



Improving Adolescent Health Literacy on Systemic Lupus Erythematosus Through a School-Based Educational Seminar: A Community Service Program (LUPUS CERDAS)

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Abstract

Background: Awareness of Systemic Lupus Erythematosus (SLE) is critically low among Indonesian adolescents, despite clinical evidence showing that approximately 52% of pediatric cases occur between the ages of 11 and 15. This study evaluated the effectiveness of a health education seminar conducted during a community service program entitled “*LUPUS CERDAS: Cekatan, Energik, Responsif, dan Sadar Sehat*” in improving health literacy regarding SLE, photoprotection, and physical activity among junior high school students.

Methods: A quasi-experimental one-group pre-test/post-test design was conducted at SMPN 2 Jatinangor, involving 35 students from Grades 7 to 9. Data were collected using a validated 20-item multiple-choice questionnaire and a thematic qualitative feedback form.

Results: There was a statistically significant improvement in knowledge scores, increasing from a mean of 72.29 ± 12.97 to 81.71 ± 15.34 ($p < 0.001$), representing a 13.04% gain from the baseline. Qualitatively, 57.1% of students identified the pathology of Lupus as the most engaging topic due to its novelty, while 85.7% rated the visual educational aids as “Very Helpful.” Notably, the study identified a “Silent Knowledge Gap,” with 28.6% of participants remaining uncertain about their family medical history regarding autoimmune symptoms.

Conclusions: Targeted community service interventions are powerful tools in enhancing adolescent health literacy. By providing students with an evidence-based framework for understanding autoimmune triggers, these programs increase awareness regarding early recognition and family health communication. Future outreach should prioritize the integration of mental health and lifestyle management into school-based health curriculum.

INTRODUCTION

Systemic Lupus Erythematosus (SLE) is a prototypical autoimmune disease characterized by a loss of self-tolerance and a clinical course marked by unpredictable flares and remissions (Piga and Arnaud, 2021; Fanouriakis et al., 2023). Due to its heterogeneous nature, SLE can manifest in multiple organ systems, including the joints, skin, kidneys, and central nervous system. This "great imitator" characteristic often leads to diagnostic delays and significant misunderstanding among the general public (Piga and Arnaud, 2021; Tear et al., 2025). Although SLE may develop in individuals of any sex and age, around 90% of cases occur in females, with the peak incidence observed during puberty and the reproductive years (15–45 years), when fluctuations in sex hormones contribute to increased disease susceptibility. (Cavalcanti et al., 2021; Yang et al., 2023). In the Indonesian context, a clinical study conducted at Dr. Hasan Sadikin General Hospital in Bandung reported that 52% of pediatric SLE patients were aged between 11 and 15 years (Ghrahani et al., 2018). This local evidence highlights that the adolescent period is a critical window for disease onset, necessitating robust health education and early screening within school environments to identify early clinical manifestations (Ghrahani et al., 2018).

A hallmark feature of SLE is photosensitivity, an abnormal cutaneous response to ultraviolet (UV) radiation (He et al., 2025). Exposure to both UVA and UVB light induces keratinocyte apoptosis, which promotes the release of nuclear autoantigens and the subsequent production of autoantibodies, potentially triggering systemic flares (Corbin et al., 2023; He et al., 2025). Evidence suggests that consistent use of high SPF, broad-spectrum sunscreens, which provide a barrier against both UVA and UVB rays, and the avoidance of peak sun hours (10:00 AM to 4:00 PM) are essential non-pharmacological interventions for risk mitigation and disease stabilization (Cavalcanti et al., 2021; Barbhaiya et al., 2023).

In addition to environmental protection, lifestyle modifications such as regular physical activity serve as a critical pillar for holistic health (Simpson et al., 2015). Evidence suggests that moderate-intensity exercise

enhances immune cell circulation and provides significant psychological benefits, including the reduction of fatigue, anxiety, and depressive symptoms commonly associated with chronic autoimmune conditions (Dwyer, Durcan and Wilson, 2017; Forte, Branquinho and Ferraz, 2022).

Sedentary lifestyle is associated with chronic low-grade inflammation, while acute, exhaustive, or excessive exercise can lead to temporary immunosuppression, often referred to as the "open window" theory (Nieman and Wentz, 2019). In individuals with autoimmune predispositions, excessive physical stress can provoke pro-inflammatory responses. Therefore, establishing a clear distinction between moderate and excessive activity is a vital component of adolescent health literacy, as structured moderate exercise is proven safe and effective in reducing fatigue and anxiety without inducing SLE flares (Dwyer, Durcan and Wilson, 2017; Luo et al., 2024). Health literacy refers to the ability to obtain, understand, evaluate, and apply health information to support appropriate health-related decisions and preventive behaviors. Improving health literacy during adolescence is particularly important because this developmental stage strongly influences long-term lifestyle patterns, disease prevention practices, and future health outcomes (Sarhan et al., 2023; Mancone et al., 2024).

Adolescence is a critical developmental period for establishing long-term health behaviors, yet traditional didactic lectures are frequently ineffective for this demographic. Research indicates that adolescents respond best to educational content that is brief, highly visual, and interactive (Sawyer et al., 2018). Programs that integrate short theoretical modules with practical demonstrations, such as applying sun protection or performing quick exercise routines, within a condensed timeframe (under two hours) yield significantly higher immediate knowledge retention (Patton et al., 2016). According to the World Health Organization (WHO) and regional health guidelines, adolescents should engage in at least 60 minutes of moderate-to-vigorous physical activity daily to maintain optimal cardiovascular and immunological function

(Bull et al., 2020).

Furthermore, modern health interventions emphasize the importance of qualitative feedback mechanisms. By incorporating open-ended questions and thematic analysis, educators can contextualize quantitative gains within the lived experiences and familial health patterns of the participants. This mixed-methods approach not only improves program efficacy but also fosters deeper engagement by addressing the specific curiosity and perceived needs of the community (Josephine and Widhani, 2023).

Despite these proven benefits, there remains a significant “Silent Knowledge Gap” regarding the clinical nature of SLE and the efficacy of preventive lifestyle measures among adolescents. To address this issue, a community service program entitled “LUPUS CERDAS” (“*Lupus, Cekatan, Energik, Responsif, dan Sadar Sehat*”) was conducted at a junior high school setting. “LUPUS CERDAS” refers to the title of the educational event and not to a specific intervention model or educational framework.

The educational method used in this program consisted of a brief school-based health education seminar delivered using interactive lectures, visual educational aids, practical demonstrations of sunscreen application, and guided discussion regarding physical activity. This approach was selected because adolescents tend to respond better to short, interactive, and visually engaging educational sessions that facilitate immediate knowledge retention and contextual understanding of health information.

Therefore, this study aimed to evaluate the effectiveness of the educational seminar conducted during the “LUPUS CERDAS” community service program in improving adolescents’ knowledge regarding Systemic Lupus Erythematosus, photoprotection, and moderate physical activity.

METHODS

Research design

This study employed a quasi-experimental one-group pretest – post test design. The design is widely recognized in educational and public health interventions as an effective

method for evaluating immediate knowledge gain when a randomized control group is not feasible (Rogers and Revesz, 2019). By assessing baseline knowledge prior to the session and comparing it with post-intervention results, the study directly measures the effectiveness of the educational seminar conducted during the “LUPUS CERDAS” community service program.

Study Setting and Participants

The intervention was conducted on 18 December 2024 at SMPN 2 Jatinangor, Sumedang, West Java, Indonesia. The study population consisted of approximately 900 students enrolled in grades 7–9. The minimum sample size was calculated using the following finite population sampling formula:

$$n = \frac{N}{1 + N(e)^2}$$

where n = sample size, N = population size, and e = margin of error (Tejada, Raymond and Punzalan, 2012; Sari et al., 2025).

$$n = 900 / (1 + 900(0.1)^2)$$

$$n = 900 / (1 + 9)$$

$$n = 900 / 10 = 90$$

However, as this activity was implemented as a one-time community service educational program with voluntary participation, the final sample consisted of 35 students who attended the session and agreed to participate. Voluntary convenience sampling was used to recruit participants. Inclusion criteria included students enrolled in grades 7–9 at SMPN 2 Jatinangor who attended the educational seminar and agreed to participate in the study. Participants were also required to complete both the pre-test and post-test questionnaires.

Exclusion criteria included students who experienced difficulties in participating in the educational session or questionnaire process due to absence during substantial parts of the seminar, inability to understand the questionnaire instructions, or incomplete questionnaire responses that could affect the validity of the data analysis.

Variables

The independent variable in this study was a school-based educational seminar conducted during the “LUPUS CERDAS” community service program. The seminar consisted of interactive lectures, visual educational materials, sunscreen demonstrations, and education regarding moderate physical activity. The primary dependent variable was adolescent health literacy regarding SLE, photoprotection, and physical activity, which was measured quantitatively using pre-test and post-test

questionnaire scores.

In addition, qualitative variables explored in this study included students’ engagement during the educational session, interest in educational topics, perceived usefulness of visual educational materials, and awareness regarding family medical history related to autoimmune diseases. Potential bias may have arisen from self-reported responses and the absence of a control group, which are recognized limitations in quasi-experimental educational studies (Rogers and Revesz, 2019).

Instruments and procedures

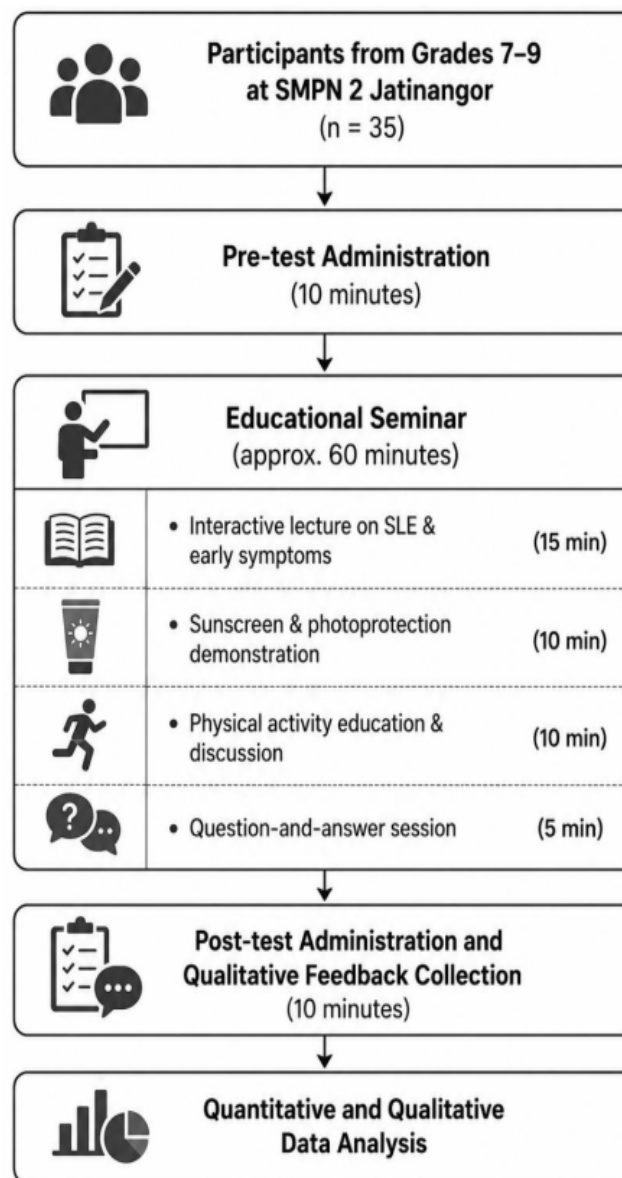


Figure 1. Overview of Participant Recruitment, Educational Intervention, and Data Collection Process

This study was conducted as part of a community service program entitled “*LUPUS CERDAS*” (“*Cekatan, Energik, Responsif, dan Sadar Sehat*”). “*LUPUS CERDAS*” refers to the title of the community engagement activity and not to a specific intervention model or educational framework. The educational intervention used in this program consisted of a structured health education seminar delivered using a pre-test and post-test approach to evaluate changes in students’ knowledge.

The seminar included three main educational topics: (1) an interactive lecture on SLE and its early symptoms, (2) a visual and practical demonstration of sunscreen use and photoprotection strategies, and (3) education regarding moderate physical activity and healthy lifestyle behaviors. Educational materials were delivered using PowerPoint presentations, posters, visual illustrations, and direct demonstrations to improve student engagement and comprehension.

The educational session was conducted in a single-session format lasting approximately 60 minutes. The procedure consisted of: (1) Program introduction and pre-test administration (10 minutes), (2) an interactive educational lecture on SLE (15 minutes), (3) sunscreen and photoprotection demonstration (10 minutes), (4) moderate physical activity education and discussion (10 minutes), (5) a question-and-answer session (5 minutes), and (6) post-test administration and participant feedback collection (10 minutes).

Students’ knowledge regarding SLE, photoprotection, and moderate physical activity was assessed using a researcher-developed 20-item multiple-choice questionnaire administered before and after the seminar. The questionnaire was developed based on the educational materials delivered during the session. Prior to implementation, the content of the questionnaire was reviewed and validated by an internal medicine specialist to ensure the scientific accuracy and relevance of the items. In addition, face validity assessment was conducted among three junior high school

students outside the study sample to evaluate the clarity, readability, and comprehensibility of the questionnaire items. Minor revisions in wording were subsequently made to ensure that the questions were easily understood according to the cognitive level of adolescents.

Statistical analysis

Quantitative data were processed using Paired-Samples T-Tests to determine the significance of knowledge improvement. To ensure the robustness of the findings, the Wilcoxon Signed-Rank Test was also applied as a non-parametric alternative with a significance level of $p < 0.05$ (Richardson, 2015). Data analysis was performed using IBM SPSS Statistics (Version 27). Qualitative responses were analysed descriptively using simple thematic categorization based on recurring response patterns.

Ethical clearance

This activity was conducted as part of a community service program involving a non-invasive health education seminar and questionnaire-based assessment. Official permission to conduct the activity was obtained from SMPN 2 Jatinangor through an authorization letter issued by Universitas Padjadjaran (No.6825/UN6.Q.1/TU.00/2025), and the school administration welcomed and supported the implementation of the program. Participation was voluntary, and participant anonymity and confidentiality were maintained throughout the study.

RESULTS AND DISCUSSION

A total of 35 junior high school students participated in the educational intervention. Most participants were female students (85.7%), while male students accounted for 14.3% of the sample. Based on grade level, the majority of participants were from Grade 7 (57.1%), followed by Grade 8 (37.1%) and Grade 9 (5.7%). These findings indicate that the intervention primarily involved early adolescent students from junior high school.

Table 1. Characteristics of Participants (n = 35)

Variable	Category	n	%
Gender	Female	30	85.7
	Male	5	14.3
Grade	Grade 7	20	57.1
	Grade 8	13	37.1
	Grade 9	2	5.7

Knowledge Gain Analysis

The quantitative data demonstrated a marked improvement in student understanding following the intervention. The mean pre-test score was 72.29 ± 12.97 , while the mean post-test score increased to 81.71 ± 15.34 , indicating

an overall improvement in knowledge following the educational intervention. The mean difference between post-test and pre-test scores was 9.43 ± 11.81 points, corresponding to a 13.04% improvement relative to baseline.

Table 2. Descriptive Statistics of Pre-test and Post-test Scores among junior high school students

Variable	Mean $\pm$ SD	Mean Difference	Improvement (%)
Pre-test	72.29 ± 12.97	–	–
Post-test	81.71 ± 15.34	$+9.43 \pm 11.81$	13.04%

A paired sample t-test was conducted to compare pre-test and post-test scores. The analysis demonstrated a statistically significant increase in post-test scores compared to pre-test scores: $t(34) = 4.73$, $p < 0.001$

To confirm the robustness of the findings, a Wilcoxon signed-rank test was also performed, which showed a consistent statistically significant difference: $V = 64.5$; $p < 0.001$

Table 3. Inferential Statistical Analysis of Pre-test and Post-test Scores

Statistical Test	Test Statistic	p-value	Interpretation
Paired sample t-test	$t(34) = 4.73$	< 0.001	Significant
Wilcoxon signed-rank test	$V = 64.5$	< 0.001	Significant

These results indicate that the educational intervention led to a statistically significant and meaningful improvement in students' knowledge levels. The observed 13.04% increase in mean score, together with a highly significant p-value ($p < 0.001$), suggests that the improvement was unlikely to have occurred by chance. The agreement between parametric and non-parametric test results further strengthens the reliability of the findings.

Qualitative Findings

Qualitative responses from the questionnaire indicated a high level of engagement among students toward the educational session. Most participants reported that the topic was interesting, relevant, and easy to understand, particularly when examples were linked to daily life and common health situations. Students demonstrated curiosity by actively asking questions and expressing interest in understanding how health information

relates to themselves and their families.

Several responses suggested that the interactive delivery approach helped maintain attention and facilitated comprehension, indicating that the topic was well aligned with the cognitive and developmental level of the students. Overall, the qualitative feedback supports the quantitative findings, showing that the intervention was not only effective in improving test scores but also successful in engaging students cognitively and emotionally.

Qualitative responses from the questionnaire also suggest that the topic of SLE generated the highest level of interest among students primarily because it was new and unfamiliar to them (Figure 1). Many students reported that they had never previously encountered information about SLE in school lessons or daily discussions, which contributed to heightened curiosity and engagement during the session.

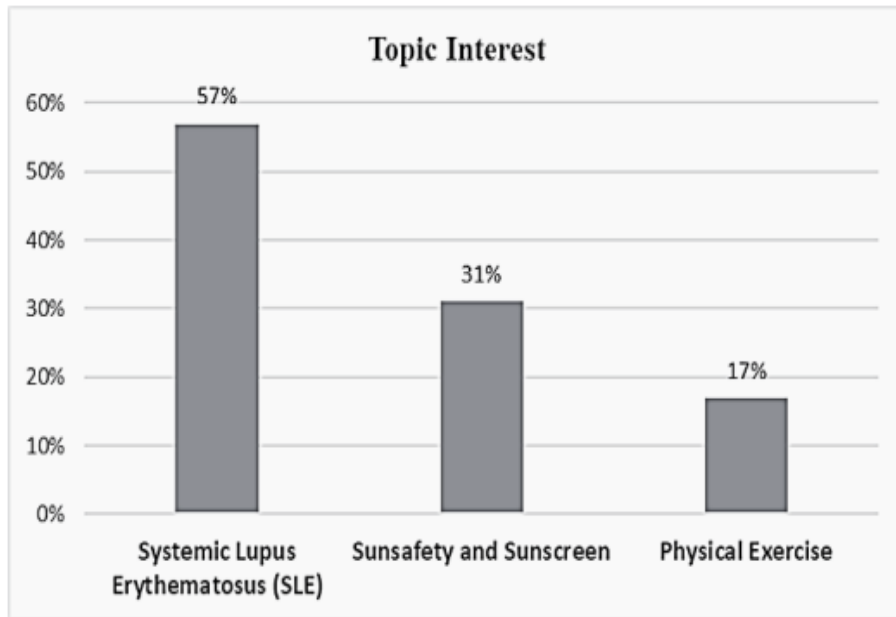


Figure 2. Distribution of students' preferred educational topics during the LUPUS CERDAS seminar.

The novelty of the topic played a central role in attracting students' attention. Unlike more commonly discussed health topics, SLE was perceived as a condition that is rare, complex, and not widely recognized, particularly among school-aged populations. This unfamiliarity encouraged students to actively seek explanations, ask questions, and engage more deeply with the learning material.

In addition, the discussion of SLE helped students connect health education with real-world contexts, including chronic illness, family health, and long-term disease management. This relevance, combined with the novelty of the topic, appeared to enhance students' motivation to learn and contributed to sustained engagement throughout the educational intervention. Overall, the high level of interest in SLE reflects the importance of introducing less commonly addressed health topics in school-based education, as novel content can stimulate curiosity, increase attention, and promote deeper learning among students.

Based on students' open-ended responses, there was a strong interest in continuing health-related education with topics that are directly applicable to their everyday experiences. Commonly suggested future topics including basic disease prevention and healthy lifestyle habits (especially smoking prevention); nutrition and physical activity; mental health and emotional well-being. These suggestions indicate that students prefer topics that are practical, relatable, and preventive in nature, rather than purely theoretical. This highlights the importance of designing future educational programs that emphasize real-life applications and self-care awareness.

Awareness of Family Health History

Qualitative analysis of the questionnaire responses revealed that many students had limited awareness of their family health history prior to the educational intervention. Several students indicated that they were not familiar with chronic or hereditary conditions within their families or had never discussed such topics at home.

Table 4. Student Awareness of Family Medical History of Lupus

Family History with Lupus	(n)	Percentage (%)
No	24	68.5%
Uncertain	10	28.6%
Yes	1	2.9%

However, after the session, students expressed increased awareness of the importance of knowing their family's health background. Some respondents reported an intention to ask parents or guardians about family medical history, suggesting that the intervention may have initiated early health awareness and communication within the family context. This finding is particularly important, as early awareness of family health history can play a role in promoting preventive health behaviors and informed decision-making later in life.

Qualitative findings from the questionnaire demonstrate that the educational intervention was well received, engaging, and meaningful for students. The program successfully stimulated interest in health topics, encouraged reflection on personal and family health, and motivated students to seek further information beyond the classroom. These qualitative insights complement the significant quantitative improvement observed in test scores, reinforcing the overall effectiveness of the intervention in increasing both knowledge and health awareness among students.

Interest in Lupus as a Novelty Factor

The high interest in Lupus (57.1%) suggests that students are highly motivated by "novel" medical information that is not typically included in the standard school curriculum. This aligns with findings by Josephine et al., who noted that education regarding disease symptoms and management is the primary informational need for the general public. The significant knowledge gain confirms that brief, targeted interventions can bridge major literacy gaps effectively (Mousavi-sagharchi et al., 2025) (Josephine and Widhani, 2023).

The finding that 28.6% of students were "uncertain" about their family history highlights a critical lack of health communication within households. In many cases, the nonspecific nature of early SLE manifestations, particularly mild joint pain and fatigue, contributes to its tendency to mimic other conditions and delays accurate diagnosis (Mitchell, 2024). By educating students, the program creates "detection agents" who can potentially identify

undiagnosed cases within their families, facilitating earlier medical consultation.

The Role of Sunscreen and Physical Activity

The students' interest in sunscreen (31.4%) reflects an understanding of environmental triggers. UV radiation is a known driver of inflammation in SLE through the induction of keratinocyte apoptosis and subsequent antigen release (Barbhaiya et al., 2023). Furthermore, regular physical activity is proven to improve sleep quality and reduce anxiety in individuals with autoimmune predispositions, which is a vital lifestyle habit for adolescents (Dwyer, Durcan and Wilson, 2017).

Limitations and Future Directions

Despite the significant improvement in knowledge scores and the high level of participant engagement observed during the educational session, this study has several limitations that should be acknowledged. First, the study employed a quasi-experimental one-group pre-test/post-test design without a randomized control group, which limits the ability to control for potential external confounding factors. Second, the study was conducted among 35 students from a single junior high school, SMPN 2 Jatinangor, which may limit the generalizability of the findings to broader adolescent populations with different demographic or socio-cultural backgrounds. In addition, the final sample size was smaller than the calculated minimum sample size due to the voluntary participation system and the single-session nature of the community service activity. Furthermore, findings related to the "Silent Knowledge Gap" regarding family medical history were based on students' self-reported responses and recall, without verification through clinical records or direct interviews with parents or guardians.

Future studies are recommended to involve larger and more diverse participant populations and to incorporate control groups to strengthen the external validity of the findings. Longitudinal follow-up assessments are also needed to evaluate long-term knowledge retention and the sustainability of preventive health behaviors, including consistent

photoprotection practices and regular moderate physical activity. In addition, future school-based educational programs should consider involving parents or guardians to improve family health communication and awareness regarding autoimmune diseases. Expanding educational topics to include mental health, smoking, and other lifestyle-related risk factors may further enhance adolescent health literacy. Finally, the positive response toward visual and interactive educational materials in this study suggests that future interventions may benefit from integrating digital and multimedia-based learning approaches to improve engagement and learning outcomes among adolescents.

CONCLUSION

The health education seminar conducted during the “LUPUS CERDAS” community service program demonstrated that brief, targeted, school-based educational interventions can effectively improve adolescent health literacy regarding Systemic Lupus Erythematosus and related preventive behaviors. The program also increased students’ awareness regarding early disease recognition and family health communication.

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CONFLICT OF INTERESTS

The authors declare that they have no financial, commercial, legal, or professional relationships with any organizations or individuals that could inappropriately influence or bias the outcomes of this community service project. This activity was conducted independently as part of the academic community empowerment mandate.

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