuring cylinder, and a plastic bottle for final packaging. The workshop, guided step by step by facilitators, lasted

approximately 45 minutes and allowed each participant to prepare and take home their own product.

The post-implementation stage involved data analysis using a paired t-test with a 95% confidence interval, followed by report preparation. The target group for this activity was members of the RPTRA Sutra Indah 3 community in Jakarta. The community service activity was held on Wednesday, October 15, 2025, and involved 30 community members. Participants were recruited voluntarily and provided informed consent prior to their involvement in the program.
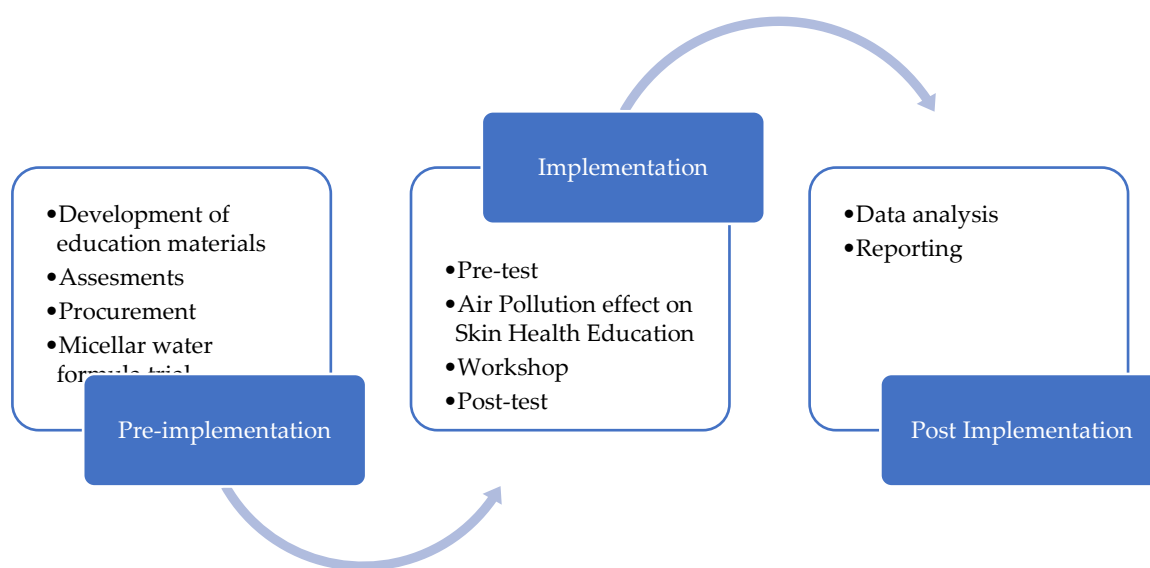

Figure 1. Step Community-Based Skin Health Education and Homemade Micellar Water Workshop

3. FINDINGS AND DISCUSSION

The community service activity was conducted on October 15, 2025, targeting the RPTRA community. This location was selected because the urban community is at the highest risk of air pollution-related skin problems. Moreover, the majority of participants are women, who are known to have a high need to maintain skin health. Additionally, older women are at a higher risk of developing skin-related issues, including air pollution-induced(Kitagaki, 2023). The activity was attended by 30 participants, all of whom were women. The demographic distribution is shown in Figure 2. The largest age group is 50–59 years, comprising 37% of the population, followed by the 40–49 age group at 33%. Only 20% of participants are younger than 40.
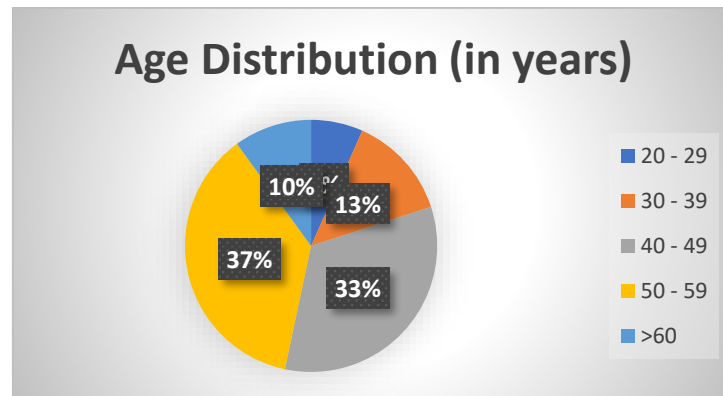
Figure 2. Respondent Age Distribution at RPTRA Sutra Indah 3 Community Engagement Program

3.1. Air Pollution Effect on Skin Health Education

Public understanding of skin-related issues caused by air pollution remains relatively low. To address this, knowledge-enhancement efforts were carried out through a lecture session(Saptutyningsih & Kamiel, 2021). Several approaches have been proven to deliver knowledge, include lecturing sections. Lecture sessions have previously been shown to increase public awareness in various community service programs, such as the Maternal and Child Health (KIA) book education program, to improve mothers' knowledge (Dewi et al., 2025).

To evaluate the impact of the lectures, an initial assessment was conducted. Knowledge was measured using a 10-question test, with each correct answer worth 10 points, making a total possible score of 100. The scores were then classified into five categories (Susanto et al., 2025). The average pre-test score was 53.0, which falls into the "moderate" category. However, more than 50% of participants scored in the "poor" or "very poor" categories, indicating significant room for improvement in this area (Figure 3).
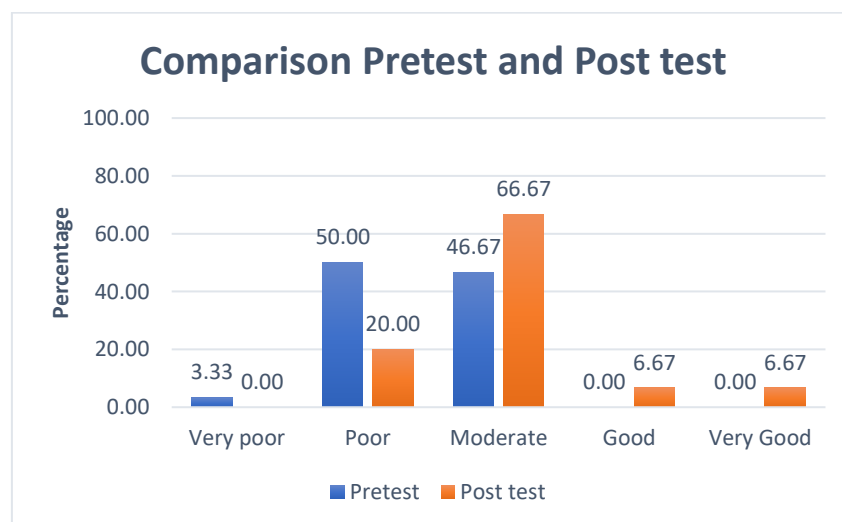

Figure 3. Comparison of Pre-Test and Post-Test Scores Among Participants

All age groups showed improvement in knowledge after the intervention (Table 2). The highest increase was seen in the 20–29 age group, which rose from 50.00 to 65.00. The >60 age group achieved the highest post-test score at 73.33, followed by the 50–59 group, which improved from 52.73 to 67.27. These results indicate that the educational activity was effective across different age ranges.

Table 2. Pre-Test and Post-Test Scores by Age Group of Participants

Age	Pretest	Post test
20 - 29	50	65
30 - 39	50	60
40 - 49	53	64
50 - 59	52,73	67,27
>60	60,00	73,33

The lecture session began with an introduction to air pollution and its various sources, including local pollution issues in Jakarta. This was followed by a discussion on different skin problems related to pollution and preventive measures to maintain skin health. A Q&A session was then held to enhance participant engagement (see Figure 4).

A final assessment was conducted before the workshop session using the same questions as in the initial test. The average score increased from 53.0 (moderate) to 65.67 (good). The percentage of participants in the "poor" knowledge category decreased from 50% to 20%, while those in the "moderate" category increased to 66.67%. Notably, the "good" and "very good" categories rose from 0% to 6.67%. This result was relatively comparable to the lip health education and lip balm workshop, where a significant increase in the "good" category was observed, rising from 31.91 percent to 89.36 percent (Arrang et al., 2025). In the study by Fahmi (2023 nearly 100 percent of participants demonstrated a strong understanding after the intervention. However, the assessment consisted of only five questions, which may have limited the depth and accuracy of the evaluation (Fahmi et al., 2023). In both studies, no statistical analysis was performed. A paired t-test was used to evaluate statistically significant differences within the same group after an intervention, such as lecturing (Susanto et al., 2025). The difference in knowledge before and after the lecture was statistically significant, as indicated by a paired t-test ($t = 4.91$, $p < 0.05$), suggesting a meaningful improvement in knowledge levels following the session.

Figure 4. Participant of the Community Engagement Program in RPTRA Sutra Indah 3, Jakarta

3.2. Workshop on Homemade Micellar Water

Experiential learning has been shown to enhance understanding of specific topics significantly (Rahmi, 2024). This has been demonstrated in various educational activities, particularly those that combine workshops and lectures, which are effective in improving participant comprehension. Similar approaches, which combine education and workshops already been done for high school students regarding lip health and show promising results (Arrang et al., 2025).

In this study, a workshop was conducted on the formulation of homemade micellar water using cocoyl betaine as a surfactant. Micellar water is a cosmetic product used for facial cleansing without rinsing (Taieb et al., 2021). Its regular use is believed to improve skin health, particularly in protecting against the effects of air pollution. Additionally, the micellar water formula in this workshop was enriched with natural bilberry extract, known for its antioxidant properties. Antioxidants support skin regeneration and help mitigate damage caused by free radicals generated from air pollution (Fitri et al., 2023).

Figure 5. Homemade Micellar Water Workshop

The workshop consisted of two main steps: mixing and filling. The mixing process began by combining cocamidopropyl betaine and bilberry extract in a glass beaker. DMDM hydantoin, used as a preservative, was then added to the mixture and stirred thoroughly. After that, 15 mL of glycerin was incorporated into the solution. Glycerin functions as a humectant, helping to retain skin moisture and improve the texture of the final product. Finally, distilled water was added to reach the desired final volume. Once mixing was completed, the solution was transferred into containers during the filling step. Exactly 8 mL of micellar water was measured using a measuring cylinder and poured into each bottle. The bottles were then sealed, and the micellar water was ready for use.

To ensure participant safety, all materials used in the formulation were cosmetic-grade and handled under hygienic conditions. Participants were instructed to perform a patch test before regular use. The final product was intended solely for personal, non-commercial use, and its preparation was designed as an educational exercise rather than a replacement for professionally manufactured skincare products. Limitations of the homemade formulation include a lack of clinical testing, potential variability in ingredient measurements, and a shorter shelf life due to simplified preservation methods.

This community service activity had several limitations. The small number of participants and the short-term nature of the assessment may limit the generalizability of the results. Additionally, the impact on long-term behavior change could not be measured within the program's timeframe. Despite these limitations, the positive response and knowledge improvement observed suggest that this model could be further developed. Future programs should consider expanding the participant base, incorporating follow-up evaluations, and exploring integration with local health campaigns or community policies to strengthen environmental health awareness at a broader level.

Overall, the workshop offered participants a valuable opportunity to apply newly acquired knowledge through direct practice. The interactive community program increased the participants' engagement. This practical session effectively complemented the educational component, leaving a lasting impression on participants' health behaviors.

4. CONCLUSION

This community-based program successfully achieved its objective of increasing public knowledge about the impact of air pollution on skin health, as demonstrated by a statistically significant improvement in participants' test scores. The average pre-test

score was 53.0, which increased to 65.67 after the intervention (p < 0.05). The combination of structured education and a hands-on micellar water workshop effectively enhanced participant engagement and practical understanding. Although limited by a small sample size and short-term evaluation, the program shows potential to support skin health awareness and promote simple preventive practices at the community level. Future initiatives should involve larger participant groups and collaboration with local health stakeholders to extend impact and sustainability.

REFERENCES

Anandari, A. A., Farid Wadjdi, A., & Harsono, G. (2024). Dampak Polusi Udara terhadap Kesehatan dan Kesiapan Pertahanan Negara di Provinsi DKI Jakarta. *Journal on Education*, *06*(02).

Arrang, S. T., Dewi, K. P., Prasetyanto, Y. E. A., Vivian, A. C. L., F. S. H., F., W., K. C. M., L., C., S., P., Y. B. I. D. P. W., & Kristoforus, Y. (2025). Edukasi Kesehatan Bibir dan Pembuatan Lip Balm di SMK Farmasi Kristen Penabur Jakarta. *Mitramas, Jurnal Pengabdian DanPemberdayaan Masyarakat*, *3*(1).

Budi. (2016). Pemanfaatan RPTRA sebagai Pusat Kegiatan Pengabdian Masyarakat. *Jurnal Pengabdian & Kewirausahaan*, *1*(1).

Dewi, U. M., Novianti, H., Munjidah, A., & Masita, E. D. (2025). The Use of the Maternal and Child Health (KIA) Book as a Medium to Improve Mothers' Knowledge and Skills in Toddler Development Stimulation: A Community Service in Wage Village, Sidoarjo. *Amalee: Indonesian Journal of Community Research and Engagement*, *6*(2), 401–410.

Fahmi, A. G., Suryaneta, H., K. Y., P., T., S., I. P., & Auli, W. N. (2023). Program Peningkatan Kesadaran Kesehatan Kulit pada Kelompok PKK di Kecamatan Way Tuba, Way Kanan, Lampung. *Warta LPM*, 471–480. https://doi.org/10.23917/warta.v26i4.1733

Fitri, H. A., Maulani, F., Astuti, I. Y., Kunci, K., & Antipolutan, (2023). Formula Optimization of Antipollutant Micellar Water Containing Red Roselle Flower (Hibiscus sabdariffa L. var. roselindo) Extract. *PHARMACY: Jurnal Farmasi Indonesia*, *21*(2). https://jurnalnasional.ump.ac.id/index.php/PHARMACY

Haykal, D., Lim, H. W., Calzavara-Pinton, P., Fluhr, J., Cartier, H., & Berardesca, E. (2025). The impact of pollution and climate change on skin health: Mechanisms, protective strategies, and future directions. *JAAD Reviews*, *6*, 1–11. https://doi.org/10.1016/j.jdrv.2025.05.001

Kambira, P. F. A., Khosasi, V., Juwono, J., Yen, Y., Novi Meliana, F., Claudia Limardi, F., & Dansen Fernandes, F. (2024). Peningkatan Pengetahuan Kesehatan Kulit

pada Siswa SMA Methodist Jakarta Utara melalui Kegiatan Promosi Kesehatan. *Mitramas : Jurnal Pengabdian Dan Pemberdayaan Masyarakat*, *2*(1).

Kitagaki, H. (2023). Skin Health of the Elderly and People in Long-term Care. *Current Cosmetic Science*, *2*. https://doi.org/10.2174/2666779702666230320125811

Manisalidis, I., Stavropoulou, E., Stavropoulos, A., & Bezirtzoglou, E. (2020). Environmental and Health Impacts of Air Pollution: A Review. *Frontiers in Public Health*, *8*. https://doi.org/10.3389/fpubh.2020.00014

Institute for Quality and Efficiency in Health Care (IQWiG). (2006). *In brief: How does skin work? [Updated 2025 Apr 22].* Https://Www.Ncbi.Nlm.Nih.Gov/Books/NBK279255/.

Rahmi, W. (2024). Analytical Study of Experiential Learning: Experiential Learning Theory in Learning Activities. *EDUKASIA: Jurnal Pendidikan Dan Pembelajaran*, *5*(2), 115–126. https://doi.org/10.62775/edukasia.v5i2.1113

Ramírez, A. S., Ramondt, S., Van Bogart, K., & Pérez-Zúñiga, R. (2019). Public Awareness of Air Pollution and Health Threats: Challenges and Opportunities for Communication Strategies To Improve Environmental Health Literacy. *Journal of Health Communication*, *24*(1), 75–83. https://doi.org/10.1080/10810730.2019.1574320

Roberts, W. (2021). Air pollution and skin disorders. *International Journal of Women's Dermatology*, *7*(1), 91–97. https://doi.org/10.1016/j.ijwd.2020.11.001

Sahawneh, P. (2024). Factors Influencing Skin Health from Within. *Journal of Integrated Health*, *3*(1), 156–163.

Saptutyningsih, E., & Kamiel, B. P. (2021). Raising Public Awareness of Air Pollution and How to Mitigate The Health Risk. *Jurnal Warta LPM*, *24*(4), 636–645.

Susanto, S., Christian, Y. E., Susanto, M. D., Putri, F. S., Nababan, A. A., & Gunawan, U. (2025). Pengenalan Simbol dalam Kemasan Obat pada Masyarakat di Area Car Free Day Jakarta. *Prima Abdika: Jurnal Pengabdian Masyarakat*, *5*(2), 242–249. https://doi.org/10.37478/abdika.v5i2.5598

Syuhada, G., Akbar, A., Hardiawan, D., Pun, V., Darmawan, A., Heryati, S. H. A., Siregar, A. Y. M., Kusuma, R. R., Driejana, R., Ingole, V., Kass, D., & Mehta, S. (2023). Impacts of Air Pollution on Health and Cost of Illness in Jakarta, Indonesia. *International Journal of Environmental Research and Public Health*, *20*(4), 2916. https://doi.org/10.3390/ijerph20042916

Taieb, C., Gayraud, F., Dinet, D., & Sayag, M. (2021). Interest in Micellar Solution to Reduce Unpleasant Skin Sensations. *Clinical, Cosmetic and Investigational Dermatology*, *Volume 14*, 1017–1022. https://doi.org/10.2147/CCID.S318802