

## INDIRECT OBSTETRICS CAUSES OF MATERNAL DEATH: A-20 YEAR RETROSPECTIVE AUTOPSY STUDY AT THE KORLE-BU TEACHING HOSPITAL

Der EM<sup>1,3</sup>, Adu-Bonsaffoh K<sup>2</sup>, Kwame-Aryee RA<sup>2</sup>, Akosa BA<sup>1</sup>

<sup>1</sup>Department of Pathology, School of Biomedical Sciences, College of Health Sciences, University of Ghana; Korle-Bu Accra – Ghana, <sup>2</sup>Department of Obstetrics and Gynaecology, College of Health Sciences, University of Ghana, Korle-Bu Accra – Ghana, <sup>3</sup>Department of pathology, School of Medicine and Health Sciences, University for Development Studies, Tamale - Ghana

### Abstract

**Background:** The pattern and contributions of indirect causes of maternal deaths in Ghana from autopsy data have not been studied. The aim of this study was to estimate the proportions, the spectrum and demographic characteristics of maternal deaths that resulted from indirect obstetrics causes, and to offer recommendations.

**Material and methods:** This was a retrospective study of the above stated parameters from autopsy records in the department of pathology of Korle-Bu Teaching Hospital (KBTH).

**Results:** Approximately 15.2%, of all maternal deaths during the period of study were indirect obstetric causes with a mean age of 28.0 years. About 32.5% of the deaths were recorded in women within 25 – 29 year age group. A little more than a third (35.9%) of the deaths occurred in a health facility. The common underlying indirect causes of death were: infections 99 (39.4%), SCD 73 (29.1%), anaemia in pregnancy 32 (12.7%), chronic liver disease (CLD) 15 (6.0%), cardiovascular disorders (CVS) 10 (4.0%), pulmonary thromboembolism (PE) 8 (3.2%) and neoplastic lesions 5 (2.0%). The common infections were: HIV/AIDS 24

(24.2%), pneumonia 19 (19.1%), purulent bacterial meningitis 17 (17.2%), malaria 9 (9.1%) and tuberculosis 8 (8.1%). The common complications of SCD leading to death were: anaemia 40 (54.8%), haemolytic crisis 10 (13.7%) and acute chest syndrome 9 (12.3%). The major complications of anaemia and CLD in pregnancy leading to death were congestive cardiac failure 28 (87.7%) and septicaemia 7 (46.7%). Deaths due to CLD 3 (37.5%) CVS 6(40.0%) and neoplastic lesions 3 (60.0%) were commoner within the age group of 30 – 34 years. Deaths due to CVS disorders 6 (60.0%) and neoplastic lesions 3 (60.0%) occurred commonly in health facilities.

**Conclusion:** The study found that 15.2% of all maternal deaths were due to indirect causes. These commonly occurred in the community and in the 25 -29 year age group. Infections were the commonest cause of death. The authors conclude that indirect causes of maternal deaths cannot be ignored and that efforts should be focused on their reduction. Research is needed in this area of maternal death including the mechanisms by which these cause death and what programme could reduce it.

**Key Words:** *Indirect obstetric causes, Autopsy, Maternal death,*

### INTRODUCTION

Indirect obstetric deaths are deaths resulting from previous existing disease or disease that developed during pregnancy and which was not due to obstetric causes, but was aggravated by physiologic effects of pregnancy<sup>1</sup>. These deaths include infections, vascular disorders, mental disease, diabetes and many other medical conditions<sup>2</sup>. The proportions of maternal deaths due to indirect obstetric cause varies across the globe<sup>3,4,5,8b</sup>.

Studies in both developed and developing countries have found a rising trend in the proportions of maternal deaths resulting from indirect obstetric causes<sup>3,6,7,8</sup>.

**Corresponding Author: Dr Der Muonir Edmund**

School of Medicine, University for Development Studies, Tamale, Ghana

Telephone Number: 0208709807

E-mail Address: maadelle@yahoo.com

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Prompt programmes and appropriate actions to reduce the number of pregnant women dying from these preventable deaths are recommended. Available literature on indirect causes of maternal death in Ghana are usually from the clinicians<sup>3,6</sup>. The pattern and contribution of indirect causes of maternal deaths in Ghana from autopsy data has not been studied. Most maternal mortality prevention programmes have focused mainly on the direct causes with the indirect caused being least studied, prevented or managed. For instance, there are globally recognized guidelines for prevention and management of obstetric haemorrhage and hypertensive disorders in pregnancy but not much has been done concertedly regarding the causes of indirect maternal death. The contribution of this subcategory of causes of maternal death is remarkable and cannot be overlooked. In previous clinical studies conducted in the southern and northern parts of the country, indirect causes of maternal deaths accounted for 28.8%<sup>3</sup> and 29.0%<sup>6</sup> respectively. Yet, indirect causes of maternal deaths have not been given the needed recognition and therefore not explored

independently as a plausible means of improving maternal health in Ghana. The aim of this autopsy study was to estimate the proportions of maternal death and the pattern of maternal death that resulted from indirect obstetrics causes and offer recommendation for reducing maternal deaths. The outcome of this study would provide local evidence to urgently stimulate the development of standardized multidisciplinary preventive and treatment protocols (with specific reference to indirect maternal deaths) for improving maternal health in Ghana.

## Material and Methods

### Study Site

All data were gathered from the files of the Korle-Bu Teaching Hospital Mortuary, the largest mortuary in the country, Ghana, where between 3,000 and 6,000 autopsies are performed each year. This mortuary receives cases from Korle-Bu Teaching hospital, the largest referral hospital in Ghana; as well as cases within the Accra Metropolis, neighbouring towns and districts, and in special circumstances, cases from other regions across the country. Not all pregnancy related deaths within the catchment area, automatically, had an autopsy. This is because some deaths that occur in the hospital are issued with death certificate by the clinicians. Similarly, deaths that occurred in the communities and were not reported to the police, or due to other reasons, did not have autopsy done on them.

### Study design

#### Data Collection and Analysis

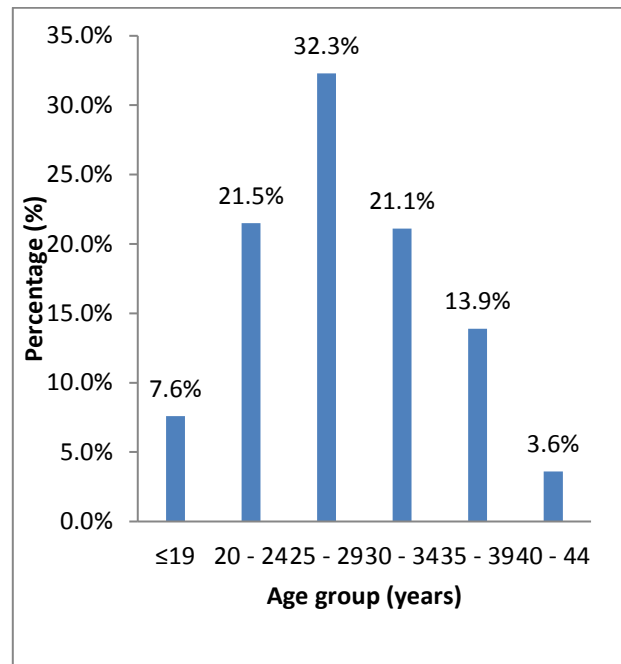
All autopsy logbooks, autopsy sheets and hospital files were reviewed for the period of 1<sup>st</sup> January 1995 to 31<sup>st</sup> December 2014, and all cases of pregnancy-related deaths were recorded. Data were collected and cross-checked by two doctors, to prevent double entry. For each case of maternal death, data were collected on age, cause of death and category of death (Coroner's or hospital). Coroner's deaths were deaths that occurred in the community or within 24-hours of admission to a health facility, where no definitive diagnosis was arrived at before death. Hospital deaths on the other hand were deaths that occurred in a health facility while the patient was on treatment for a given diagnosis. The cause of death was based on review of clinical and macroscopic autopsy findings. The data were entered into a computerized spreadsheet and analyzed using SPSS software (Version 23). Frequency distributions and descriptive statistics were calculated for each variable. Given the descriptive nature of this study, no multivariate analyses were attempted.

## Results

Age characteristics and spectrum of the underlying

indirect obstetrics causes of maternal deaths

A total of 251 (15.2%) out of the 1,656 pregnancy related deaths for which autopsy was performed from 1995 to 2014 at KBTH were classified as indirect obstetrics causes of deaths. Approximately 64.1% of the deaths occurred in the community, with 35.9% occurring within a health facility. The ages ranged from 15 – 43 years with a mean age of 28 years (SD± 6.1). Most (32.5%) of the deaths were recorded in women within 25 – 29 year age group (figure 1).



**Fig 1.** Age distribution of women with indirect causes of maternal death

The common underlying indirect causes of death were: infections 99 (39.4%), sickle cell disease (SCD) 73 (29.1%) and anaemia in pregnancy 32 (12.7%) (Table 2).

#### Infections as underlying causes of maternal deaths

The ages of women who died of infection ranged from 15 to 42 years with a mean of 27.7 years (SD ± 6.0) and a modal age group of 25 – 29 years (33.3%) table 1. The common causes of infection related maternal deaths were: HIV/AIDS 24 (24.2%), pneumonia 19 (19.1%) and purulent bacterial meningitis 17 (17.2%) table 2. The immediate causes of infection related maternal deaths were: septicaemia 50 (50.5%), anaemia 15 (15.2%) and cerebral toxoplasmosis 11 (11.1%) table 2. Most of the deaths occurred in the community (59.6%) table 3.

#### Sickle cell disease

Of the 73 (29.1%) cases of SCD as an underlying indirect obstetric cause of maternal death, the ages of

**Table 1.** Age characteristics and the various underlying indirect obstetrics causes of maternal death

Age (years)	Infections No. (%)	SCD No. (%)	Anaemia No. (%)	CLD No. (%)	PE No. (%)	CVS No. (%)	Neoplasms No. (%)	Others No. (%)
≤19	8(8.1)	6 (8.2)	2(6.3)	0(0.0)	2(20.0)	0 (0.00)	0(0.0)	1 (11.1)
20-24	23(23.3)	18(24.7)	<b>10(31.3)</b>	1(12.5)	1(10.0)	0 (0.0)	1(20.0)	0 (0.0)
25-29	<b>33(33.3)</b>	<b>29(39.7)</b>	9(28.1)	1(12.5)	<b>4(40.0)</b>	3 (20.0)	0(0.0)	2 (22.2)
30-34	18(18.2)	13(17.8)	7(21.9)	<b>3(37.5)</b>	0(0.0)	<b>6 (40.0)</b>	<b>3(60.0)</b>	3 (33.3)
35-39	13(13.1)	6(8.2)	4(12.5)	1(12.5)	2(20.0)	5 (33.3)	1(20.0)	3 (33.3)
40-44	4(4.0)	1(1.4)	0(0.0)	2(25.0)	1(10.0)	1(6.7)	0(0.0)	0 (0.0)
Total	99(100.0)	73(100.0)	32(100.0)	15(100.0)	8(100.0)	10(100.0)	5(100.0)	9 (100.0)
Mean age	27.7	26.8	27.0	33.4	28.2	32.6	30.6	30.2

KEY; SCD = sickle cell disease, CLD = chronic liver disease, PE = pulmonary thromboembolism, CVS = cardiovascular system

affected women ranged from 16 – 40 years, with a mean of 26.8 (SD ± 5.4) and a modal age group of 24 – 29 years (39.7%) table 1. The immediate causes of SCD related maternal deaths were: anaemia 40 (54.8%), haemolytic crisis 10 (13.7%) and acute chest syndrome 9 (12.3%) Table 2. Approximately 61.6% of the deaths occurred in the community table 3.

#### Anaemia in pregnancy

The ages of the 32 (12.7%) women who died of anaemia in pregnancy ranged from 18 – 39 years, with a mean of 27.0 years (SD ± 6.2) and a modal age group of 20 – 24 years table 1. The commonest immediate cause of death was congestive cardiac failure (87.6%) table 2 and the great majority (78.1%) occurred in the community Table 3.

#### Chronic liver disease (CLD) in pregnancy

There were 15 (6.0%) women with chronic liver disease in pregnancy, with their ages ranging from 26 – 40 years and a mean age of 32.6 years (SD ± 4.2) and a modal age group of 30 – 34 years (40.0%) Table 1. Septicaemia was the common immediate cause of death 7 (46.7%) Table 2. The majority (80.0%) of the deaths occurred in the community Table 3.

#### Cardiovascular (CVS) disorders in pregnancy

The ages of the 10 (4.0%) women who died of CVS disorders in pregnancy ranged from 17 – 40 years with a mean of 28.2 years (SD 7± 8) and a modal age group of 25 – 29 years (40.0%) Table 1. The commonest underlying cause of death was dilated cardiomyopathy 6 (60.0%) Table 2. Most of the deaths occurred in the hospital (60.0%) Table 3.

#### Pulmonary thromboembolism (PTE)

The ages of 8 (3.2%) women who died of PTE ranged from 22 – 43 years with a mean age of 33.4 years

(SD ± 7.5). Most were within the 30 - 34 year age group 3 (37.5%) Table 2. Approximately 87.5% of the deaths occurred in the community Table 3.

#### Neoplastic causes of maternal death

There were 5 (2.0%) neoplastic causes of death. Three (60.0%) of deaths were due to hepatocellular carcinoma Table 2. Most deaths occurred in the hospital (60.0%) table 3.

#### Other indirect causes of maternal deaths

There were 9 (3.6%) cases in this category of maternal deaths with mean age of 30.2 years (SD ± 6.8) Table 1. The common underlying cause was epileptic attack 2 (22.2%) with head injury as the commonest immediate cause of death 3 (33.3%) Table 2.

#### Discussion

During the 20-year period of study, it was found that indirect obstetrics deaths constituted 15.2% of all pregnancy related deaths. This value is much lower than values from previous studies; such as 28.8% in Northern Ghana<sup>3</sup>, 27.0% in Egypt<sup>4</sup>, and 27.5% in Asia<sup>5</sup>. The low value in this current study, may be an underestimation, judging from the fact that most of the causes are medical and may have been diagnosed prior to pregnancy and death. Thus, clinicians may have issued a death certificate without requesting for autopsy in cases with relatively clear clinical diagnosis. However, this current study being the first in Ghana to deal with autopsy based data has shown the growing importance of indirect causes of maternal deaths as pointed out in previous studies within and outside Ghana<sup>6,7,8</sup>. This finding again, has given an insight into the proportions of maternal deaths that result from indirect causes. It further underscores the need for key policy strategy documents

**Table 2:** Categories of indirect causes of maternal deaths

Indirect causes	Underlying causes	No. (%)	Immediate causes	No. (%)
<b>Infections</b>				
	HIV/AIDS	24(24.2)	Septicaemia	50 (50.5)
	Pneumonia	19(19.2)	Anaemia	15 (15.2)
	Meningitis	17 (17.2)	Cerebral toxoplasmosis	11 (11.1)
	Malaria	9 (9.1)	Disseminated TB	9 (9.1)
	Tuberculosis	8 (8.1)	Haemorrhagic shock	4 (4.0)
	Diarrhoea	7 (7.1)	Acute liver failure	4 (4.0)
	Hepatitis	7 (7.1)	Acute renal failure	4 (4.0)
	Pelvic abscess	1 (1.0)	<b>Acute pyelonephritis</b>	<b>1(1.0%)</b>
	Chicken pox	1 (1.0)	<b>Lung abscess</b>	<b>1(1.0%)</b>
<b>Sickle Cell Disease</b>				
			CCF	40 (54.8)
			Haemolytic crisis	10 (13.7)
			Acute chest syndrome	9 (12.3)
			Septicaemia	8 (11.0)
			PE	5 (6.8)
			Cerebral toxoplasmosis	1 (1.4)
<b>Anaemia in Pregnancy</b>				
			CCF	28 (87.6)
			Septicaemia	2 (6.3)
			Acute renal failure	2 (6.3)
<b>CLD in Pregnancy</b>				
	Liver cirrhosis	12 (80.0)	Septicaemia	7 (46.7)
	Severe fatty liver	3 (20.0)	DIC	6 (40.0)
			Acute renal failure	2 (13.3)
<b>CVS Disorder</b>				
	DCC	6 (60.0)	CCF	8 (80.0)
	Valvular diseases	2 (20.0)	Cardiogenic shock	1 (10.0)
	PE	1 (10.0)	Septicaemia	1 (10.0)
	Aortic aneurysm	1(10.0)		
<b>PTE</b>			Acute right heart failure	6 (100.0)
<b>Neoplasms</b>				
	HCC	3 (60.0)	Haemorrhagic shock	3(60.0)
	Colonic ca	1 (20.0)	Anaemia	1 (20.0)
	Brain tumour	1 (20.0)	PE	1 (20.0)
<b>Others</b>				
	Epilepsy	2 (22.2)	Head injury	3 (33.3)
	Asthma	1 (11.1)	Anaemia	2 (22.2)
	ESKD	1(11.1)	Asphyxia	2 (22.2)
	<b>Cerebral oedema</b>	<b>2 (22.2)</b>	<b>PE</b>	<b>1(11.1)</b>
	Grave's disease	1 (11.1)	Haemorrhagic shock	1 (11.1)
	GI bleeding	1 (11.1)		
	Malnutrition	1 (11.1)		

KEY: HCC = hepatocellular carcinoma, DCC, dilated cardiomyopathy, GI = gastrointestinal, UTI urinary tract infection, DIC = disseminated intravascular coagulation, ca = carcinoma, ESKD = End stage kidney disease

**Table 3:** Indirect causes of maternal deaths by location.

	Community/Coroner No. (%)	Hospital/Permission No. (%)	Total No. (%)
Infections	59 (59.6)	40 (40.4)	99 (100.0)
SCD	45 (61.6)	28 (38.4)	73 (100.0)
Anaemia in pregnancy	25 (78.1)	7 (21.9)	32 (100.0)
CLD disease in pregnancy	12 (80.0)	3 (20.0)	15(100.0)
CVS disorders	4 (40.0)	6 (60.0)	10 (100.0)
PTE	7 (87.5)	1 (12.5)	8 (100.0)
Neoplasms	2 (40.0)	3 (60.0)	5 (100.0)
Others	7 (77.8)	2 (22.2)	9 (100.0)

of leading international bodies on maternal health, as well as -governmental organizations and the Ghana

Government to redirect attention on this component of maternal deaths, which hitherto has not been the main focus<sup>9,10,11</sup>. In most countries including Ghana, the focus has been on the direct causes of maternal deaths with specific globally accepted management protocols such as the use of active management of the third stage of labour and magnesium sulphate regimen for prevention/treatment of primary postpartum haemorrhage and eclampsia respectively.

Although a larger proportion (64.1%) of the deaths occurred in the community, a significant proportion also occurred in the health facilities (35.9%). The higher proportions of indirect deaths occurring in the community are in keeping with the fact that in Ghana and other Sub-Saharan African countries, more than 60.0% deliveries are done at home and mostly not supervised by trained personnel.<sup>4</sup> In this current study, maternal deaths were commoner in the 25 – 29 year age group, in keeping with previous autopsy studies of maternal deaths in Ghana<sup>12,13</sup>.

The common indirect causes of death in descending order were: infections, SCD, anaemia in pregnancy, CLD, CVS disorders, pulmonary thromboembolism and neoplasms. The spectrum of indirect causes of maternal deaths in this current study is in keeping with previous autopsy<sup>13</sup> and clinical studies in Ghana<sup>3,6,14,15,16,17,18</sup> and across Africa<sup>19</sup>. Further grouping of deaths due to indirect causes suggests that more than 80% of indirect causes are from pre-existing disorders, including HIV.

The common causes of infection related maternal deaths were: HIV/AIDS (24.2%), pneumonia (19.1%), purulent bacterial meningitis (17.2%), malaria (9.1%) and tuberculosis (8.1%). This is in keeping with studies in developing countries, particularly Sub-Saharan

Africa, that found infections as the major contributors of indirect maternal deaths, mainly HIV/AIDS<sup>20,21,22</sup>.

Pregnancy commonly induces complications of sickle cell disease and thus a common indirect cause of maternal death in both developed and developing countries where the disease is common.<sup>23,24,25</sup> Sickle cell disease was the second common underlying indirect cause of maternal death in this study, accounting for 29.1% of the total deaths. It is known that pregnancy induces a number of physiological changes that affect the haematological indices, and patients with SCD may experience worsening of anaemia and other complications<sup>26</sup>. Despite the medical advances in recent decades, pregnancy is still associated with many clinical and obstetric complication in patients with SCD, resulting in a higher maternal mortality. The significant number of maternal deaths in this current study thus supports these previous publications.<sup>27,28</sup> The spectrum of immediate causes of death in SCD pregnant women in descending order in this study were; anaemia, haemolytic crisis and acute chest syndrome. These findings are in keeping with other studies<sup>25,29</sup>.

Anaemia complicating pregnancy leading to death has been reported as a major cause of maternal death in Ghana and other Sub-Saharan countries<sup>12,13,25,30</sup>. In this study, a significant proportion (12.7%) of maternal deaths were due to anaemia in pregnancy with congestive cardiac failure (87.6%) being the most common immediate cause of death. This supports studies decades ago that found high prevalence of anaemia among African pregnant women and the associated serious complications such as congestive cardiac failure<sup>30,31,32,33</sup>. Infections before and during pregnancy such as malaria and pneumonia are recognized as contributory factors of anaemia via haemolysis and can precipitate life threatening

complications such as congestive cardiac failure<sup>22,34</sup>. The study found approximately 39.9% of all causes of maternal deaths to be infection related, and this may explain why significant numbers of maternal deaths were due to anaemia.

Viral hepatitis commonly predates chronic liver disease<sup>35,36</sup>. Also studies have shown that chronic liver disease is commonly worsened during pregnancy<sup>37,38</sup>. In this study, 6.0% of all maternal deaths were due to chronic liver diseases and that most of the deaths occurred in the community. The current findings are in keeping with studies that found significant maternal deaths to be associated with chronic liver disease in pregnancy<sup>39,40,41</sup>.

Cardiovascular disorders other than pregnancy induced hypertension have been reported in autopsy and clinical studies globally as significant indirect causes of maternal deaths, although most are preventable<sup>3,42,43</sup>. In this study, 4.0% of maternal deaths were due to cardiovascular disorders, particularly dilated cardiomyopathy (60.0%) and these mostly occurred in health facilities. This proportion is lower than the 6.0% found in developed countries but comparable with findings in developing countries<sup>3,44</sup>.

Pulmonary thromboembolism (PTE) as a cause of maternal death has been reported in the literature<sup>45,46</sup>. In this study, PTE accounted for 3.2% of all indirect causes of maternal deaths. This value is similar to the 3.3% in Panchabhai et al autopsy study in India<sup>47</sup>. This is however higher than some other previous autopsy studies also in India<sup>48,49</sup>. The current finding confirms that pulmonary thromboembolism remains a significant cause of maternal death in developed countries.<sup>50</sup> Furthermore, the great majority (87.5%) of PTE related maternal deaths occurred suddenly in the community. This is partly due to the fact that most cases are asymptomatic and diagnosis is made only at autopsy.<sup>50</sup> Some of these deaths may have been prevented with more timely identification of risk factors and prevention through the use of prophylaxis.

## Conclusion

The study found that 15.2% of all maternal deaths were due to indirect causes. These commonly occurred in the community and in the 25 -29 year age group. Infections were the commonest indirect cause of maternal death. The authors conclude that indirect causes of maternal deaths cannot be ignored and that efforts should be focused on their reduction. Research is needed in this area of maternal death including the mechanisms by which these cause death and what programmes could reduce it.

## Recommendations

1. Further research is needed in the area of maternal death including the mechanisms by which these deaths are caused., Specific preventive and management programmes to improve pregnancy

outcomes from these pre-existing medical conditions need to be implemented.

2. We recommend the development of specific measures for prevention of complications in pregnant women with pre-existing medical conditions such as SCD, coupled with early and active multidisciplinary involvement.
3. There is an urgent need for developing evidence based management protocols and guidelines for the various indirect causes of maternal deaths especially in resource limited settings like Ghana to improve maternal deaths.
4. Finally, adequate and regular counseling and education of clients including the pre-conception, antenatal, intrapartum and postnatal periods are critical in reducing indirect causes of maternal mortality.

## Limitation of the study

1. This study did not consider indirect causes of maternal deaths for which death certificates were issued by the clinicians in the wards without autopsy, resulting in significant under-reporting.
2. The autopsy log book for the year 2008 could not be traced resulting in significant missing data which is an inherent problem of retrospective studies. However, the findings of this study are significant as they provide a general overview of the burden of indirect maternal deaths and the major underlying causes in Ghana.

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