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## **Predictors of Late-Life Depression among Retired Civil Servants in Kupang City, Indonesia**

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### **Abstract**

One significant factor in managing late-life depression is retirement because retirees experience substantial changes due to retirement itself and aging. This study sought to analyze predictors of depression among retired civil servants in Kupang City, Indonesia. Recognizing predictors can inform prevention strategies to minimize risk factors and support healthy aging. We employed a cross-sectional survey and analyzed the primary data from 166 participants (N=166) using binary logistic regression as the primary tool, along with distribution and association reports. Up to 26.1% of 166 retirees experienced depression based on the Geriatric Depression Scale, with significant associations depicted between depression and variables of sex, education levels, retirement periods, chronic physical diseases, pains, social activities, and enjoyable activities. Income revealed an insignificant association with depression. The potency of explanatory variables to simultaneously predict depression was 80.1%. Individually, retirees who had been retired for 11 to 15 years were less likely to experience depression compared to younger retirees (OR= 0.02). The odds of being depressed were 32 times greater among retirees who never participated in social activities, 73 times greater among those who did not do enjoyable activities, and 69 times greater among those with physical pain experiences. Multi-dimensional adjustments, post-power syndrome, and others could be linked to risk factors. Pre-retirement programs, increasing awareness among retirees and their significant others, and community-based participatory interventions are promising strategies to help prospective retirees transition nicely into retirement and reduce risk factors of depression.

**Keywords:** *depression, retirees, retirement, Indonesia*

### **Introduction**

Retirement is characterized by a discontinuous loss of job-related identity. Most workers are required to retire at a specified age, mainly after the age of 60 (Dang et al., 2020; Pabón-Carrasco et al., 2020). Similarly, the minimum retirement age for Indonesian civil servants is between 58 and 65 years old (Badan Kepegawaian Negara, 2017). This circumstance leads to two major conditions: retirement itself and aging.

Life changes upon retirement may be problematic. The changes in daily routines, social relations, roles, identities, accomplishments, aspirations, struggle with time management, feeling isolated (Pabón-Carrasco et al., 2020; Robinson & Smith, 2024), facing financial strain and limited insurance access, and other employer-provided benefits, and others may trigger retirees to develop depressive symptoms (Dang et al., 2022). In fact, retirement is rated 10<sup>th</sup> on the list of life's most stressful events (The British Psychological Society, 2018).

Aging itself is not identified as the primary reason for higher depression rates. Instead, factors bound to aging, such as disability, health issues, bereavement, retirement, and others, increase depression risks (Kouvatsou et al., 2020). Besides, individuals aged 60 and older may encounter several biological damages and complex health states commonly called geriatric syndromes (World Health Organization [WHO], 2024), with some conditions of geriatric syndromes associated with depression (Imaoka et al., 2021).

Depression negatively affects someone's feelings, thinking, actions, and perception of life. Such symptoms are feelings of sadness, hopelessness, worthlessness, loss of pleasure, unexplained physical problems, and others. Older adults often want to stay at home rather than go out to socialize or do new things. Symptoms must last at least two weeks (Sawchuk, 2022; WHO, 2023b).

Depression is one of the most common mental issues in the late-life population (WHO, 2023a). Around 3.8% of the world's population experienced depression, with 5.7% of them aged older than 60 years (WHO, 2023b). Earlier studies reported that depression among retirees was estimated at 28% higher than that of the overall older adults (Dang et al., 2022), and 27.8% of Indonesian surveyed retirees experienced depression (Putri et al., 2015). Sadly, depression increases the risks of degenerative diseases, disability, poor quality of life (QoL), self-harm, suicide (Lin et al., 2021), health service costs (Miller et al., 2022), complicates the treatment of other conditions (National Council on Aging [NCOA], 2024a), and harms relationships between depressed older adults and families (Counselling Directory, 2023).

Predicting how retirement influences health is challenging, as retirement often proceeds hand in hand with aging. Besides not being a normal part of aging (Centers for Disease Control and Prevention [CDC], 2024), depression itself is the most treatable condition among all mental health issues, and it can be controlled by reducing risk factors (Cleveland Clinic, 2023). Unfortunately, 66% of older adults are not receiving the care they need (NCOA, 2024a). Accepting depression as a natural aging process, failing to recognize depressive symptoms, and having less information to handle depression (CDC, 2024; Robinson et al., 2024) can be barriers to reaching healthy aging. The main objective of this study is to analyze predictors of depression among retired civil servants in Kupang City, East Nusa Tenggara Province, Indonesia. Recognizing predictors in this study can inform required evidence-based preventive and promotive interventions to minimize risk factors of depression and support healthy aging.

## **Methods**

### **- Participants**

The final number of qualified participants was 166 based on the criteria, which were retired civil servants due to reaching the minimum retirement age (mandatory retirement), represented themselves, obtained scores 4-5 on the Mini-Cog assessment, were able to speak and understand the Indonesian language, or did not have a hearing problem, and voluntarily participating by doing the informed consent process. Those with cognitive impairment, functional disabilities, staying in a nursing home, pension recipient heirs, and pension recipient representatives were excluded.

## Measurements

- i. *The Mini-Cog Assessment*. This instrument was statistically eligible (Borson et al., 2020), and we utilized it to screen prospective participants' basic cognitive abilities rapidly. The qualified participants needed to obtain scores of 4-5.
- ii. *The Geriatric Depression Scale-Short Form*. This instrument is a 15-item self-report assessment in a "Yes/No" format. The validity, sensitivity, and specificity were acceptable statistically (Greenberg, 2019). We distinguished the results into no depression (scores 0-4) and depression (scores 5-15).
- iii. *Health-Related Questionnaire*. First, health-related experiences in the past two weeks: 1) Have you experienced any physical pains, like low back pain, knee pain, chest pain, headache, toothache, or other physical pains? 2) Have you participated in social activities, like social and community activities/ services, church services/ programs, and others requiring you to interact socially with others? 3) Have you practiced enjoyable activities, like doing your hobbies, finding new hobbies, having picnics, or watching movies with families or friends? Each question has two possible answers: yes (whether it was always, sometimes, not very often) and no (never). Second, demographic data, including sexes: male or female; education levels: primary/elementary school, secondary/junior and senior high school, or tertiary/higher education; retirement periods: 1-5 years, 6-10 years, 10-15 years, or >15 years; income: having additional income besides pension or no income besides pension; and physical diseases: no chronic physical diseases or having chronic physical diseases medically.

## Procedures and processes

- i. *Documents and ethical, legal processes*. Questionnaires and informed consent documents were developed in two languages, English and Indonesian, through forward and backward translations involving two different qualified translators. Questionnaires, in detail, were anonymous and structured. The university-based Institutional Review Board has reviewed and approved this study, and the One-Stop Permit Issuance Office of East Nusa Tenggara Province released a permit letter to collect data at the location.
- ii. *Data collection process*. We employed a cross-sectional survey and convenience sampling to accidentally identify and recruit participants who would manually take their monthly pensions in the waiting room of the Post Office at Palapa Street in Oebobo Village, Kupang City (named *Kantor Pos Indonesia (Persero) Cabang Kupang*). The data was collected on the first nine workdays in February 2024.
- iii. *Data analysis*. The qualified data was analyzed based on distributions, the test of independence with a significance level ( $\alpha$ ) of 0.05, and binary logistic regression as the main tool, with a 95% confidence interval (CI) utilizing the Statistical Program for Social Sciences version 28. Demonstrating as explanatory variables were sex, formal education levels, retirement periods, income, chronic physical diseases, social activities, enjoyable activities, and pain. Depression was a measured variable.

## **Results**

Up to 24.1% of 166 retirees experienced depression. Depression was more commonly reported by participants who were female, had completed tertiary education, had retired between 1 and 5 years, received no income besides pensions, had chronic physical diseases, did not participate in social activities, did not do enjoyable activities, and experienced physical pains (Table 1). The presence of depression was significantly associated with sex ( $p= 0.038$ ) and education levels ( $p= 0.006$ ). Likewise, variables of retirement periods, physical diseases, social activities, enjoyable activities, and physical pains demonstrated significant associations with depression, with a  $p$ -value  $< .001$  for each variable. Yet, income revealed an insignificant association ( $p= 0.724$ ) (Table 1).

The model's Nagelkerke  $R^2$  was 0.801, indicating that 80.1% of the variance in depression was explained by the predictors simultaneously. In contrast, 19.9% were explained by other factors not measured in our study. Individually, four explanatory variables could significantly predict depression among surveyed retirees. Concerning retirement periods, retirees who had retired between 11-15 years were likely to suffer from depression 0.02 times lower than those who were in 1-5 years ( $p= 0.017$ ; OR= 0.02; 95% CI= 0.001 - 0.51). Likewise, retirees in the period of 6-10 years were predisposed to experience depression 0.05 times lower than those in 1-5 years ( $p= 0.046$ ; OR= 0.05; 95% CI= 0.013 - 0.95). Moreover, retirees who never participated in social activities were 32.46 times more likely to experience depression compared to those who participated ( $p= 0.012$ ; OR= 32.46; 95% CI= 2.171 - 48.54). Then, retirees who never did enjoyable activities were more likely to suffer from depression, 73.27 times higher than those who did ( $p= 0.002$ ; OR= 73.27; 95% CI= 4.602 - 116.73). Lastly, retirees with physical pains were 69.44 times more likely to suffer from depression than those without any physical pains ( $p= 0.008$ ; OR= 69.44; 95% CI= 3.061 - 157.53) (Table 1).

## **Discussion**

Almost a quarter of retirees suffered from depression in our study, with the potency of eight explanatory variables to concurrently predict depression being 80.1%. Retirement might increase the probability of depression by about 40% (Sahlgren, 2013), specifically those with mandatory retirement (Pabón-Carrasco et al., 2020), because some retirees might find it challenging to modify daily activities, time management, and social and mental adjustments (Robinson & Smith, 2024). Life changes and health challenges due to getting older, and inappropriate treatment older adults receive might also place individuals at greater risk for depression (CDC, 2024). In detail, four explanatory variables in our study could individually predict depression significantly.

### **The adjustment period of retirement**

Retirees in the retirement periods of 6 and 10 years and 11 and 15 years were predicted to be less likely to suffer from depression than in a younger period in our study. Prior studies found a negative directional relationship between retirement ages and depression levels (Kholish, 2015), and depression was more present in retirees with fewer years of retirement (Putri et al., 2015). Multi-dimensional adjustments may generally occur upon retirement. Retirees typically enjoy their life in the first two to three years after retirement (honeymoon phase). After the emotional

high begins to decline, some retirees begin to feel disappointed and let down (disenchantment phase) (Inspired Villages, 2023) due to the loss of work life, feel stressed about how to fill days, worry about being at home all day, feel isolated without interaction (Robinson & Smith, 2024), feel less productive and let down, even slipping into depression (Bertić, et al., 2019; Streamline Financial, 2021). Re-orientation, after disenchantment, is a stage to begin realistic and new circumstances and navigate new life by re-finding purposes and establishing new things (Inspired Village, 2023; Bertić et al., 2019). Then, retirees typically experience less depression and anxiety up to 15 years after the official retirement (reconciliation and stability). This period is characterized by feeling content and hopeful in their transition, settling into a fun, and rewarding retirement lifestyle, and prioritizing simplifying and relaxing lifestyles (Streamline Financial, 2021). Similarly, retirees who have retired >15 years in our study depicted the lowest percentage of depression. Still, poor life adjustment upon retirement might lead to Post Power Syndrome (PPS), which is an adverse psychological condition that occurs when individuals leave a high-level position, escape from power, or leave work, and results in feeling moody, sick, irritable, and worthless, because of feeling neglected, loss of the respect and praise that they had while in power, which can trigger depression. Retirees with light PPS experienced a higher quality of life statistically (Indarwati et al., 2017). New retirees could experience PPS due to feeling unhappy and losing dignity or honour (Rahman, 2016). Likewise, the youngest retirement period in our study illustrated the highest percentage of depression. Sadly, a study indicated that 51% of employees with a workplace pension worry about their retirement (World Economic Forum, 2019), while unprepared retirement may trigger sudden retirement syndrome, like feelings of uncertainty, restlessness, or meaninglessness (Kendal on Hadson, 2025). Thus, health promotion strategies are required during the retirement preparation programs to enhance awareness and assist in life adjustment.

### **The critical role of social engagement**

Social connections are essential in older adults' lives. In fact, never engaging in social activities elevated the likelihood of experiencing depression by about 32 times among surveyed retirees. Prior studies found that a higher rate of depression tended to be reported by older adults who engage less in social activities (Kouvatsou et al., 2020; Lin et al., 2021). Meaningful social activities like befriending initiatives, community and support groups, social skills training, creative arts classes, leisure and educational services, and volunteering programs can significantly improve satisfaction and reduce depressive symptoms (WHO, 2023a). Regular participation in social activities can establish a sense of purpose and happiness and develop a strong antidote for feeling isolated and lonely, which are two risk factors for depression (PACE, 2023). We assumed that having chronic physical diseases (38.0%) and physical pains (21.1%) might restrict retirees in our study from being socially active, which may lead to loneliness and trigger depression. Besides, changes in roles and identities due to retirement (Robinson & Smith, 2024) and stigma among young retirees, like feeling devalued and unengaged with social activities (Silva et al., 2023), could drive individuals to withdraw from social activities. We presumed that factors tied to aging, like geriatric syndromes and physical limitations (WHO, 2024), might lower confidence to participate in social activities. The high predictive power of lacking social activities suggests that community-based interventions in Kupang, perhaps

facilitated through "*Rukun Tetangga/Rukun Warga*" (local neighbourhood associations), could be particularly effective and beneficial.

### **The importance of a feel-good hormone**

Retirees who never did pleasurable activities in our study were more likely to suffer from depression 73.27 times. Engaging in hobbies has been statistically proven to lower depressive symptoms and increase satisfaction and pleasure (Bone et al., 2022; Mak et al., 2023). Essentially, when individuals do enjoyable activities (like picnics or hobbies), chemical messengers in the brain (such as dopamine, a feel-good hormone) are released to help them feel enjoyable and motivated, which can increase life satisfaction and happiness, decrease depressive symptoms, and improve physical health and brain function (memory) (McCabe, 2021). Individuals with low dopamine could experience a lack of motivation and enjoyment, hopelessness, poor concentration, moodiness, and other symptoms that link to depression (Cleveland Clinic, 2022). Besides, participating in hobby groups can maintain strong social connections and reduce loneliness and isolation (Godman, 2024). We considered that combating loneliness through some integrated activities is necessary, as the relationship between loneliness and depression is bidirectional statistically, though often stronger with loneliness as the origin (Domènech-Abella et al., 2019).

### **The pain-depression cycle**

Chronic pain is a crucial public health issue and more commonly affects adults aged 65 and older and often overlaps with depressive symptoms (NCOA, 2024b). We also found a substantial number of retirees with physical pains also experienced depression, with those with physical pain experiences being more likely 69.44 times than those without physical pains to report depression. Our findings collaborated with previous studies reporting that older adults with pain were more likely to be depressed than those without pain (Muhammad & Rashid, 2021), and a positive directional relationship between pain and depression degrees (Ogliari et al., 2023). Pain is depressing, and depression may cause physical pain. This reciprocal relationship involves processes at the somatosensory cortex in the brain and neurotransmitters, which are responsible for responding to pain and contributing to depression (Harvard Health Publishing, 2021). Depression also happens due to a functional deficiency of norepinephrine and serotonin, which can affect pain development. In fact, most individuals seeking help for depression also reported at least one type of pain (Lee et al., 2020). Hence, practitioners should not ignore pain complaints when conducting depression management. Notably, collaborative methods should be considered, including pharmacological, psychosocial, and complementary approaches to reduce negative thoughts of depression and enhance coping skills.

Overall, the high odds ratios for individual predictors should be interpreted cautiously, as they may indicate a strong associative signal with depression. However, the model's characteristics, the sample size, and the characteristics of selected predictors that are closely tied to one another and to the outcome variable should also be considered.

## **Limitations**

Administering self-reported questionnaires may result in answers influenced by other factors, and the binary measures for some questions were simple but lacked nuance. Due to the convenience sampling, we only asked general questions to reduce survey time for participants at a pension withdrawal facility. Thus, it may limit generalizability to all retirees in Kupang, especially those who are frail or isolated and do not collect pensions in person. Additionally, employing a cross-sectional survey means results cannot be generalized to all retirees and at all pension withdrawal facilities, and results might change over time and place. Besides, specific causality cannot be inferred (e.g. between depression and pain perception). Moreover, model overfitting among predictors or possible complete separation might be the reason for high ORs.

## **Recommendations**

First, organizations need to apply and optimize the Retirement Preparation Period (RPP) as 1-2 years before retirement to prepare employees to reach positive retirement adjustment upon retirement by training and discussing healthy aging and combating depression post-retirement. The RPP program should educate soon-to-be retirees on the risks of social isolation and the 'disenchantment phase,' and equip them with strategies to develop new routines and hobbies. Second, retirees are supposed to have a positive perception of retirement. Additional research is needed to examine retirees' perceptions of retirement, particularly forced retirement. Third, community-based participatory interventions are required to develop social and recreational activities, physical exercise, and health education for retirees and their supportive individuals. Establishing 'Senior Activity Centers' at "Kelurahan" (village) level that offer structured social and recreational activities to combat isolation may be a promising program. Fourth, collaborative approaches are needed in handling depressed older adults, including training primary healthcare workers in Kupang to screen for depression in retirees, especially those presenting with complaints of chronic pain. Fifth, family, close friends, and others working with older adults need additional education on retirement-related mental health changes. Sixth, future research should seek to identify additional moderating and mediating variables of depression while also evaluating any future programs to ensure effectiveness. Moreover, studies may increase the sample size, consider the characteristics of selected predictors to avoid model overfitting and complete separation, and utilize more nuanced scales to measure frequency and intensity.

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## *Competing interests*

None declared.

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**Tabel 1. Distributions, Associated Factors, and Predictors of Depression among Retired Civil Servants in Kupang City, Indonesia**

Explanatory variables	Distributions				Test of Independence			Binary Logistic Regression			
	N=166		Depression (%)		X <sup>2</sup>	df	p	p	OR	95% CI	
	n	%	No	Yes						LL	UL
Sexes <sup>b</sup>								0.117	0.15	0.13	1.63
Male	98	59.0	48.2	10.8	4.29	1	0.038				
Female <sup>a</sup>	68	41.0	27.7	13.3							
Education levels <sup>b</sup>											
Primary Edu. <sup>d</sup>	10	6.0	3.6	2.4	10.19	2	0.006	0.510			
Secondary Edu.	86	51.8	44.6	7.2				0.210	0.01	0.001	0.45
Tertiary Edu. <sup>a</sup>	70	42.2	27.7	14.5				0.206	0.12	0.004	3.22
Retirement periods <sup>b</sup>											
1-5 years <sup>a, d</sup>	34	20.5	4.2	16.3				0.105			
6-10 years <sup>e</sup>	27	16.3	12.7	3.6	74.58	3	< .001	0.046	0.05	0.013	0.95
11-15 years <sup>e</sup>	60	36.1	33.1	3				0.017	0.02	0.001	0.50
>15 years	45	27.1	25.9	1.2				0.145	0.07	0.002	2.97
Income besides pension <sup>c</sup>								0.847	1.23	0.151	10.01
Yes	62	37.3	28.9	8.4	0.12	1	0.724				
No <sup>a</sup>	104	62.7	47	15.7							
Ch. physical diseases <sup>b</sup>								0.217	3.78	0.457	31.28
No	103	62.0	58.4	3.6	49.54	1	< .001				
Yes <sup>a</sup>	63	38.0	17.5	20.5							
Social activities <sup>b, c</sup>								0.012	32.46	2.171	48.54
Yes	124	74.7	70.5	4.2	91.23	1	< .001				
No <sup>a</sup>	42	25.3	5.4	19.9							
Enjoyable activities <sup>b, c</sup>								0.002	73.27	4.602	116.73
Yes	117	70.5	68.1	2.4	92.66	1	< .001				
No <sup>a</sup>	49	29.5	7.8	21.7							
Physical pains <sup>b, c</sup>								0.008	69.44	3.061	157.53
No	131	78.9	69.3	9.6	47.97	1	< .001				
Yes <sup>a</sup>	35	21.1	6.6	14.5							

Source: Data primer

Note: N=166, 75.9% of participants did not experience depressive symptoms, whereas 24.1% reported depressive symptoms in the last two weeks based on the Geriatric Depression Scale-Short Form;

<sup>a)</sup> indicating dominant participants in experiencing depressive symptoms in a certain variable,

<sup>b)</sup> indicating variables revealing significant associations with depression ( $\alpha= 0.05$ ), <sup>c)</sup> indicating the variable revealing insignificant association with depression ( $\alpha= 0.05$ ), <sup>d)</sup> indicating comparison variables in the logistic regression model, <sup>e)</sup> indicating conditions in certain variables that could significantly predict depression individually with the significance level of 0.05.

## Examination of the Association between Pre-treatment Neutrophil-to-Lymphocyte Ratio and Platelet-to-Lymphocyte Ratio and Survival among Breast Cancer Patients Treated with Adjuvant Chemotherapy and Radiotherapy

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### Abstract

**Background:** Previous studies have shown that the neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) can serve as independent prognostic factors for various cancers, reflecting systemic changes caused by chemotherapy and radiotherapy. However, optimal cut-off values and definitive information regarding their prognostic significance in breast cancer patients receiving adjuvant chemotherapy with radiotherapy remain unclear. Therefore, our aim was to evaluate their prognostic impact in this scenario.

**Methods:** This retrospective study examined the pre-treatment NLR and PLR values of 287 breast cancer patients, using cut-off values determined by the Youden's index method to categorize them. Patients were classified as having low NLR (<4.70) or high NLR ( $\geq$ 4.70), yielding a sensitivity of 27.27% and a specificity of 83.46%. Similarly, patients were categorized as having low PLR (<194.14) or high PLR ( $\geq$ 194.14), resulting in a sensitivity of 60.61% and a specificity of 43.31%.

**Results:** In a cohort of 287 patients, the five-year overall survival rate was 91.15% (95% confidence interval [CI]: 87.18–93.94). Regarding inflammatory markers, the 5-year overall survival rate was 90.94% (95% CI: 86.43–94.00) for patients with low NLR and 92.16% (95% CI: 80.44–96.98) for those with high NLR. Similarly, the 5-year overall survival rates were 90.97% (95% CI: 84.29–94.90) for low PLR and 91.34% (95% CI: 85.80–94.78) for high PLR. Kaplan-Meier curves indicated that only chemotherapy and surgery types showed statistically significant differences. In multivariable analysis, only anthracycline/taxane chemotherapy remained were significantly associated with a higher risk of 5-year mortality (adjusted hazard ratio: 4.63; 95% CI: 1.04–20.61).

**Conclusions:** In this cohort, pre-treatment NLR and PLR were not associated with 5-year OS. The significant association of anthracycline/taxane regimen with poorer OS likely reflects its use in higher-risk patients rather than a causal effect. The prognostic value of on-treatment inflammatory dynamics warrants further investigation. Further study with refined thresholds and larger cohorts are needed to improve predictive accuracy and clinical applicability.

**Keywords:** *Breast cancer, Chemotherapy, Overall survival, Neutrophil-to-lymphocyte ratio, Platelet-to-lymphocyte ratio*

## **Introduction**

Breast cancer (BC) is the most common cancer and a major cause of death among women worldwide [1]. The incidence of BC has been rising in Asia and, in Thailand, is the third most common type of cancer-related mortality [2]. BC treatment is complex and requires a combination of various modalities, including surgery, chemotherapy, radiotherapy, and hormonal therapy, to improve survival outcomes [3]. Adjuvant systemic therapies, including endocrine therapy and chemotherapy, effectively reduce the risk of both distant and local recurrence, even in patients at low risk for recurrence [4].

The factors considered truly prognostics include clinicopathological characteristics, age, race, hormonal receptor status, and HER2 overexpression [5]. In recent years, the immune system played a crucial role in cancer development, progression, and treatment resistance and is also associated with relapse, metastasis, and mortality [6]. Increasing attention has been given to neutrophil-to-lymphocyte ratio (NLR), and platelet-to-lymphocyte ratio (PLR) as key indicators of systemic inflammation. The NLR and PLR, which reflect systemic inflammation [7-8], have consistently been reported as poor prognostic factors for the overall survival (OS) of patients with various cancer types [9]. These markers are widely utilized across all medical disciplines as reliable indicators of immune response, proving useful for monitoring oncological therapies, including immune checkpoint inhibitors and biological treatments. Furthermore, the NLR serves as a highly sensitive indicator of inflammation, infection, and sepsis [10]. NLR and PLR, which can be easily derived from routine full blood analysis (complete blood count (CBC)), offer a simple and cost-effective method for BC prognostication [11]. Additionally, may correlate with both patient outcomes and responses to chemotherapy [12]

Several studies have demonstrated that high NLR and PLR correlate with worse clinical outcomes and shorter OS [13-15]. However, the optimal cut-off values for these biomarkers remain undetermined, with various thresholds having been proposed to determine survival outcomes [13]. The study of Kim, H. Y. et al. [14] found breast cancer patients with low NLR ( $\leq 2.21$ ) and PLR ( $\leq 143.36$ ) values had better treatment outcomes ( $p=0.006$ ) and longer OS when treated with neoadjuvant chemotherapy before surgery ( $p=0.078$ ). Similarly, Kim et al. [15] reported that a high NLR ( $>2.47$ ) significantly lowered the OS ( $p=0.006$ ) after treatment completion in patients with triple-negative breast cancer. A retrospective cohort study by Anwar et al. [16] determined cut-off values for NLR and PLR of 2.8 and 170, respectively, based on the maximum point of sensitivity and specificity from a receiver operating characteristic (ROC) curve; a high NLR was significantly associated with skin and chest wall infiltration by T4-lymphocytes ( $p<0.001$ ), while an elevated PLR was linked to a more advanced stage of cancer at diagnosis ( $p=0.030$ ). In a meta-analysis of the various NLR cut-off values from 15 studies involving breast cancer [17], the authors classified high NLR with a median cut-off point of 3.0 (interquartile range (IQR): 1.9–5.0) being linked to worsening of the OS (hazard ratio (HR): 2.56; 95% CI = 1.96–3.35;  $p<0.001$ ). In addition, a meta-analysis of 12 studies showed that patients with high PLR ( $\geq 185$ ) had a worse prognosis

(pooled HR: 1.32; 95% CI: 1.11–1.57;  $p=0.002$ ) [9]. Increasing evidence suggests that NLR and PLR could serve as predictive markers for the therapeutic response and clinical outcomes from BC treatment [18].

As a results, NLR and PLR are important prognostic values for patients with breast cancer. The current lack of established cut-off values can adversely affect both treatment decisions and patient outcomes. Since adjuvant chemotherapy and radiotherapy are among the major therapeutic modalities for BC [19], our aim was to determine whether pre-treatment NLR and PLR are associated with the OS of BC patients who underwent this treatment regimen.

## **Method and Materials**

### **2.1. Data Collection**

In this retrospective study, we obtained data for 287 patients who had received adjuvant chemotherapy and radiotherapy between 2011 and 2021 from the Chiang Mai Cancer Registry. This study was approved by the Ethics Committee of the Faculty of Medicine at Chiang Mai University (approval number 259/2022).

Inclusion criteria were BC patients who had been treated with adjuvant chemotherapy and for whom blood analysis data were available at three time points: before ( $\pm 7$  days), during, and after ( $\pm 3$  days) radiotherapy to monitor hematologic and immune responses associated with treatment. The exclusion criterion was the presence of metastasis. The sample size was calculated based on a 5-years OS rate of 70.0% for the BC patients [20]. The estimated sample size was calculated as being at least 323 for a confidence level of 95% and assuming an error margin of 5%.

Patient clinical characteristics included age, weight, height, chronic diseases, cancer stage, estrogen receptor (ER) status, progesterone receptor (PR) status, and human epidermal growth factor receptor-2 (HER-2) status, Ki-67 proliferation index values, chemotherapy regimen, type of surgery, and tumor size. Blood analysis data included white blood cell count (WBC), neutrophil and lymphocyte percentages, and platelet count. NLR and PLR were calculated for each timepoint as follows: NLR by dividing the relative neutrophil count by the relative lymphocyte count [21] and PLR by dividing the platelet count by the absolute lymphocyte count [22]. OS was defined as the time from the date of diagnosis or definitive therapy to the date of death from any cause or last follow up July 21, 2023.

### **2.2. Statistical Analysis**

The baseline clinical characteristics and blood analysis data at each visit are presented as numbers and percentages for categorical variables and as means and standard deviation (SD) or median and interquartile range (IQR) for continuous variables, as appropriate. The median values between survival status groups were compared using the Mann–Whitney U test. Receiver operating characteristic (ROC) curves were generated to obtain the area under the curve (AUC) values, and Youden's index was used to determine the optimal cut-off points for NLR and PLR [23]. OS was analyzed using the Kaplan-Meier method, with the log-rank test used to compare differences between OS curves. Univariable and multivariable Cox regression were used to

investigate potential prognostic indicators for OS. Variables with a p-value<0.20 in the univariable analysis, as well as those deemed clinically relevant, were included in the multivariable analysis. A p-value<0.05 was considered statistically significant. All statistical analyses were performed using Stata version 16.0.

## Results and Discussion

### 3.1. Results

The clinical characteristics of the 287 patients eligible for the study are summarized in Table 1. The average age at the time of treatment was  $52.1 \pm 10.3$  years. The median weight, height, and body mass index were 56 kg (IQR: 49–64), 155 cm (IQR: 151–160), and 23 (IQR: 21–27), respectively. Chronic diseases were present in 58 patients (20.2%). Most of them had cancer stage III (56.1%); the ER and PR statuses were positive in 60.7% and 57.5% of them, respectively. The HER-2 status was negative in 41.8% of cases. In 184 patients (64.1%), the chemotherapy regimen administered was anthracycline/taxane (AC-T). In addition, 75.0% had Ki-67 proliferation index values greater than 20% and 59.6% had tumors larger than 2 cm in size. Breast-conserving surgery was the most employed method (50.2%). The OS rate was 90.2% at 5 years.

Table 1: Clinical characteristics of the patients (N = 287)

Characteristic	Category	Statistics
Age (years)	Mean $\pm$ SD	52.1 $\pm$ 10.3
Weight (kg) (n=184)	Median (IQR)	56 (49–64)
Height (cm) (n=207)	Median (IQR)	155 (151–160)
Body mass index (n=162)	Median (IQR)	23 (21–27)
Chronic disease, n (%)	Yes	58 (20.2)
	No	171 (59.6)
	Unknown	58 (20.2)
Cancer stage <sup>†</sup> , n (%)	Stage I	55 (19.2)
	Stage II	68 (23.7)
	Stage III	161 (56.1)
	Unknown [1]	3 (1.0)
ER status, n (%)	Negative	87 (30.3)
	Positive	200 (60.7)
PR status*, n (%)	Negative	121 (42.5)
	Positive	164 (57.5)
HER-2 status, n (%)	Negative	120 (41.8)
	Positive	77 (26.8)
	Equivocal	90 (31.4)
Ki-67 proliferation index*, n (%)	< 20%	54 (25.0)
	$\geq$ 20%	162 (75.0)
Chemotherapy regimen, n (%)	Anthracycline (AC)	89 (31.0)
	Anthracycline/taxane (AC-T)	184 (64.1)

Characteristic	Category	Statistics
	Other	14 (4.9)
Type of surgery, n (%)	Mastectomy	143 (49.8)
	Breast-conserving surgery	144 (50.2)
Tumor size*, n (%)	≤ 2 cm	114 (40.4)
	> 2 cm	168 (59.6)
Survival status, n (%)	Alive	254 (88.5)
	Dead	33 (11.5)
5-year survival status, n (%)	Alive	231 (80.5)
	Dead	25 (8.7)
	Unknown [2]	31 (10.8)

Note: Percentages are based on the number of non-missing observations for that item. \* contains missing data.

† Cancer stage according to the AJCC Cancer Staging Manual 8<sup>th</sup> Edition. [1] There were three cases of unknown cancer staging: one where stage N could not be assessed and two where stage M could not be assessed. [2] Of the 31 patients, 27 survived beyond 4 years and were right-censored at their last known follow-up for the survival analysis.

Abbreviations: ER, estrogen receptor; PR, progesterone receptor; HER-2, human epidermal growth factor receptor-2; SD, standard deviation.

The CBC at the first visit, the median WBC was 5,600 cells/ $\mu$ L (IQR: 4,400–6,900), of which 63.70% (IQR: 57.1–70.4) were neutrophils and 22.20% (IQR: 17.0–27.8) were lymphocytes. The median platelet count was 260,000 cells/ $\mu$ L (IQR: 225,000–306,000). From these data, the NLR and PLR were calculated as 2.84 (IQR: 2.0–4.1) and 212.97 (IQR: 153.4–299.7), respectively (Table 2).

Table 2: Blood analysis results for the BC patients (N = 287)

Variable	1 <sup>st</sup> Visit (N = 287)	2 <sup>nd</sup> Visit (N = 287)	3 <sup>rd</sup> Visit (N = 287)
n (missing)	287 (0)	287 (0)	287 (0)
WBC count (cells/ $\mu$ L)	5,600 (4,400–6,900)	4,900 (3,900–6,100)	4,700 (3,700–5,710)
Neutrophils (%)	63.70 (57.1–70.4)	67.20 (60.0–73.0)	68.20 (61.8–74.7)
Lymphocytes (%)	22.20 (17.0–27.8)	18.40 (14.1–24.5)	17.10 (12.0–22.4)
Platelet count (cells/ $\mu$ L)	260,000 (225,000–306,000)	238,000 (203,000–275,000)	216,000 (180,000–253,000)
NLR	2.84 (2.0–4.1)	3.64 (2.4–5.1)	4.04 (2.8–6.2)
PLR	212.97 (153.4–299.7)	259.30 (188.3–383.3)	274.45 (194.9–425.2)

Note: Data are presented as the mean  $\pm$  standard deviation or the median (interquartile range). Complete blood analysis data were only available for the 3<sup>rd</sup> visit; data from the other visits had  $\geq$  50% missing values.

Abbreviations: WBC, white blood cell count; NLR, neutrophil-to-lymphocyte ratio; PLR, platelet-to-lymphocyte ratio.

The comparison of median NLR and PLR values between survival status groups at each visit showed no statistically significant differences. However, a near significance of NLR at Visit 3 showed a trend of different median during treatment between people who were alive and dead ( $p=0.058$ ) (Table 3).

In the present study, the NLR and PLR values were used to determine the cut-off values

calculated using Youden's index to predict mortality. For pre-treatment (at first visit) NLR, patients were categorized as  $< 4.70$  (low NLR) or  $\geq 4.70$  (high NLR), with a sensitivity of 27.27%, specificity of 83.46% and accuracy 77.00%. Although this cut-off point demonstrates a good specificity, its low sensitivity indicates limited ability to identify patients who will die. For pre-treatment PLR, patients were categorized as  $< 194.14$  (low PLR) or  $\geq 194.14$  (high PLR), with a sensitivity of 60.61%, specificity of 43.31% and accuracy of 45.30% (Table 4).

Table 3: Comparison of median blood test results by survival status of BC patients (N = 287)

Variable	Visit	Total (N = 287)	Alive (n = 254)	Dead (n = 33)	p-value
NLR	1	2.84 (2.0–4.1)	2.85 (2.0–4.1)	2.76 (2.1–4.7)	0.692
	2	3.64 (2.4–5.1)	3.52 (2.4–5.0)	4.24 (2.9–5.4)	0.100
	3	4.04 (2.8–6.2)	3.92 (2.8–6.1)	4.73 (2.8–8.7)	0.058
PLR	1	212.97 (153.4–299.7)	213.45 (156.4–305.7)	203.04 (145.2–281.5)	0.496
	2	259.30 (188.3–383.3)	258.10 (188.0–383.3)	285.10 (207.6–379.4)	0.467
	3	274.45 (194.9–425.2)	274.41 (194.9–417.3)	279.89 (197.2–498.0)	0.471

Note: Data are presented as the median (interquartile range). P-value from Mann-Whitney U test. \* A significance level of 0.05. Abbreviations: NLR, neutrophil-to-lymphocyte ratio; PLR, platelet-to-lymphocyte ratio.

Table 4: ROC analysis of the NLR and PLR in predicting the mortality.

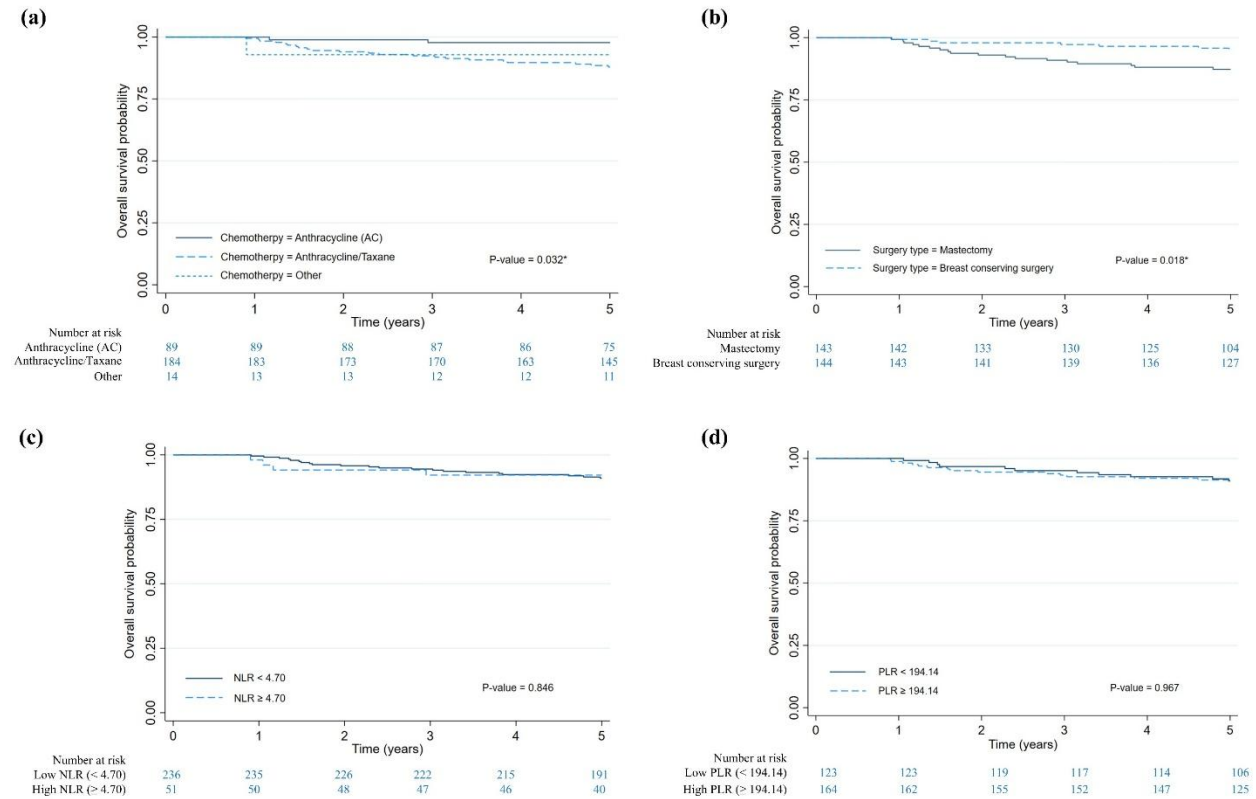
Variable	Visit	Cut-off	AUC (95% CI)	Sensitivity	Specificity	Accuracy
NLR	1	$\geq 4.70$	0.55 (0.47–0.63)	27.27	83.46	77.00
	2	$\geq 3.70$	0.62 (0.53–0.70)	69.70	53.94	55.75
	3	$\geq 8.31$	0.61 (0.52–0.69)	30.30	90.94	83.97
PLR	1	$\geq 194.14$	0.52 (0.43–0.61)	60.61	43.31	45.30
	2	$\geq 281.71$	0.56 (0.47–0.65)	54.55	57.09	56.79
	3	$\geq 480.53$	0.57 (0.49–0.66)	33.33	81.10	75.61

Abbreviations: ROC, Receiver operating characteristic; AUC, Area under the curve; 95% CI, 95% confidence interval; NLR, neutrophil-to-lymphocyte ratio; PLR, platelet-to-lymphocyte ratio.

In the survival analysis, patients had 5-year OS rates of 91.15% (95% confidence interval [CI]: 87.18–93.94). Patients who received anthracycline had highest 5-year OS rate at 97.75% (95% CI: 91.31–99.43), compared to 87.87% (95% CI: 82.15–91.84) for those who received anthracycline/taxane and 92.86% (95% CI: 59.08–98.96) for those on other regimens ( $p=0.032$ ). In terms of surgical intervention, patients who underwent breast-conserving surgery had a 5-year OS rate 95.03% (95% CI: 89.86–97.96), which was higher than patients who had a mastectomy 87.29% (95% CI: 80.57–91.80) ( $p=0.018$ ). Although the AUC and accuracy of NLR and PLR cut-off points at visits 2 and 3 appeared better for classifying 5-year OS (Table 4), we considered using the cut-off values only on the visit 1 (pre-treatment) measurement. These baseline values reflect systemic inflammatory and immune status prior to therapy and avoid treatment-related alterations and immortal-time bias, as supported by prior prognostic studies [8, 11]. Patients with low pre-treatment NLR had a 5-year OS rate of 90.94% (95% CI: 86.43–94.00), while those with high NLR had a 5-year OS rate of 92.16% (95% CI: 80.44–96.98), which is indicating a slightly

higher OS in the high NLR group. However, the OS rates were not significantly different ( $p=0.070$ ). The 5-year OS rates were 90.97% (95% CI: 84.29–94.90) for low PLR and 91.34% (95% CI: 85.80–94.78) for high PLR. The Kaplan-Meier curves show that only chemotherapy regimen and surgery types were significantly differed. However, no significant variations were found in the Kaplan-Meier curves for NLR and PLR classifications with respect to the 5-year OS, as shown in Figure 1.

Figure 1: Kaplan-Meier curves for chemotherapy regimen (a), surgery type (b), neutrophil-to-lymphocyte ratio (NLR) (c), and platelet-to-lymphocyte ratio (PLR) (d). p-values are from log-rank tests.



The univariable Cox regression indicate that chemotherapy regimen and surgery type was a significant prognostic factor. Patients who received anthracycline/taxane had poorer 5-year OS compared to those who receiving anthracycline only (hazard ratio [HR]: 5.55; 95% CI: 1.30–23.58;  $p=0.020$ ). Moreover, patients who underwent mastectomy had poorer 5-year OS compared to those who underwent breast-conserving surgery (HR: 2.74; 95% CI: 1.14–6.56;  $p=0.024$ ). In multi-variable analysis, the association between anthracycline/taxane chemotherapy regimen and poorer 5-year OS remained statistically significant (adjusted hazard ratio [aHR]: 4.63; 95% CI: 1.04–20.61;  $p=0.044$ ). Our findings revealed no differences in 5-year OS based on age; ER, PR, or HER-2 status; or having undergone mastectomy. In addition, the pretreatment NLR and PLR levels were not found to be associated with the mortality of the BC patients as showed in Table 5.

Table 5: Factors associated with 5-year OS of the BC patients (N = 287)

Variable	n/N (%)	Univariable Analysis		Multivariable Analysis	
		HR (95% CI)	p-value	aHR (95% CI)	p-value
Age (years old)		1.03 (0.99 – 1.07)	0.151	1.03 (0.98 – 1.07)	0.224
ER					
Negative	8/87 (9.2)	Ref.			
Positive	17/200 (8.5)	0.91 (0.39 – 2.10)	0.817		
PR					
Negative	12/121 (9.9)	Ref.			
Positive	13/164 (7.9)	0.78 (0.35 – 1.70)	0.529		
HER-2					
Negative	12/120 (10.0)	Ref.			
Positive	6/77 (7.8)	0.77 (0.29 – 2.06)	0.609		
Equivocal	7/90 (7.8)	0.77 (0.30 – 1.96)	0.588		
Chemotherapy regimen			0.064		
Anthracycline	2/89 (2.3)	Ref.		Ref.	
Anthracycline/Taxane	22/184 (12.0)	5.55 (1.30 – 23.58)	0.020*	4.63 (1.04 – 20.61)	0.044*
Other	1/14 (7.1)	3.45 (0.31 – 38.08)	0.312	3.31 (0.30 – 37.01)	0.332
Surgical types					
Mastectomy	18/143 (12.6)	2.74 (1.14 – 6.56)	0.024*	1.69 (0.67 – 4.29)	0.268
Breast-conserving surgery	7/144 (4.9)	Ref.		Ref.	
NLR					
Low (< 4.70)	21/236 (8.9)	Ref.		Ref.	
Hight ( $\geq$ 4.70)	4/51 (7.8)	0.90 (0.31 – 2.62)	0.846	0.81 (0.26 – 2.59)	0.726
PLR					
Low (< 194.14)	11/123 (8.9)	Ref.		Ref.	
Hight ( $\geq$ 194.14)	14/164 (8.5)	0.98 (0.45 – 2.17)	0.967	1.12 (0.48 – 2.62)	0.785

Note: n = number of deaths; N = number of patients. Percentages are based on the number of non-missing observations for that item. The univariable and multivariable analyses were performed using a Cox regression. p-values are derived from the Cox regression. \* A significance level of 0.05.

Abbreviations: NLR, neutrophil-to-lymphocyte ratio; PLR, platelet-to-lymphocyte ratio; HR, hazard ratio; aHR, adjusted hazard ratio; 95% CI, 95% confidence interval; NA, Not applicable.

### 3.2. Discussion

In this cohort, pre-treatment NLR and PLR were not significantly associated with 5-year OS in BC patients receiving adjuvant chemotherapy and radiotherapy. Our results are consistent with a study by Zhang, P. et al. [24], which found that NLR was not significantly associated with OS when compared with low NLR (p=0.579) in patients undergoing complete resection of breast cancer at the Chinese PLA General Hospital (Beijing, China). Similarly, Huszno, J. and Kolosza, Z. [25] observed a non-significant reduction in 5-year OS among patients with NLR > 2.65 compared to those with NLR  $\leq$  2.65 (82.5% vs. 89.6%; p=0.053). However, there were several studies on breast cancer have demonstrated that having a high NLR level significantly results in worse OS [15-17, 26]. Additionally, many studies have found that both high NLR and PLR were associated with reduced OS in patients with nonmetastatic inflammatory BC [22, 27]. Our finding

of non-significant association with worse OS was contrast with the findings in [27] which is indicating a significantly worse OS rate linked to an elevated PLR ( $>169.1$ ) in men with BC (22.2% vs. 70.1%;  $p=0.008$ ). While several meta-analyses have indicated that a high PLR was associated with a worse prognosis for BC patients [25, 28]. However, our results aligned with a study of Van Berckelaer, C. et al. [29], which showed that the high PLR was not significant predictor of worse OS in inflammatory breast cancer (HR: 0.98; 95%CI: 0.49-1.95;  $p=0.95$ ).

Even though the pre-treatment NLR and PLR could not be used in examining the risk of death in this study, a near-significance of difference on the median NLR at visit 3 between alive and dead patients is interesting ( $p=0.058$ ). The trend of increasing NLR during treatment and its near-significant association with death proposed that on-treatment or change in NLR may be a more valuable biomarker than a single pre-treatment value [30]. Further study including on-treatment or changes of this indicator during treatment period should be conducted.

While NLR and PLR are simple tools and cost-effective parameters [9, 11] identifying the optimal cut-off point remain unclear. Most authors use the median to divide patients into groups with high and low NLR and PLR values [30]. Consequently, the cut-off values vary widely across studies. Previous meta-analysis studies have reported high NLR cut-off values ranging from 2.0 to 5.0 [17] and PLR values ranging from 107.64 to 300 [26]. In our study, as mentioned above, the cut-off was 4.70 and 191.14 for pre-treatment NLR and PLR, respectively. Although pre-treatment NLR and PLR were not statistically significant prognostic factors for OS in this study, their role as markers of systemic inflammation and immune status may still be valuable [31] when interpreted alongside other clinical and pathological variables (i.e., body mass index, tumor size, and cancer subtype) [27]. Therefore, the clinical utility of systemic inflammation indices requires further validation and evaluation through prospective studies to determine their prognostic relevance and applicability [30]. Other inflammatory indicators such as lymphocyte-to-monocyte, monocyte-to-lymphocyte, and absolute lymphocyte count, which have been examined for their prognostic in BC, are not measured in our study [13]. Numerous studies have consistently shown that elevated NLR and PLR levels are linked to worse survival outcomes and serve as valuable prognostic indicators for patients with various solid malignancies [32].

According to multivariable analysis, only AC-T chemotherapy was associated with higher 5-year mortality (aHR: 4.63; 95% CI: 1.04–20.61;  $p=0.044$ ). This result seems to reflect confounding by indication since this regimen is typically given to patients with more aggressive disease (e.g., higher stage, HER2-positive, triple-negative BC) [33]. Although this variable may be not a casual effect to death, it may be valuable for prognostic of on-treatment inflammatory dynamics.

The main limitations of this study are its retrospective, single-institution design, small sample size, and missing data, which may have introduced selection bias [34]. Incomplete data for known prognosis factors such as Ki-67 and tumor size may result in limited ability of adjustment in the multivariable analysis for interpretation of chemotherapy results. The requirement for at least three blood analyses further reduced the number of eligible samples ( $N=287$ ) below the calculated minimum ( $N=323$ ), which may have reduced statistical power. Consequently, larger prospective studies with comprehensive clinical and laboratory data are needed to validate these findings.

## **Conclusion**

Routine blood tests are among the most accessible and essential tools for monitoring oncological therapies. Although there was no significant association between pre-treatment NLR or PLR and 5-year OS, on-treatment and changes of NLR parameter during treatment suggested an interesting biomarker in addition to a single pre-treatment value. The chemotherapy regimen was significantly related to survival; however, it might be a confounding from a consequence of high-risk patient treatment. In addition, given that NLR and PLR may be influenced by clinical and pathological factors, future prospective studies should evaluate their dynamic changes during treatment and ensure complete collection of key prognostic variables to better account for confounding factors.

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## The Five Key Messages of Communication and Advocacy for No Smoking in Indonesian Educational Institutions

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### Abstract

**Introduction:** According to Indonesia's national regulations contained in Health Law No. 17 of 2023 and PP No. 28 years 2024, the place of teaching and learning is an area free from cigarette smoke. However, not all education institution in Indonesia have enforced this regulation. Universitas Airlangga (Unair) is a pioneer and, at this time, the only university in Indonesia to implement a total ban including TAPS. This article examine how Unair successfully implemented a 100% smoke-free policy on its campus. What are the most effective methods of communication and advocacy to ensure the successful implementation of the regulation and what the key message is?

**Method:** This is an action research. The study begins with analyzing the current efforts to control smoking issues at Universitas Airlangga by observation and document study. The evaluation covers policies, facilities, signage, and personnel involved in smoking control. Subsequently, objectives are set, along with the messages to be conveyed and the most appropriate methods, based on advocacy and health communication principles. The key actors involved include university leadership, lectures, staffs, students, and the Airlangga Health Promotion Center (AHPC). The research was conducted over a period of four years, from 2021 to 2024.

**Result:** After many times and many method of communication and advocation, as a result, Unair has a special Rector's Regulation regulating zero tolerance of smoking. Universitas Airlangga Rector's Regulation No. 13 of 2023 states that Unair is an area free from cigarette smoke. No one should smoke at Unair. Smokers in Unair's management area will be fined Rp 250,000,- Unair also formed a officer task force to enforce the implementation of this regulation. The five key communication and advocacy messages are: (i) Smoking causes health problems. (ii) Smoking creates social issues by disturbing others who want to breathe fresh air free from cigarette smoke. (iii) Economically, purchasing cigarettes risks increasing family expenses,

which can reduce budgets allocated for health, education, and nutrition. (iv) Many families divert their income towards buying cigarettes, making it difficult to afford their children's education. As a result, students—specifically Unair students—have requested tuition discounts from the university, which inevitably impacts Unair's revenue. (v) The regulation regarding smoke-free areas at Unair does not prohibit the right to smoke but rather regulates where smoking is allowed within the campus: smoking is only permitted outside the university premises.

**Conclusion:** Airlangga University is the first one and the only educational institution in Indonesia that is Total Zero Smoking and TAPS Banned through communication, advocacy, capacity building and enforcement of smoke free area and using 5 key message of communication.

**Keywords:** *Health Communication, Advocation, Message, Universitas Airlangga, No Smoking*

## **1. Introduction**

As a densely populated and rapidly growing country, Indonesia encounters major issues linked to smoking. The high rate of smoking carries serious consequences for public health and the general well-being of its people. In 2018, the smoking rate in Indonesia was 33.8% for both men and women. This figure ranks Indonesia among the countries with the highest smoking prevalence in Southeast Asia (Effendi et al., 2024). Tobacco-related illnesses are among the primary causes of early mortality in Indonesia, accounting for approximately 16.2% of all deaths. This includes 24.3% of deaths among adult men and 6.3% among adult women (Meilissa et al., 2022). The prevalence of smoking among youth is 16.1% for males and 1.3% for females. In Indonesia, it is estimated that approximately 268,614 people die each year due to smoking. Additionally, the economic cost associated with smoking and tobacco use is estimated to be around Rp 288.054.294.795.929 (The Tobacco Atlas, 2024).

The Indonesian government is attempting to address the issue of smoking by implementing health regulations and laws. The central government has mandated all regional administrations to establish smoke-free zones (SFAs) through Health Law No. 36/2009 and Presidential Regulation No. 109/2012 since 2009. However, by 2020, only 324 out of 514 districts had implemented policies concerning SFAs in their areas (Sufri et al., 2023). Then, this regulation updated by Health Law No. 17 of 2023 and Government Regulation No. 28 of 2024, the place of teaching and learning is an area free from cigarette smoke. The Indonesian government has been working to decrease smoking rates by implementing smoke-free policies across seven areas: healthcare facilities, educational institutions, children's play zones, places of worship, public transportation, workplaces, and general public places (Kramer et al., 2023).

As a result, 55% of these zones continue to violate the SFZ regulations. Tobacco control remains a challenge in Indonesia, especially considering that it is the only one among six developing countries that has not ratified the World Health Organization's Framework Convention on Tobacco Control (Sulistiadi et al., 2020). However, not all education institution in Indonesia have enforced this regulation. But Universitas Airlangga (Unair) is the only one of higher education institution in Indonesia who enforce the total zero tolerance of smoking including TAPS Banned (total banned of advertising, promotion and sponshorship) in all of their area. This article will examine how Unair successfully implemented a 100% smoke-free policy on its campus. What are the most effective methods of communication and advocacy to ensure

the successful implementation of the regulation and what the key message is? Key messages are the core pieces of information that an organization aims to communicate about itself or its initiatives. They are intended for the organization's audiences to understand, accept, or act upon. Additionally, they represent what the organization wants third parties—such as mediators or intermediaries—to relay to their audiences. These messages are typically visible on the surface of communication, easily identifiable through specific words or phrases. They may include references to objects, names of individuals or organizations, issues, or topics; attributes—whether substantive or evaluative; or associations, such as co-occurrences between objects, attributes, or a combination of both (E. Carroll et al., 2014). These messages serve as a guide to help for prioritizing and clarify the information, ensuring consistency, continuity, and accuracy throughout the communications. Key message also enable to measure and monitor progress and remain focused when engaging with the media or stakeholders, ultimately strengthening the impact of the message (Department of Health & Services, n.d.). This article examines how Unair successfully implemented a 100% smoke-free policy, identifying the most effective communication and advocacy methods and the key messages that drove compliance.

## **2. Method**

This is an action research. The study begins with analyzing the current efforts to control smoking issues at Universitas Airlangga by observation and document study. The evaluation covers policies, facilities, signage, and personnel involved in smoking control. Based on document studies, it was found that there are no specific regulations addressing the ban on smoking within Unair's environment. Preliminary observations revealed five cigarette butts in the park and in the corridor of one faculty. Additionally, preliminary studies also found security personnel smoking in the Unair parking area. It was also not found any signage indicating a smoking ban on the Unair campus. Subsequently, objectives are set, along with the messages to be conveyed and the most appropriate methods, based on advocacy and health communication principles. The key actors involved include university leadership, lectures, staffs, students, and the Airlangga Health Promotion Center (AHPC). The Advocacy to the rector was conducted three times via Zoom meetings, and advocacy to middle management was carried out once offline. Advocacy and dissemination to staff were conducted three times offline, while advocacy to students was held twice through online webinars. The research was conducted over a period of four years, from 2021 to 2024 involving 10 workshops, 14 materials used, social media campaigns on Instagram (10 times) and youtube (4 times). In this action research, what is being sought is the most effective and efficient key communication message to ensure the implementation of the smoke-free campus regulation.

## **3. Result and Discussion**

In 2009, the Indonesian government issued regulations regarding Smoke-Free Zones, which were later updated with the 2023 Health Law. These regulations specify designated smoke-free areas, including educational institutions. Universitas Airlangga (Unair), as an educational institution, is subject to these regulations. Unair is the largest university in eastern Indonesia, with more than 40,000 students and over 5,000 staff and faculty members. Unair is the second best university in Indonesia and Unair is ranked 12th in Southeast Asia (*Universitas Airlangga : Rankings, Fees & Courses Details*, 2025). Due to its size and reputation, Unair is considered a

reference for other campuses across Indonesia.

Through document study, it was found that in 2017, Airlangga University adopted the concept of a Health Promoting University (HPU), aimed at improving the health status of the campus community, including lecture, staff, and students. By 2021, the Airlangga Health Promotion Center (AHPC) was established to oversee HPU activities. The AHPC reports directly to the university's rectorate and is accountable to the Vice Rector for Research, Innovation, and Community Development (RICD). In the same year, the AHPC conducted a situational analysis, which included an assessment of issues related to tobacco control within the university environment. Based on the results of an identification and situational analysis conducted through document study, it was found that Unair did not yet have a formal policy document regarding tobacco control. Observations revealed that Unair lacked clear signage indicating a no-smoking policy. Additionally, the study of the campus environment showed that there were still smokers on campus, with cigarette butts, ashtrays, and the smell of cigarette smoke present in various areas. Smoking has long been stigmatized in society, and medical research consistently shows that it poses health risks to both smokers and those exposed to secondhand smoke (Büyükyılmaz, 2023). Some study showed indicated that awareness of the risks associated with smoking was relatively high among the participants. However, their attitudes toward smoking were generally negative, as most still accepted peer invitations to smoke. In Indonesia, aAccess to cigarettes was fairly simple, as students could purchase retail cigarettes from nearby stalls near the school. Additionally, peers played a significant role in influencing smoking behavior within the school environment (Syam et al., 2023).

Therefore, the AHPC, the unit responsible for enhancing the health status of campus communities promptly initiated advocacy efforts to establish Smoke-Free Area regulations at Unair. The advocacy began with lobbying the Vice Rector for RICD to align perceptions, at the end of 2021. This initial step was relatively smooth because the Vice Rector shared the same views and strongly supported the initiative. Next, the advocacy targeted the Rector, as the highest leader of the university. Together with the Vice Rector, the AHPC approached the Rector to communicate the purpose of tobacco control efforts. The key message emphasized regulation of designated places for smoking. A key message is the core piece of information to convey the audience. It should be a concise, impactful statement that clearly resonates with and connects to audience. To successfully inform and educate the public about our specialty, it is essential to master the art of crafting key messages (Farris, 2012). The key message for rector is about the national regulation. It was made clear that throughout the entire Unair campus, as an educational institution, smoking is prohibited—no cigarette butts, ashtrays, or cigarette smoke odor should be present. Smokers are only permitted to smoke outside the campus boundaries. There are no designated smoking areas within Unair. This policy aligns with the Health Law No. 36 of 2009, updated by Law No. 17 of 2023, concerning tobacco control. In accordance with these regulations, no-smoking signs (zero tolerance) are displayed throughout the campus to reinforce the policy.

Due to the ongoing COVID-19 pandemic and the nationwide lockdown in Indonesia, including at Unair, all communication and advocacy efforts with the Vice Rector and Rector were conducted via Zoom meetings. There were no offline activities on campus. This virtual communication took place four times: twice with the Vice Rector and twice with the Rector. The first Zoom meeting focused on aligning perceptions regarding the concept and urgency of tobacco control within the campus. The second meeting aimed to agree on the finalized concept

after several revisions. Subsequently, we reached consensus on the content and message to be conveyed. Key message integrity pertains not only to the content of the messages being conveyed but also to the effectiveness with which they are communicated (E. Carroll et al., 2014).

The next step throughout 2022 was to advocate to all university leaders within Unair who are in middle management positions, such as deans, directors of departments, heads of agencies, unit leaders, section heads, and sub-section heads. Since COVID-19 cases had decreased, in-person face-to-face meetings were conducted. These communications and advocacy efforts involved gathering them in a single venue and organizing seminars that discussed the impacts of smoking on health, social aspects, and the economy. This dissemination aims to increase awareness about the impact of smoking. Previous research shows that providing education on the knowledge and attitudes regarding smoking is a crucial component in efforts to prevent smoking and enhance public health overall. Through a comprehensive and integrated approach, it is hoped that society will become more aware of the risks associated with smoking and better equipped to make choices that promote both individual and community health and well-being (Wijaya et al., 2024).

In this communication and advocacy, several key messages are utilized. The key messages conveyed were around health, social and economically issues. There are key messages in 5 categories that are health, social, economic (personal), economic (institutional) and right and regulation.

(i) The key message of health category: "Smoking is a primary cause of preventable death and disease, harming both smokers and those exposed to secondhand smoke."

(ii) The key message of social category: "A smoke-free campus ensures everyone's right to clean air and protects youth, as smoking is a known gateway to other risky behaviors." Smoking creates social issues by disturbing others who want to breathe fresh air free from cigarette smoke. Additionally, smoking often serves as an entry point into drug use, especially among youth—most who fall into drug abuse have first engaged in smoking.

(iii) Economic (Personal) category: "Spending on cigarettes diverts crucial family income from essentials like food, healthcare, and education." Purchasing cigarettes risks increasing family expenses, which can reduce budgets allocated for health, education, and nutrition. Notably, 70% of smokers in Indonesia come from low-income families.

(iv) Economic (Institutional) category: "Smoking directly impacts the university's finances, as families struggling with tobacco expenses request tuition discounts, reducing institutional revenue." Many families divert their income towards buying cigarettes, making it difficult to afford their children's education. As a result, students—specifically Unair students—have requested tuition discounts from the university, which inevitably impacts Unair's revenue.

(v) Rights & Regulation Category. "This policy does not ban smoking; it regulates where it is permitted to protect the majority. Smoking is allowed only outside university premises." This should be the central, most repeated message. This is the most important category for compliance. The regulation regarding smoke-free areas at Unair does not prohibit the right to smoke but rather regulates where smoking is allowed within the campus. Smoking is only permitted outside the university premises.

Successful key messages avoid technical jargon and intricate details. Instead, they deliver simple, clear, and concise information designed to capture people's attention and generate interest in the work. A strong key message is concise, utilizing clear and approachable language that is easy to articulate aloud. It centers on a single idea, making it straightforward for people to grasp

and recall. Additionally, it should be persuasive without being judgmental and directly relevant to the target audience, ensuring the message resonates and leaves a lasting impression (Agot, 2008).

These five key messages were discussed in meetings with middle management at the university and faculty levels. The discussions were animated, involving passionate debates about human rights, the interests of tobacco farmers, and the cigarette manufacturing industry, which is notably prominent in East Java—home to all three of Indonesia’s major tobacco companies and where Universitas Airlangga is located. However, based on the data presented and the discussions held, an agreement was reached that Unair, as an educational institution, must adhere to national regulations and uphold the spirit of education aimed at youth.

The next step for the AHPC team was to advocate to all faculty members, including lecturers, administrative staff, and students. This communication was carried out across all faculties by gathering lecturers, staff, and students around five key messages communication. Key messages are vital instruments for effectively conveying your subject (Murphy & Grant, 2011). Debates and conflicts frequently arose during these discussions; however, they consistently concluded with an agreement to implement regulations banning smoking within Unair. The advocacy directed at students was conducted by the AHPC team in collaboration with Soby. Initially, efforts focused on engaging and communicating with the Student Executive and Legislative Unit before extending the outreach to the entire student body. For successful advocacy, so needed addition to standard key messages through find it necessary to craft additional messages to address various situations that emerge throughout research (Agot, 2008).

Eventually, everyone agreed to introduce a no-smoking regulation at Unair. In February 2023, the university issued Rector Regulation No. 13 of 2023 concerning a 100% Smoke-Free Zone across the entire campus. The regulation stipulates that smoking, producing, selling, sponsoring, or advertising cigarettes and anything affiliated with the tobacco industry is prohibited throughout Unair’s premises. Violators who smoke on campus are subject to a fine of IDR 250,000. The regulation also assigns responsibility to the leaders of all units within Unair to disseminate the rules, display no-smoking signs, and enforce the regulations within their respective areas. If a unit head fails to comply, they are subject to punishment by the rector.

Furthermore, the regulation mandates follow-up enforcement through the establishment of a dedicated task force responsible for overseeing the smoke-free zone at Unair. Consequently, the same year, Decree No. 49 of 2023 was issued to form the Unair Smoke-Free Zone Task Force. This team comprises staff from all 19 faculties and the 28 units within Universitas Airlangga.

With the formation of this task force, the AHPC team shifted from solely enforcement to supporting the team through training on the five key communication messages and proper enforcement techniques. Monthly surprise inspections are conducted across all areas of Unair to ensure compliance. In 2023, these inspections focused mainly on education and dissemination of the regulations. However, by 2024, enforcement efforts shifted from just dissemination to active enforcement. Over the course of a year, the results are illustrated in Figure 1.

Figure 1. The Implementation Indicator for Smoke Free Regulation at Universitas Airlangga 2024

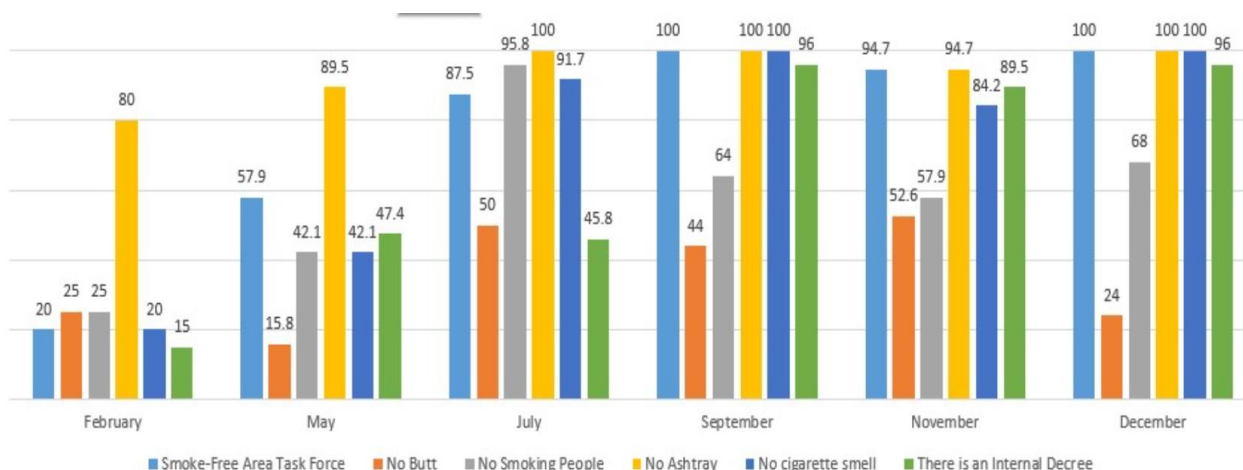


Figure 1 shows that there is a decrease in smokers and an increase in compliance. Compliance has increased significantly from the beginning to the end of 2024. The indicator of implementation compliance used is a measurement from the Ministry of Health of Republic Indonesia. There was a slight increase when new students entered the campus. This is because new students are not sure that the enforcement of no smoking rules is properly implemented at Unair. So the communication of no smoking regulation by AHPC has been carried out when new students enter.

#### **4. Conclusion**

Airlangga University is a pioneer and at this time the only university in Indonesia to implement a total ban including TAPS through communication, advocacy, capacity building and enforcement of smoke free area. The five keys communication and advocacy messages that were successfully and effectively implemented are: (i) The key message of health category: "Smoking is a primary cause of preventable death and disease, harming both smokers and those exposed to secondhand smoke." (ii) The key message of social category: "A smoke-free campus ensures everyone's right to clean air and protects youth, as smoking is a known gateway to other risky behaviors." (iii) Economic (Personal) category: "Spending on cigarettes diverts crucial family income from essentials like food, healthcare, and education." (iv) Economic (Institutional) category: "Smoking directly impacts the university's finances, as families struggling with tobacco expenses request tuition discounts, reducing institutional revenue." (v) Rights & Regulation Category. "This policy does not ban smoking; it regulates where it is permitted to protect the majority. Smoking is allowed only outside university premises." This should be the central, most repeated message. This is the most important category for compliance.

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## 7. Appendix

### Biography - Dr. Widati, Sri

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