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Prevalence, sub-types, and associated factors of anemia among inpatients at a tertiary psychiatric hospital in Tanzania: a cross-sectional study

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Abstract

Background Anemia has been linked to psychiatric disorders including depression, bipolar disorder, and schizophrenia. Studies have demonstrated an association between anemia and worsening clinical presentation and treatment outcomes of these disorders. This study aimed to assess the prevalence and factors associated with anemia among adult patients admitted at Mirembe National Mental Health Hospital (MNMH) in Dodoma, Tanzania.

Methods A cross-sectional analytical study was conducted at MNMH among 265 adults admitted at the hospital. Socio-demographic and clinical variables were collected using a closed-ended questionnaire, and anemia and other hematological indices were assessed via complete blood count (CBC). Data were entered into an Open Data Kit (ODK) app and analyzed using SAS version 9.4. Chi-squared test was used initially to assess association between individual exposures and the outcome, anemia. Variables with a *p*-value < 0.20 from the chi squared analysis were fitted into a logistic regression model to determine their odds of association with anemia. Odds ratios from adjusted regression analysis were used to identify factors independently associated with anemia. Significance level was set at *p* value < 0.05.

Results The prevalence of anemia among adult patients admitted at MNMH was 44% (CI 38.08, 50.36). The majority of participants had mild anemia (74.36%). Microcytic hypochromic and normocytic normochromic were the common types of anemia (47% and 46% respectively). Being male, institutionalization, and using Olanzapine was associated with anemia among participants at bivariate analysis, however, only institutionalization remained as a statistically significant factor associated with anemia at multivariable analysis (AOR:5.742, 95% CI 2.048, 16.105).

Conclusions Comprehensive care strategies addressing anemia among psychiatric inpatients are crucial, extending beyond psychiatric symptoms to address factors related to prolonged admission, such as nutritional considerations. It is recommended that regular screening for anemia be implemented among psychiatric inpatients and efforts should be made to investigate and address the underlying causes of anemia among this population.

Keywords Anemia, Psychiatric patients, Prevalence, Factors, Severity, Type of anemia, Dodoma, Tanzania

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Background

Anemia is a common hematological disorder characterized by a decrease in hemoglobin concentration and red blood cell (RBC) count, with or without alterations in individual RBC sizes. Males and non-pregnant females are diagnosed with anemia when their hemoglobin levels fall below 13 g/dl and 12 g/dl, respectively [1]. Approximately 1.8 billion people worldwide were diagnosed with anemia in 2019 [2]. Anemia can lead to negative health consequences such as deteriorating immune function, cognitive impairment, and psychiatric problems [3, 4].

Anemia has been associated with multiple psychiatric disorders, including depression, bipolar disorder, and schizophrenia [5, 6]. Studies have shown that anemia affects neurotransmitter homeostasis, including dopamine, serotonin, and norepinephrine, which affect behavior, learning, and memory [7, 8]. Decreased iron levels have been associated with reduced concentration, expression, and transport of epinephrine, as well as a reduction in the level of norepinephrine receptors in the basal ganglia [7]. Furthermore, patients with anemia may experience symptoms of depression, including mood and behavior changes [6, 9]. A link has been established between anemia and the severity of depressive disorders, and studies have shown that the clinical manifestation of depression is affected by anemia [5, 10, 11]. Furthermore, studies have illustrated the association between the severity and type of anemia and risk of psychiatric disorders [12–15].

Psychiatric inpatients are a vulnerable population at higher risk of developing anemia due to factors such as poor nutrition, chronic medical conditions, and side effects of medication [10, 11]. Studies have shown that the prevalence of anemia among psychiatric inpatients ranges from 27.3 to 73% [6, 11]. Despite its high prevalence, anemia is often underdiagnosed and undertreated in this population, leading to complications and poor outcomes.

Poor nutrition, chronic medical conditions, medication side effects, and comorbid substance use disorders have been shown to be correlates of anemia among psychiatric inpatients [6, 10, 11]. Psychotropics such as antipsychotics and mood stabilizers can result in bone marrow suppression and lead to a decrease in red blood cell production [2, 16, 17]. Studies have demonstrated a link between antipsychotics such as olanzapine and hematological disorders, including anemia, agranulocytosis, and pancytopenia [17, 18]. Substance use disorders, such as alcohol use disorders, can lead to anemia due to poor nutrition and impaired nutrient absorption [10]. Studies have shown that anemia has significant clinical implications among psychiatric inpatients, including morbidity and mortality, impaired cognitive function, and reduced quality of life [4–6, 11]. Furthermore, institutionalization has been associated with risk of anemia among psychiatric patients [13, 19, 20]. Anemia has also been associated with multiple hospitalizations and longer hospital stays among psychiatric patients [6, 21].

Despite the high prevalence and established correlates of anemia among psychiatric patients, reports in the Tanzanian setting investigating the prevalence and correlates of anemia in this population are scarce. Understanding the magnitude and association of these factors is crucial in addressing modifiable risk factors in this population and subsequently improving patient outcomes, resulting in a reduction in healthcare costs. This study aimed to determine the prevalence and factors associated with anemia among patients admitted at Mirembe National Mental Health Hospital (MNMH) in Dodoma, Tanzania.

Methods

Study design and setting

A hospital-based analytical cross-sectional design.

Study setting and population

This study was carried out at different psychiatric units at Mirembe National Mental Health Hospital (MNMH). MNMH is the only consultant, tertiary, and teaching hospital for clinical psychiatry and mental health in Tanzania. Located in Dodoma region, the capital city of Tanzania, the hospital serves approximately three million people from Dodoma and nearby regions [22]. The hospital provides inpatient and outpatient psychiatric and medical services. Over the years, MNMH has expanded its services to include the following units: Dental clinic, Ophthalmology, Physiotherapy, Neurology clinic, and Itega Drug Dependence Treatment Center. The majority of psychiatric admissions at the hospital are for psychotic and bipolar related disorders, with significantly fewer patients admitted for anxiety and depressive disorders. Given that most psychiatric patients are financially dependent, they are considered vulnerable and usually chronic, therefore, treated under an exemption policy. This limits their psychotropic medications to mostly older generation drugs, such as Haloperidol and Chlorpromazine.

Sample size estimation

A Taro Yamane formula $n = N/1 + N(e)2$ was used to calculate the minimal sample size (n), where N is the potential size of the population to be studied, value from the standard normal distribution $(Z) = 1.96$, and e is an acceptable margin of error set 0.05 at 95% confidence interval [23]. For this study, there were potentially 450 participants to be studied for the expected three-month study duration. Therefore, a minimum of 212 was required. At the end of the study period from November 2022 to March 2023, 265 participants were recruited.

Inclusion criteria

All patients aged 18 years and above admitted to MNMH during the period of study and could provide informed consent. The patients must have been on any psychotropic medication for at least six months.

Exclusion criteria

Patients with known history of hematological conditions and/or comorbid physical conditions prior to the diagnosis of psychiatric condition were excluded. This was done through self-report and cross-checking medical records of patients. Patients who were acutely agitated or aggressive, unable to comprehend and follow the assessment procedures during the study, were also excluded.

Study variables

Outcome variable

Anemia was defined as a hemoglobin (Hb) level of < 12 g/dl for females and sub-categorized into Mild (11.9–10 g/dl), Moderate (9.9–7 g/dl) and < 7 g/dl as Severe [1]. For Males, the criteria for Anemia was met if the Hb level was < 13 g/dl and further subcategorized as Mild (12.9–10 g/dl), Moderate (9.9–7 g/dl) and Severe (< 7 g/dl) [1]. Anemia types were categorized as Microcytic with mean cell volume (MCV) of < 80 fl., Normocytic with MCV of 80–100 and Macrocytic based on MCV > 100 fl., respectively; Normochromic if mean corpuscular hemoglobin concentration (MCHC) is 28–36 g/dl and Hypochromic if MCHC is < 28 g/dl [24–26].

Explanatory variables

Sociodemographic variables comprised of age (completed years), sex (female/male), education level (no formal, primary level, secondary, or tertiary) and marital status (never married, married/cohabiting, or separated/divorced/widowed). The clinical profile included the psychiatric diagnosis, duration of illness, duration of hospital stay, number and types of psychotropic medications used, white blood cell (WBC) count, and platelet count [26]. In this study, the terms "institutionalization/institutionalized" are used to refer to patients who have been at MNMH for a duration of one year or more.

Data collection

Research assistants (four final year medical students, 2 registrars, and a registered nurse) collected data from participants who met the inclusion criteria through the use of closed-ended questionnaires and blood sample collection for hematological indices. The closed-ended questionnaires included socio-demographic and clinical variables, and information was verified by checking through participants' medical records. Blood sample collection followed established venipuncture protocol and procedures and approximately 3mls of blood was collected in an EDTA tube. The hematological analysis was done within 24 h of sample collection at BMH laboratory using the SYMEX XP300 hematology analyzer (Sysmex, Norderstedt, Germany).

Before data collection, the medical doctors working in the hospital reviewed the study participants' medical records for relevant demographic and medical information, including verification of a psychiatric diagnosis and previous hematological profile. Throughout the duration of the study, communication was maintained with hospital management regarding participants identified with anemia. Ethical considerations prompted the immediate notification of hospital authorities facilitating swift evaluation and management tailored to the individual needs of these participants.

Data analysis

Data was collected in a questionnaire with all the variables, then entered into an Open Data Kit (ODK) app and analyzed using Statistical Analysis Software (SAS) version 9.4. Categorical variables were summarized into frequencies and percentages, while continuous variables were summarized using median and range, and mean (μ) and standard deviations (SD). Association between the explanatory variables and anemia was first assessed using the chi-squared test. Variables with a p-value < 0.20 from the chi squared analysis were fitted into a logistic regression model to determine their odds of association with anemia, univariately and by multivariable analysis. Statistical significance for independent association determined by the adjusted analysis was set at a p-value of < 0.05.

Results

Sociodemographic and clinical characteristics of study participants

The mean age of participants was 36.2 years (SD ± 11.19) and the majority of the sample were male (78.11%). Approximately 41% were married/cohabiting and 53.96% had primary level of education. Psychotic disorder and Epilepsy with psychosis accounted for the most common and least common diagnoses respectively among the study sample (43.02% vs. 7.55%). Approximately half of the sample reported being ill for a duration of 1–6 years (50.57%) and there was not much difference reported in terms of use of one antipsychotic or two/or more (50.19% vs. 49.81% respectively) (Table 1).

Prevalence of anemia and distribution of hematological indices of the study participants

One hundred and seventeen out of the 265 participants were found to be anemic, a prevalence of 44.15% (CI 38.08, 50.36). The erythrocytic indices; Hb, hematocrit (Hct), MCV, mean corpuscular hemoglobin (MCH), MCHC and red cell distribution width (RDW) of the

Table 1 Demographic and clinical characteristics of study participants (*N* = 265)

Variable	Frequency	Percent
Age	**36.20 ± 11.19***	
18–29	84	31.70
30–39	94	35.47
40–49	51	19.25
50+	36	13.58
Sex		
Female	58	21.89
Male	207	78.11
Marital status		
Divorced/separated/ Widowed	94	35.47
Married	109	41.13
Never married	62	23.40
Years of formal education		
No formal education	28	10.57
Primary	143	53.96
Secondary	62	23.40
College/University	32	12.08
Living arrangement		
Institutionalized	93	35.09
Lives alone	68	25.66
Lives with spouse/relative	104	39.25
Primary psychiatric diagnosis		
Primary psychotic disorder	114	43.02
Bipolar disorder	69	26.04
Epilepsy with psychosis	20	7.55
Anxiety and depressive disorder	34	12.83
Substance use disorder	28	10.57
Duration of illness		
less a year	109	41.13
1–6 years	134	50.57
> 6 years	22	8.30
Duration of hospital stay		
1 month or less	87	32.83
> 1–6 months	60	22.64
> 6 months	118	44.53
Number of antipsychotics taken		
Single medication	133	50.19
Two or more medications	132	49.81

* Mean ± S.D

study participants obtained from their complete blood count results were distributed based on the anemia status. Median and range was used to summarize the indices. The distribution is tabulated and median values are consistent with the anemic and non-anemic grouping under which they belong (Table 2).

Severity of anemia

Out of the 117 participants who were classified as anemic, 74.36% had mild anemia, 19.66% had moderate anemia, and 5.98% had severe anemia (Fig. 1).

Table 2 Distribution of hematological indices by anemia status (*N* = 265)

Hematological index	Anemic *n* = 117 (44.15%)	Non-Anemic *n* = 148 (55.85%)
	Median (range)	**Median (range)**
Hb (g/dL)	11.20 (3.00- 12.90)	14.00 (12.00- 17.70)
Hct (%)	35.20 (12.90–44.80)	42.75 (32.60–51.50)
MCV (fL)	79.90 (30.60- 106.90)	88.10 (17.00- 111.00)
MCH (pg/cell)	25.30 (12.90–36.30)	29.45 (16.90–36.00)
MCHC (g/dL)	31.40 (23.30–38.90)	33.20 (29.00- 39.90)
RDW (%)	15.20 (11.00- 52.30)	12.60 (10.40–38,50)
WBC (x 10^3/μL)	4.40 (0.90–8.70)	4.40 (0.80–16.20)
Platelets (x 10^3/μL)	214.00 (50.00- 1832.00)	206.50 (71.00- 650.00)

Characterization of anemia by red blood cell size and hemoglobin content

Among the participants who were found to have anemia (*n* = 117), 55 had microcytic hypochromic type and 54 had normocytic normochromic type (Table 3).

Factors associated with anemia

On univariate analysis by chi squared test, the primary psychiatric diagnosis, living arrangement, duration of hospital stay, and taking olanzapine showed significant association with anemia. No similar association was evident for the common demographic factors of age, sex, marital status and years of schooling (Table 4).

On adjusted analysis based on a logistic regression model, only being institutionalized (i.e., being admitted at MNMH continuously for at least 12 months) showed significantly higher odds of being anemic (AOR 5.742, 95%CI [2.048, 16.105]) (Table 5).

Discussion

Anemia is prevalent among psychiatric patients at MNMH with at least 44 out of every 100 patients being anemic. Such a number is not unheard of in the general population, in some communities in Tanzania, according to a recent nationwide survey [27]. Indeed, also, a recent synthesis of the Global Burden of Disease (GBD) study 2019 by Safiri and colleagues [2] would put the national average near this prevalence figure. Nonetheless, this level of anemia is higher than what would be the expected average among age bracket counterparts in and around Dodoma communities where MNMH is located [27]. Considering that over three quarters (78.1%) and over 85% of the study participants were males and aged 18–49 years respectively, it is notable that this observed prevalence of anemia is actually much higher than the general community average reported by the surveys above. In the general community, the burden among young males is usually lower and it is the females who drive up the overall burden proportions.

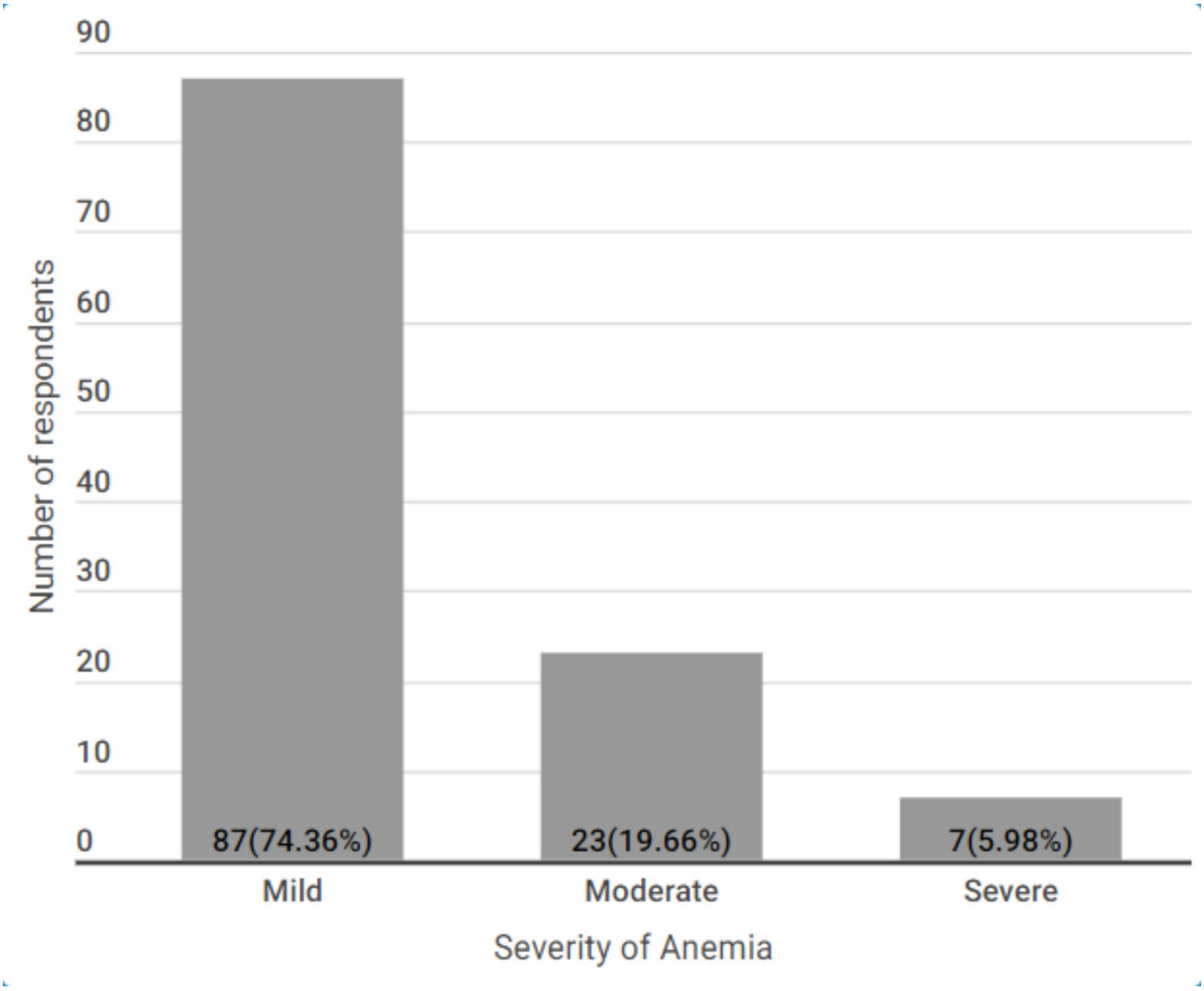

Fig. 1 Distribution of severity of anemia among study participants with anemia (*N* = 117)

Table 3 Characterization of anemia by erythrocyte size and hemoglobin content of the anemic study participants (*N* = 117)

		MCH		
		Hypochromia	**Normochromic**	**Total**
MCV	Microcytes	55(93.22)	4(6.78)	59(50.43)
	Normocytes	3(5.26)	54(94.74)	57(48.72)
	Macrocytes	0(0.00)	1(100.00)	1(0.85)
	Total	58(49.57)	59(50.43)	117(100.00)

Prevalence of anemia being higher among psychiatric inpatients than non-patient peers in the community is corroborated by findings in several studies in different countries [13, 28]. Relatively higher incidence of psychiatric diagnoses on the one hand, and stronger presence of negative symptoms and/or suboptimal response to treatment of psychiatric ailments on the other hand, have been reported in association with anemia [4, 5, 29–32]. Put together, the observed prevalence warrants mainstreaming of screening and management of anemia in the psychiatric preventive and curative protocols.

The burden of anemia found in this study while at par with several other studies in a similar population, is also both smaller and larger than what yet other studies in psychiatric patients report. Considering these other studies with the present study, it is deducible that the burden of anemia relates inversely with the general economic standing of the community, and is likely psychiatric diagnosis- and/or severity-dependent [6, 11, 19, 20, 33]. Although diagnosis and duration of hospital stay were not independently significant as factors associated with anemia in this study.

Male patients and those between the ages of 30 and 40 years tended towards overrepresentation among the anemics albeit without statistical significance in this study. This is in contrast to several studies that show anemia, in this age category, to reflect the trend in the general

Table 4 Factors associated with anemia among psychiatric patients at MNMH (*N* = 265)

Variable	Anemic *N* (%)	Non-Anemic *N* (%)	Chi sq	*p*-value
Age			5.1353	0.1622
18–29	29(34.52)	55(65.48)		
30–39	48(51.06)	46(48.94)		
40–49	23(45.10)	28(54.90)		
50+	17(47.22)	19(52.78)		
Sex			1.9003	0.1680
Female	21(36.21)	37(63.79)		
Male	96(46.38)	111(53.62)		
Marital status			3.4927	0.2744
Divorced/separated/ Widowed	45(47.87)	49(52.13)		
Married	51(46.79)	58(53.21)		
Never married	21(33.87)	41(66.13)		
Years of formal education			4.1206	0.2487
No formal education	10(35.71)	18(64.29)		
Primary	60(41.96)	83(58.04)		
Secondary	28(45.16)	34(54.84)		
College/University	19(59.38)	13(40.63)		
Living arrangement			29.5135	< 0.0001
Institutionalized	62(66.67)	31(33.33)		
Lives alone	21(30.88)	47(69.12)		
Lives with spouse/relative	34(32.69)	70(67.31)		
Primary psychiatric diagnosis			9.5719	0.0483
Primary psychotic disorder	62(54.39)	52(45.61)		
Bipolar disorder	26(37.68)	43(62.32)		
Epilepsy with psychosis	7(35.00)	13(65.00)		
Anxiety and depressive disorder	14(41.18)	20(58.82)		
Substance use	8(28.57)	20(71.43)		
Duration of illness			6.4830	0.0391
less a year	38(34.86)	71(65.14)		
1–6 years	68(50.75)	66(49.25)		
> 6 years	11(50.00)	11(50.00)		
Duration of hospital stay			13.7986	0.0010
1 month or less	29(33.33)	58(66.67)		
> 1–6 months	21(35.00)	39(65.00)		
> 6 months	67(56.78)	51(43.22)		
Number of antipsychotics taken			0.0318	0.8585
Single medication	58(43.61)	75(56.39)		
Two or more medications	59(44.70)	73(55.30)		
Type of Medication taken				
Amitriptyline			0.8452	0.3579
No	102(45.33)	123(54.67)		
Yes	15(37.50)	25(62.50)		
Chlorpromazine			1.5819	0.2085
No	83(41.92)	115(58.08)		
Yes	34(50.75)	33(49.25)		
Carbamazepine			0.2056	0.6502
No	79(45.14)	96(54.86)		
Yes	38(42.22)	52(57.78)		
Haloperidol			0.0020	0.9644
No	43(44.33)	54(55.67)		
Yes	74(44.05)	94(55.95)		
Olanzapine				**0.0348***

Table 4 (continued)

Variable	Anemic *N* (%)	Non-Anemic *N* (%)	Chi sq	*p*-value
No	110(42.97)	146(57.03)		
Yes	7(77.78)	2(22.22)		
Phenobarbital			0.8965	0.3437
No	109(45.04)	133(54.96)		
Yes	8(34.78)	15(65.22)		
WBC Count#				0.3978*
Low	32(47.76)	35(52.24)		
Normal	55(52.88)	49(47.12)		
High	0(0.00)	1(100.00)		
Platelet Count				0.1329
Low	26(52.00)	24(48.00)		
Normal	86(41.35)	122(58.65)		
High	5(71.43)	2(28.57)		

*P** is Fisher's Exact Test, # for WBC count *N* = 172

population whereby it is observed in significantly higher proportions among female patients [6, 13, 34]. The preponderance of females in prompt mental health care seeking has been reported in settings, across race, ethnicity, and socio-economic stance, globally [35–37]. This phenomenon may be at play in the index study, with one possible consequence being male patients presenting for professional care at a more advanced stage of illness with a chronic course potentially impacting their general health. This may partly explain the seemingly unexpected higher proportion of anemia among males than female patient participants and its potential consequence on duration of hospital stay, an attribute that associates with anemia in this study. It may be interesting to explore the existence of socio-cultural dynamics, in this setting, that could translate into less care and concern being afforded to males with psychiatric presentations by their kin and community in comparison to females. In addition, whether males are more likely to resist such care and concern, potentially culminating in to belated professional care and consequently lengthy stays at MNMH.

Majority (74.4%) of these anemic patients were mildly so, in line with the findings of several comparable studies [6, 13]. This can make it more likely that anemia in these patients evades clinical detection and timely correction unless there is routine objective screening. Normocytic-normochromic (46%) and microcytic-hypochromic (47%) constituted a majority of the anemias observed and the two types were comparably prevalent. The co-prevalence of these erythrocyte indices-based types of anemia in such a population has been reported in other similar studies [6]. This mixed picture is consistent with the preponderance of mild hemoglobin reduction being the case for majority of the anemic participants. It could also be suggestive of a mixed etiology for the anemia being at play in these patients. The two most likely of which being; nutritional input supply, particularly iron, failing to meet maintenance demands, and the pathophysiological dynamics of a chronic illness [12, 15, 38].

Institutionalization, operationally defined as admission for at least 12 months, was associated with a significantly higher likelihood of being anemic in a duration-of-hospital-stay-dependent manner corroborating the various studies on psychiatric patients that report a positive correlation between duration of hospital stay and the risk of anemia [39]. Nature and/or severity of the psychiatric diagnosis, pharmaco-therapy related side effects and demographic characteristics that pertain to the patient's socio-economic standing, including lack of available or supportive familial resources and homelessness, have featured severally as determinants of lengthy hospital admissions among psychiatric patients in various settings [40–44]. The stress associated with the above factors coupled with the likelihood of a nutritionally inadequate diet or less favorable dietary experience while hospitalized could explain this length of hospital stay-anemia association [45–47]. A multi-center, Sub Saharan Africa-based study observed a nutritional deterioration of patients during hospitalization [48]. In the present study, residing in the hospital for a prolonged period, even for reasons unrelated to illness severity, more strongly predicted anemia than shorter hospital stays. This remained true even when accounting for challenges in self-care often associated with patients living alone after discharge [13]. Put together with the observation that the duration since first diagnosed with a psychiatric condition was not an anemia-predicting factor further implicates a prolonged stay at this facility, and perhaps the accompanying physical-psycho-social dynamics, as the most important factor predicting anemia in psychiatric patients at MNMH.

Blood dyscrasias is a well-documented possible side effect of atypical antipsychotics such as olanzapine

Table 5 Factors associated with anemia among psychiatric patients at MNMH: Multivariable logistic regression analysis

Variable	Unadjusted analysis		Adjusted analysis	
	OR [95%CI]	***p*-value**	**AOR [95%CI]**	***p*-value**
Age				
18–29	ref		ref	
30–39	1.979[1.081, 3.623]	0.0270	1.273[0.639, 2.539]	0.4926
40–49	1.558[0.765, 3.174]	0.2222	0.699[0.305, 1.605]	0.3984
50+	1.697[0.767, 3.754]	0.1918	0.938[0.384, 2.288]	0.8877
Sex				
Male	1.524[0.835, 2.780]	0.1697	1.044[0.518, 2.105]	0.9041
Female	ref			
Living arrangement				
Lives alone	ref		ref	
Institutionalized	4.475[2.287, 8.756]	< 0.0001	5.742[2.048, 16.105]	**0.0009**
Lives with spouse/relative	1.087[0.563, 2.098]	0.8038	1.245[0.618, 2.510]	0.5394
Duration of illness				
less a year	ref		ref	
1–6 years	1.925[1.145, 3.236]	0.0135	0.910[0.414, 2.001]	0.8149
> 6 years	1.868[0.742, 4.707]	0.1848	0.853[0.254, 2.860]	0.7969
Duration of hospital stay				
1 or less month	ref			
1–6 month	1.077[0.539, 2.153]	0.8340	0.848[0.387, 1.856]	0.6799
> 6 months	2.627[1.477, 4.672]	0.0010	0.680[0.250, 1.851]	0.4505
Diagnoses				
Primary psychotic disorder	2.979[1.213, 7.319]	0.0173	2.093[0.745, 5.879]	0.1610
Bipolar disorder	1.511[0.582, 3.920]	0.3963	1.394[0.473, 4.106]	0.5471
Epilepsy with psychosis	1.346[0.393, 4.610]	0.6367	0.964[0.237, 3.914]	0.9593
Anxiety& depressive disorder	1.749[0.602, 5.084]	0.3044	1.281[0.392, 4.187]	0.6824
Substance use	ref		ref	
Number of antipsychotics taken				
Single medication	ref			
Two or more medications	1.045[0.643, 1.697]	0.8585		
Amitriptyline				
No	ref			
Yes	0.724[0.362, 0.362]	0.3593		
Chlorpromazine				
No	ref,			
Yes	1.428[0.819, 2.489]	0.2095		
Carbamazepine				
No	ref			
Yes	0.888[0.531, 1.484]	0.6503		
Haloperidol				
No	ref			
Yes	0.989[0.598, 1.635]	0.9644		
Olanzapine				
No	ref	0.0585	3.193[0.580, 17.566]	0.1820
Yes	4.645[0.947, 22.799]			
Phenobarbital				
No	Ref			
Yes	0.651[0.266, 1.592]	0.3467		
WBC Count[#]				
Normal	1.262[0.684, 2.329]			
Not normal	ref			
Platelet Count				
Low	0.434[0.077, 2.448]	0.3440	0.423[0.066, 2.726]	0.3657

Table 5 (continued)

Variable	Unadjusted analysis		Adjusted analysis	
Normal	0.282[0.053, 1.488]	0.1358	0.324[0.053, 1.969]	0.2210
High	ref		ref	

for WBC count *N* = 172

[17, 49]. Erythrocytic derangements, as a psychotropic sequelae, seem to occur least often and/or be least severe when compared to leuko-thrombocytic derangements [17]. Although initially thought to be least in hematological iatrogenicity, several reports have associated Olanzapine with neutropenia or agranulocytosis or pancytopenia among psychiatric patients [18, 50, 51]. Our observation that taking Olanzapine showed significant association with anemia is therefore not surprising. However, this factor was not independently implicated on multivariable analysis, possibly because patients taking second-generation antipsychotics were a minority in this study, and that at MNMH such patients may have a history of severe psychotic presentations refractory to first generation antipsychotics hence also prone to poor self-care-related comorbidities that may also contribute to their anemia.

This is one of the first studies to assess the burden and associated factors of anemia among psychiatric patients in Tanzania, thereby, shedding light on anemia in this population and exposing some associated nuance for further research. It is difficult to infer causality between anemia and factors that were statistically significant. Recall bias is also a limitation of this study given that participants were asked to self-report some information. This was mitigated by cross-referencing their medical records and verifying the information provided. Another limitation of this study is the lack of standardized record-keeping for patients' medical records, with some being complete while others are not. This presented challenges with ensuring that the selection criteria are fulfilled.

Conclusions

This study underscores the substantial prevalence of anemia among psychiatric inpatients at MNMH, with over 44% affected. This rate surpasses both the age group and sex-specific expected average within and around Dodoma communities and the national average reported in Tanzanian surveys [27]. Particularly noteworthy is the higher prevalence among male participants aged 18–49, challenging conventional trends where anemia is typically more prevalent among females in the general population.

Institutionalization strongly predicts anemia in this participant population. Since individual factors such as type and severity of diagnosis, pharmacotherapy-related side effects and socio-economic circumstances which can determine duration of admission did not predict anemia, institutionalization is likely a good proxy encompassing a complex interaction of these and other factors that affect length of stay at MNMHH and subsequently anemia status.

The findings from this study advocate for routine screening for anemia to be incorporated into the management and follow-up protocols for patients admitted at MNMHH. Holistic treatment protocols should be developed, integrating psychiatric care with nutritional and hematological monitoring, including regular assessments of hemoglobin levels and red cell indices as part of standard care.

Further research is needed to explore socio-economic, diagnostic, and severity-dependent variations in anemia prevalence, which can inform tailored interventions for different psychiatric and community settings. Additionally, socio-cultural barriers to timely mental health care among male patients should be investigated, with a focus on implementing community awareness programs to reduce stigma and promote early intervention.

To address iron deficiencies and other potential causes of anemia, mandatory nutritional assessments and supplement programs should be introduced for psychiatric inpatients. Improving the nutritional quality of hospital meals and establishing psychosocial support programs to alleviate stress and social isolation, particularly for long-term inpatients, is crucial. Periodic hematological assessments should also be considered for patients with prolonged hospital stays.

Patients on second-generation antipsychotics should be closely monitored for hematological side effects, and further studies are needed to evaluate the safety profiles of these medications in local psychiatric populations. Lastly, gaps in medical record-keeping must be addressed by standardizing patient documentation to ensure reliable data for future research. Larger, multi-center studies are recommended to validate these findings and expand understanding of anemia in psychiatric populations.

Abbreviations

Hb	Hemoglobin
MCH	Mean corpuscular hemoglobin
MCHC	Mean corpuscular hemoglobin concentration
MCV	Mean corpuscular volume
MNMH	Mirembe national mental health hospital
ODK	Open data kit
OR	Odds ratio
RBC	Red blood cell
RDW	Red cell distribution width
SAS	Statistical analysis software
SD	Standard deviation
WBC	White blood cell

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Author contributions
VM and AN conceptualized the study and collected data. AK and AN contributed to the analysis of the data. ZM and SAM drafted the manuscript. All authors revised the work and approved the version to be published. All authors agree to be accountable for all aspects of the work.

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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
Ethical clearance referenced 'MA. 84/261/02' was obtained from the Institutional Research Review Ethics committee (IRREC) of the University of Dodoma. The procedures used in this study adhere to the tenets of the Declaration of Helsinki. For all study participants, a written informed consent was obtained.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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