INSIGHTS-JOURNAL OF
HEALTH AND REHABILITATION

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

IMPACT OF ANEMIA ON LENGTH OF HOSPITAL STAY IN PATIENTS ADMITTED WITH HEART FAILURE

Original Research

Arsh-E-Jabeen Nasir[1]*, Muhammad Faheem[2], Qinnat Ullah[3], Nazia Sultana[4], Abuzr Ali[5]
[1]PGR FCPS, Department of Cardiology, Khyber Teaching Hospital (KTH), Peshawar, Pakistan.
[2]Associate Professor, Department of Cardiology, Khyber Teaching Hospital (KTH), Peshawar, Pakistan.
[3]Postgraduate Resident, Department of Cardiology, Khyber Teaching Hospital (KTH), Peshawar, Pakistan.
[4]Postgraduate Resident, Department of Cardiology, Khyber Teaching Hospital (KTH)(MIT), Peshawar, Pakistan.
[5]MBBS 3rd Year Student, Pak Red Crescent Medical & Dental College, Pakistan.
Corresponding Author: Arsh-E-Jabeen Nasir, PGR FCPS, Department of Cardiology, Khyber Teaching Hospital (KTH), Peshawar, Pakistan, arshukhan943@gmail.com
Acknowledgement: The authors thank the staff of Khyber Teaching Hospital for their support during data collection.

Conflict of Interest: None
Grant Support & Financial Support: None

ABSTRACT

Background: Anemia is a common comorbidity in heart failure and has been linked to poor outcomes, including increased mortality, reduced functional capacity, and higher hospitalization rates. However, its impact on the duration of hospital stay, particularly in resource-limited settings, remains underexplored.

Objective: To evaluate the impact of anemia on the length of hospital stay among patients admitted with heart failure in tertiary care hospital.

Methods: This cohort study was conducted over six months in the Department of Cardiology, Khyber Teaching Hospital, Peshawar. A total of 460 patients aged 40–80 years with diagnosed heart failure were enrolled using non-probability consecutive sampling. Patients were divided into two groups based on the presence or absence of anemia, defined as hemoglobin <13 g/dL in males and <12 g/dL in females. Data on demographics, clinical characteristics, NYHA class, hemoglobin levels, and hospital stay duration were collected. Statistical analysis was performed using SPSS v25, with significance set at $p \leq 0.05$.

Results: Out of 460 patients, 230 had anemia and 230 did not. The anemic group had a longer mean hospital stay (4.83 ± 3.95 days) compared to the non-anemic group (3.76 ± 2.69 days), with the difference being statistically significant ($p < 0.05$). The anemic group also showed a higher proportion of NYHA Class III–IV status and lower mean hemoglobin levels (10.8 ± 1.1 g/dL vs. 13.9 ± 0.7 g/dL).

Conclusion: Anemia is associated with a significantly longer hospital stay in heart failure patients, highlighting the need for routine screening and management of anemia in this population to potentially reduce healthcare burden.

Keywords: Anemia, Heart Failure, Hospitalization, Length of Stay, Morbidity, NYHA Classification, Tertiary Care.

INTRODUCTION

Heart failure (HF) is a prevalent and debilitating cardiovascular condition affecting an estimated 26 million individuals globally, and its burden continues to grow with increasing age and chronic disease prevalence. The disease trajectory is often marked by high morbidity and mortality; international data indicate that the 1-year all-cause mortality rates are approximately 17% for hospitalized patients and 7% for stable ambulatory cases (1). Despite being historically regarded as a disease of affluent societies, HF has now emerged as a significant public health issue in developing countries, where it poses a heavy burden on already strained healthcare systems (2,3). Notably, the prevalence and presentation of HF are not uniform worldwide, with marked geographic variability influenced by differing etiologies, comorbidities, and healthcare infrastructure (4). Among the numerous factors that modulate outcomes in HF, comorbidities are increasingly recognized as key determinants of prognosis. One particularly important comorbidity is anemia, which has been consistently associated with worse clinical outcomes. Studies have shown that anemia in HF patients leads to increased hospitalization rates, higher mortality, impaired quality of life, and reduced exercise capacity (5-7). The underlying pathophysiological mechanisms are thought to involve hypoxia-induced hemodynamic changes and neurohormonal activation, which together exacerbate the progression of HF (8). Importantly, data from Western populations have confirmed the adverse impact of anemia on patients with HF, regardless of their ejection fraction status (9). A significantly higher incidence of anemia among HF patients has also been reported, with detrimental effects on survival, symptom burden, and healthcare utilization (10).

In one such study conducted, it was observed that HF patients with anemia had a longer mean hospital stay (4.71±4.00 days) compared to those without anemia (3.82±2.68 days), highlighting the potential role of anemia in prolonging inpatient care (11). However, despite these findings, most of the existing literature originates from Western contexts, and the influence of ethnicity, regional disease characteristics, and variations in healthcare delivery limit the generalizability of these results to other populations. There remains a scarcity of local research examining the association between anemia and length of hospitalization in HF patients within resource-limited settings, creating a notable evidence gap. Addressing this gap is essential not only for enhancing clinical understanding but also for informing effective resource allocation, patient counselling, and targeted management strategies. The present study has thus been designed to explore the impact of anemia on the length of hospital stay among patients admitted with heart failure in a tertiary care setting. The findings aim to provide context-specific insights that could contribute to reducing hospital burden and improving patient outcomes. The objective of this study is to determine whether the presence of anemia is associated with a longer duration of hospital stay in patients admitted with heart failure.

METHODS

This cohort study was conducted in the Department of Cardiology at Khyber Teaching Hospital, Peshawar, over a duration of six months following the approval of the research synopsis by the institutional review board. Ethical clearance was obtained prior to initiation of the study. All participants were enrolled after obtaining written informed consent, ensuring that the purpose, risks, and benefits of the study were clearly explained to each patient. The study aimed to evaluate the impact of anemia on the length of hospital stay among patients admitted with heart failure. The sample size was calculated using Open Epi software based on previously reported mean hospital stay durations: 4.71 ± 4.00 days in anemic patients and 3.82 ± 2.68 days in non-anemic patients (1). With a power of 80% and a confidence level of 95%, the total sample size was estimated to be 460 patients, divided equally into two groups of 230 each. A non-probability consecutive sampling technique was employed for patient recruitment. Patients aged between 40 and 80 years of both genders, admitted with heart failure according to the predefined operational criteria, were eligible for inclusion. Those with anemia as defined by hemoglobin levels <12 g/dL in females and <13 g/dL in males were considered exposed, while those without anemia were classified as non-exposed. Patients with chronic kidney disease, malignancy, severe hemodynamic compromise, known bleeding disorders, or those who died during hospitalization were excluded to avoid confounding factors that could independently influence the length of stay (12,13).

Baseline demographics and clinical characteristics were recorded on a structured proforma by the principal investigator. Variables included age, gender, body mass index (BMI), New York Heart Association (NYHA) functional class, residential status, education level,

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

occupation, and socioeconomic status (14). Venous blood samples (5 cc) were drawn from a superficial vein in the non-dominant arm, processed within 30 minutes by the hospital laboratory, and analyzed using a calibrated hematology analyzer operated by the senior-most technician to determine hemoglobin concentration. Patients were then allocated to either the anemia group (Group A) or non-anemia group (Group B). Efforts were made to match both groups by age to minimize confounding. Data analysis was performed using IBM SPSS version 25. Quantitative variables such as age, BMI, hemoglobin levels, and hospital stay duration were assessed for normality using the Shapiro-Wilk test. Depending on the data distribution, they were expressed as mean ± standard deviation or median with interquartile range. Categorical variables such as gender, NYHA class, and socioeconomic status were presented as frequencies and percentages. The primary outcome—length of hospital stay—was compared between the two groups using the independent samples t-test or Mann-Whitney U test, as appropriate. Stratification was conducted for potential effect modifiers including age, gender, BMI, and NYHA class. Post-stratification analysis also employed the t-test or Mann-Whitney U test. A p-value of ≤0.05 was considered statistically significant.

RESULTS

The total sample comprised 460 patients admitted with heart failure, evenly divided into two groups: 230 patients with anemia and 230 patients without anemia. Both groups were matched for age to reduce confounding. The mean age of patients in the anemic group was 65.2 ± 9.4 years, while in the non-anemic group it was 64.3 ± 10.1 years. Gender distribution was relatively balanced across both groups, with a slightly higher proportion of males. BMI values were similar between groups, with anemic patients having a mean BMI of 24.1 ± 3.7 and non-anemic patients at 24.9 ± 4.1. Socioeconomic and educational backgrounds also revealed important trends. A larger percentage of anemic patients belonged to the lower socioeconomic class (48.7%) compared to non-anemic patients (42.6%). The proportion of unemployed individuals was slightly higher in the anemic group (58.3%) relative to the non-anemic group (51.7%). Regarding education, a substantial proportion of anemic patients had only primary education (44.8%) compared to 41.3% in the non-anemic group. Urban residence was more common in both groups, but slightly higher in the non-anemic group (45.7%) than the anemic group (40.0%). In terms of NYHA classification, patients with anemia exhibited a more severe symptom profile. In the anemic group, 42.6% of patients were categorized as NYHA Class III and 30.9% as Class IV. Conversely, in the non-anemic group, Class III and IV comprised 39.1% and 23.9% respectively. This indicated a relatively higher functional limitation in the anemic group.

Hemoglobin levels clearly distinguished both groups, with the anemic cohort showing a mean hemoglobin of 10.8 ± 1.1 g/dL, significantly lower than the 13.9 ± 0.7 g/dL observed in the non-anemic cohort.nThe primary outcome of interest—length of hospital stay—also differed notably between groups. Patients with anemia had a mean hospital stay of 4.83 ± 3.95 days, whereas those without anemia stayed an average of 3.76 ± 2.69 days. The median duration also differed: 4 days (IQR 2–6) for the anemic group and 3 days (IQR 2–5) for the non-anemic group. This difference was found to be statistically significant ($p < 0.05$), supporting the hypothesis that anemia is associated with prolonged hospitalization among heart failure patients. Two visual charts supplement these findings. The first chart illustrates the difference in mean hospital stay between the two groups, highlighting the longer duration in the anemic group. The second chart shows the NYHA class distribution across both groups, with a visible shift toward more severe classes in patients with anemia, reinforcing the clinical burden imposed by anemia in heart failure management.

Table 1: Demographic Characteristics of Study Population

Variable	With Anemia (n=230)	Without Anemia (n=230)
Age (mean ± SD)	65.2 ± 9.4	64.3 ± 10.1
Gender		
Male (%)	128 (55.7%)	120 (52.2%)
Female (%)	102 (44.3%)	110 (47.8%)
BMI (mean ± SD)	24.1 ± 3.7	24.9 ± 4.1
Socioeconomic Status		
Lower (%)	112 (48.7%)	98 (42.6%)
Middle (%)	91 (39.6%)	101 (43.9%)
Upper (%)	27 (11.7%)	31 (13.5%)
Occupation		

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

Variable	With Anemia (n=230)	Without Anemia (n=230)
Employed (%)	96 (41.7%)	111 (48.3%)
Unemployed (%)	134 (58.3%)	119 (51.7%)
Residence		
Rural (%)	138 (60.0%)	125 (54.3%)
Urban (%)	92 (40.0%)	105 (45.7%)
Education		
Primary (%)	103 (44.8%)	95 (41.3%)
Middle (%)	79 (34.3%)	81 (35.2%)
Higher (%)	48 (20.9%)	54 (23.5%)

Table 2: NYHA Class Distribution by Group

NYHA Class	With Anemia (n=230)	Without Anemia (n=230)
I	15	23
II	46	62
III	98	90
IV	71	55

Table 3: Hemoglobin Levels by Group

Group	Hemoglobin (mean ± SD) gm/dl
With Anemia	10.8 ± 1.1
Without Anemia	13.9 ± 0.7

Table 4: Length of Hospital Stay Comparison

Group	Mean Length of Stay (days)	SD	Median (IQR)
With Anemia	4.83	3.95	4 (2–6)
Without Anemia	3.76	2.69	3 (2–5)

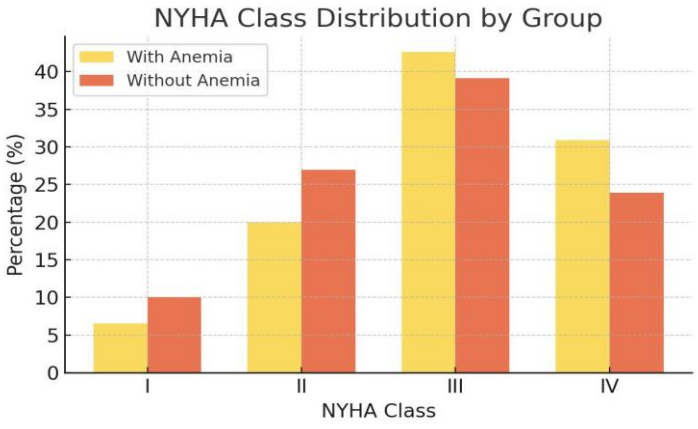

Figure 2 NYHA Class Distribution by Group

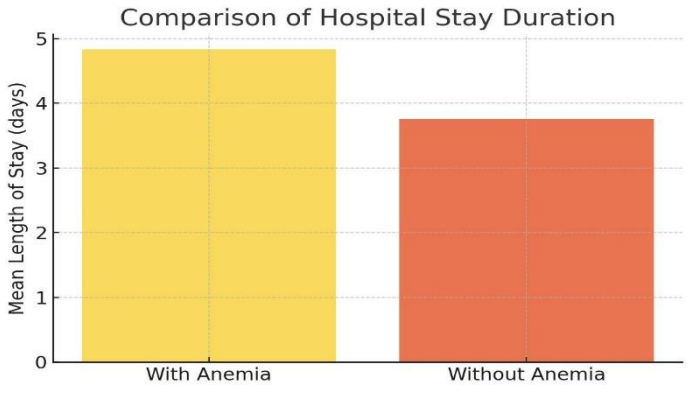

Figure 2 Comparison of Hospital stay Duration

DISCUSSION

The present study demonstrated that anemia significantly prolongs the length of hospital stay in patients admitted with heart failure, with the anemic group exhibiting a mean stay of 4.83 ± 3.95 days compared to 3.76 ± 2.69 days in the non-anemic group. These findings align with a growing body of literature underscoring the adverse clinical and economic implications of anemia in the context of heart

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

failure. Multiple studies have confirmed that anemia is not merely a comorbidity but a prognostic marker in heart failure patients. A recent population-based study involving over 250,000 admissions revealed that patients with iron deficiency anemia (IDA) and decompensated heart failure had longer hospital stays and higher hospitalization costs, even after propensity score matching and multivariate adjustment (15). Similarly, a retrospective study reported that hemoglobin levels below 10 g/dL on either admission or discharge were associated with increased length of stay, higher 30-day readmission rates, and elevated 3-year mortality in patients with acute heart failure (16). The present findings are also supported by the ARIC study which found that anemia prolonged hospital stay in both heart failure with preserved ejection fraction (HFpEF) and reduced ejection fraction (HFrEF), though the effect was more pronounced in HFpEF patients (17). The association was consistent across different study designs and populations, reaffirming the validity of anemia as a contributor to adverse hospital metrics.

The observed increase in hospital stay may be attributed to multiple mechanisms. Anemia impairs oxygen delivery to tissues, exacerbates neurohormonal activation, and aggravates myocardial workload. These pathophysiological changes can intensify HF symptoms, thereby necessitating more prolonged inpatient care (18). Anemia has also been associated with worsened NYHA functional class and reduced exercise tolerance, which correlates with our finding of a higher proportion of Class III–IV patients in the anemic group. This supports prior studies suggesting that anemia worsens clinical severity, especially among those already at higher risk (19,20). Strengths of the present study include its adequately powered sample size, standardized operational definitions, and matched control group, which allowed a fair comparison of hospitalization duration between the two cohorts. The exclusion of confounding comorbidities like CKD, malignancy, and bleeding disorders enhanced internal validity. However, the study has notable limitations. The non-probability consecutive sampling restricts the generalizability of findings. Moreover, absence of data on iron indices, renal function, natriuretic peptide levels, and medications precludes a more nuanced analysis of anemia's etiology and interaction with HF management.

Another limitation was the exclusion of patients who died during hospitalization. This may have introduced survivor bias, potentially underestimating the severity of anemia's impact on in-hospital outcomes. Literature suggests that anemic HF patients have higher inpatient mortality; for example, a study from two ESC heart failure registries reported a significantly higher 1-year mortality in anemic patients, though this was attenuated in multivariate models (21). Although anemia appears as an independent risk factor in some studies, other analyses argue it may serve as a marker of more advanced disease or comorbidity burden. The Polish cohort study observed that anemia co-occurred with worse clinical features such as older age, CKD, and diabetes, suggesting it may reflect underlying systemic deterioration rather than being causative (22). These findings have important clinical implications. Timely identification and management of anemia could potentially reduce hospital stay, resource utilization, and financial burden. Further studies are warranted to explore whether correction of anemia through intravenous iron therapy or erythropoiesis-stimulating agents can translate into shorter hospitalizations and improved outcomes. Current evidence from trials like FAIR-HF and CONFIRM-HF supports the use of intravenous iron in reducing symptoms and HF hospitalizations, though its effect on LOS remains less defined. In conclusion, the study adds to the accumulating evidence that anemia significantly increases hospital stay in heart failure patients. While causality cannot be firmly established in observational settings, the consistency across multiple cohorts and geographic regions reinforces the need to prioritize anemia management in HF care pathways. Future research should focus on interventional strategies and explore whether specific subtypes of anemia confer different risks.

CONCLUSION

This study concludes that anemia significantly increases the length of hospital stay in patients admitted with heart failure, reflecting its detrimental impact on clinical outcomes and healthcare resource utilization. Recognizing and managing anemia early in the course of heart failure may help reduce hospitalization burden and improve patient care. These findings underscore the need for integrated management strategies in heart failure patients with anemia.

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

AUTHOR CONTRIBUTION

Author	Contribution
Arsh-E-Jabeen Nasir*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Faheem	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Qinnat Ullah	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Nazia Sultana	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Abuzr Ali	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published

REFERENCES

1. Chairat K, Rattanavipanon W, Tanyasaensook K, Chindavijak B, Chulavatnatol S, Nathisuwan S. Relationship of anemia and clinical outcome in heart failure patients with preserved versus reduced ejection fraction in a rural area of Thailand. Int J Cardiol Heart Vasc. 2020;30:100597.
2. Fukuoka R, Kohsaka S, Shiraishi Y, Sawano M, Abe T, Levy WC, et al. Sudden cardiac death after acute decompensation in heart failure patients: implications of discharge haemoglobin levels. ESC Heart Fail. 2021;8(5):3917-28.
3. Habeeb HA, Todd F, Valsalan R, Schembri E, Noyhar JK, Yip G, et al. Prevalence and Adverse Outcomes of Iron Deficiency in Heart Failure. Curr Cardiol Rev. 2025;21(5):104-11.
4. Alharbi A, Shah M, Bansal N, Franz A, Kwak ES, Alsughayer A, et al. Outcomes and complications of heart failure with iron deficiency anemia: a nationwide analysis. Hosp Pract (1995). 2024;52(3):84-90.
5. Tee C, Xu H, Fu X, Cui D, Jafar TH, Bee YM. Longitudinal HbA1c trajectory modelling reveals the association of HbA1c and risk of hospitalization for heart failure for patients with type 2 diabetes mellitus. PLoS One. 2023;18(1):e0275610.
6. Foust R, Clarkson S, Nordberg M, Joly J, Griffin R, May J. Iron Deficiency Among Hospitalized Patients With Congestive Heart Failure. J Healthc Qual. 2024;46(4):220-7.
7. Okita S, Saito Y, Yaginuma H, Asada K, Goto H, Hashimoto O, et al. Impact of the Stress Hyperglycemia Ratio on Heart Failure and Atherosclerotic Cardiovascular Events After Acute Myocardial Infarction. Circ J. 2025;89(3):340-6.
8. He Z, Zheng C, Chen M, Chen T, Huang F, Zhu Z, et al. Impact of the hemoglobin-to-red cell distribution width ratio on 30-day readmission in patients with heart failure. BMC Cardiovasc Disord. 2025;25(1):219.
9. Margineanu C, Antohi L, Ambrosy A, Bartos D, Collins S, Sinescu C, et al. Impact of iron deficiency on congestion and postdischarge survival in patients recently hospitalised for decompensated heart failure: a multicentre, prospective, observational analysis of the FERIC-RO study. Open Heart. 2025;12(1).
10. Okabe T, Yakushiji T, Kato D, Sato H, Matsuda T, Koyanagi Y, et al. Impact of Bicytopenia on Mortality in Hospitalised Patients With Heart Failure. Glob Heart. 2025;20(1):41.
11. Xu JP, Zeng RX, Mai XY, Pan WJ, Zhang YZ, Zhang MZ. How does HbA1c predict mortality and readmission in patients with heart failure? A protocol for systematic review and meta-analysis. Syst Rev. 2023;12(1):35.
12. Suenaga T, Fujino T, Hashimoto T, Ishikawa Y, Shinohara K, Matsushima S, et al. Hemoglobin Level Can Predict Heart Failure Hospitalization in Patients with Advanced Heart Failure Awaiting Heart Transplantation without Inotropes or Mechanical Circulatory Support. Int Heart J. 2024;65(4):667-75.
13. Hsiao FC, Lin CP, Hsu TJ, Tung YC, Chan YH, Chen SW, et al. Glycohemoglobin Variations and Long-term Risk of Incident Heart Failure in Patients With Type 2 Diabetes. Mayo Clin Proc. 2025;100(8):1332-44.
14. Schupp T, Weidner K, Reinhardt M, Abel N, Schmitt A, Lau F, et al. Effect of anaemia and iron deficiency in heart failure with mildly reduced ejection fraction. Eur J Clin Invest. 2024;54(8):e14205.

15. Chishiki T, Nagatomo Y, Saji M, Takei M, Goda A, Kohno T, et al. Divergent effect of blood glucose dysregulation on long-term clinical outcome in acute decompensated heart failure: A reappraisal in contemporary practice. Int J Cardiol. 2022;365:91-9.
16. Lejeune S, Roy C, Slimani A, Pasquet A, Vancraeynest D, Vanoverschelde JL, et al. Diabetic phenotype and prognosis of patients with heart failure and preserved ejection fraction in a real life cohort. Cardiovasc Diabetol. 2021;20(1):48.
17. Kirzhner A, Green H, Koren R, Abu Khadija H, Sapojnik D, Schiller T. Diabetes and Acute Decompensated Heart Failure: A Comprehensive Analysis of In-Hospital Outcomes. Isr Med Assoc J. 2025;27(2):103-9.
18. Mistry RH, Kohut A, Ford P. Correction of iron deficiency in hospitalized heart failure patients does not improve patient outcomes. Ann Hematol. 2021;100(3):661-6.
19. Chen S, Chen G, Jin Y, Zhu S, Jia L, Zhao C, et al. Association between glycated albumin and adverse outcomes in patients with heart failure. J Diabetes Investig. 2024;15(10):1457-63.
20. Sze S, Squire I, Kalra PR, Cleland JG, Petrie MC, Kalra PA, et al. Age-stratified effects of intravenous ferric derisomaltose in heart failure with iron deficiency: insights from the IRONMAN trial. Heart. 2025;111(13):634-41.
21. Cleland JGF, Pellicori P, Graham FJ, Lane R, Petrie MC, Ahmed F, et al. Adjudication of Hospitalizations and Deaths in the IRONMAN Trial of Intravenous Iron for Heart Failure. J Am Coll Cardiol. 2024;84(18):1704-17.
22. Sciaccaluga C, Mandoli GE, Nannelli C, Falciani F, Rizzo C, Sisti N, et al. Survival in acute heart failure in intensive cardiac care unit: a prospective study. Int J Cardiovasc Imaging. 2021;37(4):1245-53.