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PHYSICIANS' AGREEMENT IN DETERMINING THE CAUSES OF DEATH USING VERBAL AUTOPSY DATA IN EASTERN TIGRAY, ETHIOPIA

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ABSTRACT: On average seven deaths per thousand occur each year globally, the majority of deaths were in developing countries including Ethiopia. And causes of death are not recorded systematically in these countries. So, a verbal autopsy is a tool designed to ascertain causes of death in such setting. Thus, this study aimed to assess the level of physician agreement and identify factors that can affect the identification of causes of death. The longitudinal population-based surveillance verbal autopsy data from Kilite-Awlaelo Health and Demographic Surveillance site (KA-HDSS) was used. The percent agreement, kappa statistics, and binary logistic regression were the analysis methods. The overall agreement for all deaths was 84.29% with a kappa of 0.835 (95% CI 0.827-0.841). Physician agreement was influenced by sex and occupation of the deceased, being female with (OR=0.72, 95% CI: 0.525-0.988), and being in pediatric age group, who are illegible for work, with (OR 2.18, 95% CI: 1.43-3.32) were found to be independently significant factors influencing physician agreement. The level of agreement by physicians was high in identifying causes of death. Physicians had agreed less likely on the deceased who were females compared to those males, and more likely to agree on deceased who were illegible for work compared to the workers. Finally, recommended for the site data collector to collect complete information about females and worker.

KEYWORDS: Verbal Autopsy, Physician agreement, Surveillance, Causes of death, HDSS

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1.INTRODUCTION

Worldwide, 7.89 deaths per 1000 persons occur according to world death rate of 2014 estimate. In this estimate 17.49 deaths per 1000 in South Africa, 13.91 deaths per 1000 in Somalia, and 8.52 deaths per 1000 in Ethiopia with the rank of 1st, 9th and 77th respectively [1]. And the 17.1% from all neonatal mortality in Ethiopia was cause-unknown [2]. The major causes of death today in developed countries like the United States are heart disease, cancer, and stroke. These days, the major causes of death are also not the same in countries with high and low levels of life expectancy [3]. Causes of death are not systematically recorded in a well-organized database in many developing and least developed countries [4]. Even though determining the cause of death is an essential input for planning interventions on health and making an evaluation of the impact, the detailed information is not available readily in these settings since most deaths occur at home for health-related and cultural reasons [4, 5]. The World Health Organization demonstrates that in Africa, only five countries have vital registration systems covering more than 25% of their population [5]. And in many low and middle-income countries, there is insufficient vital registration system and many factors cause to be an immediate implementation of functioning this system impossible. But the need for good and quality data on causes of death for public health planning and resource allocation has led to a renewed interest in a method used for many decades known as verbal autopsy [6-8]. Though using physician agreement method as the best alternative in the least developed countries, many factors can influence the agreement among or between physicians. The agreement between the physicians and the Inter VA model that is conducted in Kenya [9] tells us the agreement level was 31% with a $\kappa = 0.23$, A study on physician's agreement on childhood cause of deaths using verbal autopsy, overall agreement was 71.8% and kappa 0.64 [10], study conducted in India about physician agreement on cause of injury deaths tells us, the overall agreement for all injury deaths was 77.9% with a kappa of 0.74 [11] and a study on physician agreement on cause of maternal deaths in India using verbal autopsy shows overall agreement between two coding physicians was substantial with kappa of 0.66 [12]. In India location of death, age, sex, relationship and live with status were the main factors that can influence the physicians' agreement [10, 11]. If the real cause of death is not known, it is difficult to make any health-related intervention on a community to prevent and control the higher death in Ethiopia. In response to this problem, the researcher has explores the factors associated with physician agreement on the cause of deaths using verbal autopsy. Verbal autopsy is a method in which relatives or closest caregivers of a deceased are asked a list of questions about signs and symptoms of the disease that led to death. And it has been widely recognized as an alternative method for determining the cause of death at the population level where death certification is not regularly done [4, 6, 7]. In identifying causes of death based on the information on the questionnaire there are three methods; Physician's review, pre-defined and data-derived algorithms [6]. In Ethiopia, all the six Health and demographic surveillance sites including Kilite-Awlaelo, are using the physician's review to identify the causes of

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deaths. Agreement between physicians in Kilite-Awlaelo demographic and health surveillance site is using three general practitioners to decide the cause of death depending on the verbal autopsy questionnaire. And this surveillance site established to regularly register pregnancy, birth, death, marriage, in and out migration in the area [13]. Verbal autopsy has its own code from VA-01 till VA-99 which represents different diseases of internal and external causes. These Verbal autopsy codes have their own corresponding ICD-10 codes from A99 of to Z99. Finally, this study is aimed to assess the level of physician agreement on causes of death, and identifying factors associated with physician agreement on the classification of deaths. The successful accomplishment of the research work was important mainly; to make known the cause for cause unknown deaths, to get the appropriate intervention for the communities in Kilite-Awlaelo Health and demographic surveillance site area, and to develop evidence-based planning and health policy from the data generated by this study.

2. MATERIALS AND METHODS

Study area and design

This study was conducted in the KA-HDSS which is found in the Tigray region, Ethiopia and established in 2009 with nine rural and one urban kebele in the catchment area from districts Kilite-Awlaelo, Wukro, and Atsbi-wemberta. And these ten kebeles had 16, 296 [13] households ever enrolled to KA-HDSS classified into thirty-seven geographical territories of a set of households known as kushet. This study was conducted from September 01, 2014 to June 23, 2015. And the study design was the cross-sectional study using population-based longitudinal surveillance secondary data from a verbal autopsy in the KA-HDSS.

Data source and study population

The Data for this study was secondary data from VA questionnaire and from a database generated by the KA-HDSS data managers, which is a longitudinal population-based surveillance six round data and it was primarily collected using standardized data collection tools using a well-trained data collectors who trained how to collect data using verbal autopsy by the KA-HDSS supervisors. Data on socio-demographic and socio-economic characteristics were collected every six months that is taken from 2009-2014 in the KA-HDSS. The study populations were all deceased individuals who were living in the households ever enrolled to KA-HDSS which are selected from the total households that are found in the catchment area.

Study variables

The response variable was physicians agreement classified as 1=Agree and 0=Disagree. This physician agreement is affected by the explanatory variables are classified as deceased related, respondent related and geographically related variables [10-12]. The conceptual framework (see figure) was used to notice the effect of these factors on physician agreement.

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Deceased related variables

Age of deceased at a time of death (< 5years, 5-14years and ≥15years),Sex of the deceased (Male and Female),the occupation of deceased before died (Workers, Not workers and Illegible for work),Educational status of the deceased before died (Illiterate, Primary education, Secondary education and higher, and Illegible for education), Marital status of the Deceased individuals before died (Single, Married, Widowed, Divorced, and Separated, and Illegible), and Illness duration (for how long the deceased were ill before died).

Respondent related variables

Respondent relation with the deceased, Sex of respondents, Age of the respondents at the time of verbal autopsy questioning**,** Educational status of the Respondents at the time of verbal autopsy questioning (Illiterate, Primary education and Secondary and higher), and Live with status (whether the respondent was with the deceased or not at the time of death).

Geographic related variables

Place of residence for the deceased before died, and this variable is created manually considering the rural areas as "Rural" and the town as "Urban", and Place of death it is the place where the deceased were died (Health Facility, Home and Other).

Statistical analysis

Agreement measurements

Physician agreement is the agreement between or among physicians on the identification of causes of death using VA questionnaire. Physician's agreement in Kilite-Awlaelo Health and demographic surveillance site is using three physicians at a time to decide the cause of death. If the first two physicians write the same causes, it is considered as they have agreed and if they do not agree, the third physician will see the sign and symptoms and decide the causes for the given death. And if the third physician agrees with one of the first two disagreed physicians it considered as agreed on the cause of death but if three of the physicians are not agreed on the cause of death it is considered as disagree. The coding choice for these physicians is based on the International classification of diseases, 10^{th} Revision, clinical modification (ICD-10-CM) and a VA code for the corresponding ICD-10-CM codes, published by the World Health Organization which replaces ICD-9 [14, 15].

The extent of agreement between two physicians beyond that due to chance alone can be estimated by the kappa statistic [16-18]. Interpretation of the kappa statistic should also take into account the fact that kappa can be affected by the prevalence of the condition, kappa tends towards zero as the prevalence of the condition approaches either 0 or 1 [19].

Kappa Coefficient = $(P_0-P_e)/(1-P_e)$ …….[20]

Where P_o= proportion observed agreement, P_e= proportion expected agreement due to chance,

The *Landis* and *Koch* [18] classification of inter-rater reliability is used to interpret the kappa statistic as: if the value is less than 0 it is considered as poor agreement, if the value is between 0 and 0.2 as

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slight agreement, if the value is between 0.21 and 0.4 as fair agreement, if the value is from 0.41 to 0.6 as moderate agreement, if the value is from 0.6 to 0.8 it is substantial agreement and if the value is above 0.8, it is considered as a high agreement

The multivariable logistic Regression

The multivariable logistic regression for this study was binary multivariable logistic regression which is important to identify the factors that can affect the physician's agreement. And it is a regression method commonly used when the outcome variable "**Y***"* is binary or dichotomous and two or more predictor variables "$\mathbf{X}_s$*",* the equation to determine the probability or likelihood that physician agreement has the condition (***y = 1***) that depends on the independent variable $x_s$is as follows:

$\ln\left(\frac{p}{1-p}\right) = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 \ldots$, where a constant α and β coefficient and ***p*** = probability of having the event *"**y**",* i.e. the proportion of physician agreement with *y=1*.

3. RESULTS AND DISCUSSION

Background Characteristics of Deceased and Respondents

In KA-HDSS, a total of 1311 deaths were registered from 2009-2014. From these all registered deaths, the physicians have agreed on the 1107 (84.44%) of the deaths while identifying the causes of death. From the 1107 deaths that the physicians agreed on them, 1047 (94.6%) of deaths were with a known cause and 60 (5.4%) deaths was cause unknown deaths (Appendix 5). When tried to describe the characteristics of the deceased individuals from the total 1311 deaths, 1007 (76.81%) of the deceased were adults of age more than 15 years, 695 (53.01%) were male, 719 (55.65%) of these deceased were workers and 324 (25.08%) were illegible for work. (Table 1) And to see the educational and marital status of these deceased 802 (62.27%) were illiterate and only 59 (4.58%) had a secondary and higher education, in the marital status of the deceased 407 (31.33%) were married and only 78 (6%) were divorced and separated. In addition, from these deceased individuals, 331 (25.25%) died due to less than 1-day illness including stillbirth and accident deaths and 363 (27.69%) of the deceased were ill for more than four months before they died. (Table 1)

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Table 1: Characteristics of the Deceased and Respondents 2009-2014

Characteristics of deceased		**Frequency**	**Percent**
Physicians' agreement	Agree	1107	84.44
	Disagree	204	15.56
Age	Less than 5	229	17.47
	From 5 to 14	75	5.72
	Greater than 15	1007	76.81
Sex	Male	695	53.01
	Female	616	46.99
Occupation	Worker	719	55.65
	Not worker	249	19.27
	Illegible for occupation	324	25.08
Educational status	Illiterate	802	62.27
	Primary	145	11.26
	Secondary and higher	59	4.58
	Illegible for education	282	21.89
Marital status	Single	135	10.39
	Married	407	31.33
	Widowed	330	25.40
	Divorced/separated	78	6.00
	Illegible for marriage	349	26.87
Illness duration in days	0 days	331	25.25
	1 to 14 days	304	23.19
	15 to 120 days	313	23.87
	>120 days	363	27.69

When seeing to respondents characteristics, from all respondents majority 963 (73.57%) were female, the average age of these respondents were 41.24 years with the standard deviation of 16.45, 525 (40.05%) of respondents had a Father or mother relationship with the deceased, and only 36 (2.75%) of respondents had no any relationship with the deceased. (Table 2) As well, from these respondents 847 (71.87%) were illiterate and 214 (18.14%) had attained primary education. And from these respondents, 97.10% were lived with the deceased while s/he died. And finally, the 1214 (92.6%) of the deceased were living in rural areas of KA-HDSS before died, majority 1000 (76.86%) died at home, and only 14.3% died at health facilities. (Table 2)

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Table 2: Characteristics of the Respondents from 2009-2014 In KA-HDSS

The Respondents and Geographic information		Frequency	Percent
Respondent sex	Male	346	26.43
	Female	963	73.57
Respondent Education	Illiterate	847	71.78
	Primary	214	18.14
	Secondary and higher	119	10.08
Live with status	Yes	1273	97.10
	No	38	2.90
Respondents relationship	Father/Mother	525	40.05
	Spouse/sibling	310	23.65
	Others	440	33.56
	No relationship	36	2.75
Place of residence	Rural	1214	92.60
	Urban	97	7.40
Place of death	Health facilities	186	14.30
	Home	1000	76.86
	Other	115	8.84
Age of the respondent		Mean(SD) = 41.24(16.45)	

The physicians had coded their own ICD-10 and VA codes standing from VA questionnaire to identify what was the cause of the given death. Therefore physicians had agreed on 375 (86.21%) infectious and parasitic diseases caused deaths, on 153 (90%) externally caused deaths, on 152 (91.02%) prenatal caused deaths, on 136 (85%) disease of circulatory system caused death and on the 75% of unspecified causes for deaths. (Table 3)

Agreement Measurement

In agreement measurement of the cause of death, kappa statistic was used to see the agreement strength between or among physicians: the overall percent agreement was 84.29% but the expected agreement was 4.63%. These agreements are accompanied by the kappa of 0.835 with CI (0.827-0.841). If each physician had made his cause identification randomly, we would expect the two physicians to agree on 4.63% of deaths by considering probabilities equal to the overall proportion. In fact, they agreed on 84.29% of deaths with CI (0.827-0.841), or 83.5% of the way between random agreement and perfect agreement. The overall agreement kappa of 83.5% showed as there were high agreements among physicians on the identification of the given causes of deaths.

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Table 3: The ICD-10 and VA-Codes for Causes of Death In KA-HDSS

Causes of death	ICD-10 codes	VA-codes	Physician agreement	
			Agree n (%)	Disagree n (%)
Infectious and parasitic diseases	A00-B99	VA-01.01-VA-01.99	375(86.21)	60(13.79)
Neoplasm	C00-D48	VA-02.01-VA-02.99	62(69.66)	27(30.34)
Nutritional & endocrine disorder	E00-E90	VA-03.01-VA-03.99	33(91.67)	3(8.33)
Disease of the circulatory system	I00-I99	VA-04.01-VA-04.99	136(85.00)	24(15.00)
Respiratory disorders	J00-J99	VA-05.01-VA-05.99	11(73.33)	4(26.67)
Gastrointestinal disorders	K00-K93	VA-06.01-VA-06.99	43(78.18)	12(21.82)
Renal disorder	N00-N99	VA-07.01-VA-07.99	35(87.50)	5(12.50)
Mental & nervous system disorder	F00-G99	VA-08.01-VA-08.99	42(76.36)	13(23.64)
Pregnancy, child birth and-puerperium related disorder	O00-O99	VA-09.01-VA-09.99	5(100)	0(0.00)
Perinatal cause of death	P00-P96	VA-10.01-VA-10.99	152(91.02)	15(8.98)
External cause of death	V01-Y98	VA-11.01-VA-11.99	153(90.00)	17(10.00)
Misadventure to patients during-surgical and medical care	S00-T99	VA-12.01-VA-12.99	0(0.00)	1(100.00)
Other specified cause of death	R00-R99	VA-13.01-VA-99	0(0.00)	1(100.00)
Unspecified cause of death	R00-R99	VA-14.01-VA-99	60(75.00)	20(25.00)

When we see the agreements on the deceased individual characteristics to identify the causes of death, for under five children the physicians were agreed on 89.08% of deaths with kappa statistic of 0.88, among these deceased physicians were agreed on 86.19% of males with kappa statistic 0.86, for those deceased who were worker's physicians, have agreed on 81.64% of death with kappa statistic 0.81. And from the total of illiterate deceased physicians have agreed on 81.92% with kappa statistic 0.81, in addition to this for deceased who were ill for 0 days' physicians were agreed on 88.22% with kappa statistic 0.87 and from those who were ill for more than 120 days before died physicians were agreed on 85.12% with kappa statistic 0.86. (Table 4). As well, from deaths that the respondents had a father/mother relationship with deceased physicians were agreed on 86.67% of deaths with kappa statistics 0.86 and from deaths that the respondents had no relationship with the deceased physicians were agreed on 88.89% of deaths with kappa statistics of 0.877. From the deceased whose respondent were female were agreed on 85.46 % with kappa statistic 0.85, and from deaths which responded by illiterate respondents physician were agreed on 83.83% with kappa statistics of 0.83. (Table 5)

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Table 4: Kappa Statistic of Deceased characteristics In KA-HDSS

Characteristics of the deceased		Agreement %	Kappa	95% CI
Age	<5	89.08	0.880	(0.855 0.904)
	5-14	89.33	0.875	(0.822 0.907)
	>15	82.82	0.818	(0.812 0.822)
Sex	Male	86.19	0.856	(0.827 0.862)
	Female	82.16	0.811	(0.979 0.836)
Occupation	Worker	81.64	0.805	(0.792 0.812)
	Not worker	83.94	0.828	(0.798 0.899)
	Illegible for work	90.74	0.900	(0.873 0.930)
Educational status	Illiterate	81.92	0.806	(0.793 0.823)
	Primary	86.21	0.854	(0.837 0.868)
	Secondary and higher	84.75	0.838	(0.782 0.926)
	Illegible for	90.43	0.895	(0.881 0.927)
Marital status	Single	85.93	0.851	(0.811 0.897)
	Married	84.77	0.837	(0.831 0.854)
	Widowed	79.70	0.780	(0.766 0.798)
	Illegible for marriage	88.83	0.880	(0.872 0.913)
Illness long in days	0	88.22	0.874	(0.861 0.895)
	1-14	82.89	0.819	(0.788 0.864)
	15-120	80.51	0.783	(0.754 0.790)
	>120	85.12	0.863	(0.829 0.863)

In addition, from those deceased who were single physicians were agreed on 85.93% with kappa statistic 0.85, from the deceased who were living in rural areas physicians had agreed on 83.94% with kappa statistic 0.83. And physicians had agreed on 84.05% death with kappa statistic 0.83 that the respondents were live with the deceased at a time of death, on 89.78% death with kappa statistic 0.89 that the deceased were died in health facilities and from who were died at home physicians had agreed on 89.78% with kappa statistic 0.89. (Table 5)

Bivariate Logistic Regression

Bivariate analysis was performed to analyze crude associations between physician agreement and all other predictor variables, from these variables in Table 6, only respondent relationship and place of death had not a relationship with physician agreement.

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Table 5: Kappa Statistic of Respondent characteristics In KA-HDSS

Characteristics of the respondents		**Agreement %**	**Kappa**	**95% CI**
Sex	Male	81.21	0.801	(0.787 0.805)
	Female	85.46	0.848	(0.832 0.862)
Educational Status	Illiterate	83.83	0.830	(0.811 0.848)
	Primary	83.64	0.830	(0.798 0.839)
	Secondary and higher	89.92	0.895	(0.850 0.929)
Live with status	Yes	84.05	0.833	(0.810 0.841)
	No	92.11	0.903	(0.846 1.000)
Respondents relationship	Father/Mother	86.67	0.861	(0.849 0.875)
	Spouse/sibling	86.13	0.852	(0.842 0.875)
	Other	79.77	0.783	(0.760 0.810)
	No relationship	88.89	0.877	(0.875 1.000)
Place of residence	Rural	83.94	0.832	(0.814 0.845)
	Urban	88.66	0.878	(0.877 0.887)
Place of death	Health facilities	89.78	0.893	(0.854 0.904)
	Home	82.70	0.817	(0.800 0.836)
	Other	87.83	0.860	(0.821 0.874)

Multivariable Logistic Regression

Multivariable logistic regression was performed to adequately adjust for confounders and the analysis of which variables are affecting significantly the physician agreement on causes of death. In this final adjusted logistic regression analysis, only sex of the deceased and occupation of the deceased was significantly affected the physician agreement on causes of deaths. From all deaths, physicians had agreed 28% less likely on the deceased who were females compared to those deceased who were males with the odds of (OR=0.72, 95% CI: 0.525-0.988).And physicians had 2.18 times more likely to agree on those deceased who were illegible for any work compared to the deceased who were workers with (OR 2.18, 95% CI: 1.43-3.32). (Table 7). The purpose of this analysis was to better understand the factors that may influence physicians' agreement or disagreement in the determination of the cause of death using verbal autopsy questionnaire. The investigator used multiple methods including the kappa statistic, percent agreement, and both Bivariate and multivariable logistic regression to analyze the physician coded causes of death. To the best of our knowledge, this study is the first to specifically investigate factors that may contribute to physician disagreement in KA-HDSS and even in Ethiopia.

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Table 6: Bivariate Logistic Regression of Physician Agreement

Variables and their Category		**COR(95% Confidence Interval)**
Age of the deceased	<5	1
	5-14	1.03[.4419264 2.383633]
	>15	0.59[.3832806 .9365332]***
Sex of the deceased	Male	1
	Female	0.72[5.144408 7.94617]**
Occupation of the deceased	Worker	1
	Not worker	1.20[.8116495 1.773082]
	Illegible	2.18[1.433576 3.325210]****
Education of the deceased	Illiterate	1
	Primary	1.36[.8181049 2.248290]*
	Secondary and higher	1.21[.5795867 2.507482]
	Illegible	2.05[.5795867 2.507482]***
Marital status of the deceased	Single	1
	Married	0.93[.5326976 1.620328]
	Widowed	0.66[.3761068 1.141300]*
	Divorced and separated	0.51[.2503268 1.033430]*
	Illegible	1.30[.7228752 2.344888]
Illness duration in days	0	1
	1-14	0.67[.4226329 1.038726]*
	15-120	0.56[.3638457 .8717357]**
	>120	0.76[.4913114 1.188875]*
Respondent's sex	Male	1
	Female	0.72[.5227746 1.000280]*
Respondent Education	Illiterate	1
	Primary	0.96[.6400939 1.443301]
	secondary and higher	1.68[.8973745 3.129406]*
Live with status	Yes	1
	No	2.19 [.6663694 7.180935]*
Place of residence	Rural	1
	Urban	0.68[.3545905 1.291214]*

*P<0.25; ** P<0.05; *** P<0.01; **** P<0.001

The identification of the given cause known and cause-unknown deaths there was a high agreement among or between physicians even though the expected agreement on these deaths was very low in

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KA-HDSS. But these physicians were not agreed on more than three deaths from the twenty deaths. This proportion of disagreement might be due to the sex of the deceased and occupation of the deceased before death.

Table 7: Multivariate Logistic Regression for Physician Agreement

Variables and their category	Category	AOR	95% Confidence Interval
Sex of the deceased	Male	1	-
	Female	0.72*	(0.525 0.988)
Occupation of the Deceased	Workers	1	-
	Non-Workers	1.43	(0.896 2.019)
	Illegible for work	2.18***	(1.430 3.321)

The overall physician agreement for this study was a high agreement but in the related studies [10-12] conducted in India, the agreements were all substantial agreement. In this study, the agreement in pediatric, in young and in the elder ages were a high agreement but the percent agreement was higher in pediatric age than the young and elder age. This agreement was again high agreement in deceased males and females but the percent agreement was higher in males than females, this is consistent with studies [10, 11] and this agreement was high agreement on the deceased who were worker, non-worker and illegible for work but the percent agreement were higher in illegible for work deceased than the non-workers and workers. Again the percent agreement on non-workers was higher than on the workers, this was inconsistent with the study [12]. The agreement was high on the respondents who were illiterate, primary and, secondary and above but the percent agreement was higher when the respondents had an education secondary and above than the primary and illiterates. When comparing and contrasting the findings of this study with other related studies, in the studies [10-12] the overall agreement between physicians was a substantial agreement but the in this study it was high agreement. And in study [11] location of death, respondents relationship and live with status were significantly affected physicians agreement, in the study [10] sex of the deceased and age of the deceased were significant factors for physicians' agreement and there were no socio-economic or socio-demographic factors affecting physician agreement [12]. But in this study sex of the deceased and occupation of the deceased were significantly affected the physicians' agreement. Comparably, sex was the factor as a study [10] stated before. And in contrast, the new finding in this study was that occupation of the deceased had its own impact on physicians to agree on causes of deaths. The percent agreement and kappa statistic were lower when the deceased was females but this difference did not reach significantly. After the multivariable logistic regression analysis which adjusts for the effect of other factors, also found lower agreement for females than males consistent with study [11], this lower agreement on assigning cause of death in females may be reflective of a lower quality verbal data was collected by the respondents who were illiterate since more about the females verbal data was collected from illiterate respondents than about males. Hence, it will be difficult for

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physicians reviewing the verbal autopsy information in determining a cause of death among the deceased females than males. The kappa statistic and percent agreement were significantly lower when the deceased were workers and illegible for work; than the non-workers but this difference did not reach significantly. After multivariable logistic regression adjusting the effect of other factors the agreement is still lower in those deceased who were workers. This lower agreement on the assigning cause of death on workers may be reflective of a lower quality verbal data was collected by the respondents who were illiterate since more about the worker's verbal data was collected from illiterate respondents than about non-workers and the illegible for works. Hence, it will be difficult for physicians reviewing the verbal autopsy information in determining a cause of death among workers.Another influential covariate for this study was respondent's education and age of the deceased that were significant in physician agreement studies [10-12] but it was insignificant in this study. This discrepancy might be due to the methodological and scope difference that; this study was of all deaths with multivariable logistic regression but the related studies were specific age category (under 15 children), on the specific cause of death (Injury death) and on specific gender (mothers) using three level multivariable logistic regression and this study provides an implication that; the KA-HDSS has to do interventions on the significant factors of this study sex and occupation of the deceased to get fully agreed and cause known deaths.This physician agreement study was conducted in all causes of deaths, in all age categories and in both sexes at the same time. So, it will use as a benchmark for other researchers who are interested in investigating further studies like in specific causes of death, on children, mothers… since it was a prior study conducted in the Kilite-Awlaelo and even in Ethiopia.

4. CONCLUSION

In summary, a verbal autopsy is an invaluable tool in understanding and identifying causes of death in settings with a lack comprehensive and accurate vital event registration and monitoring systems. To the best of our knowledge, there has been no other study which has examined physician agreement on the cause of death using verbal autopsies in the area and even in Ethiopia. And this study is the first population-based study of inter-rater agreement of physician coded verbal autopsies in the study area. Overall, there was a high agreement between physicians in all causes of death. Specifically, this agreement was a high agreement in both males and females but higher percent agreement for males than females; again it was high agreement on workers, illegible for work but less percent agreement for workers than the illegible for work. And physician agreement was not affected by most characteristics of the deceased or respondents, with the exceptions of the sex of the deceased and occupation of the deceased. Physician agreement was more likely to agree on deceased males than females and less likely to agree on deceased workers than non-workers and illegible for work.

As a recommendation, the site has to work on collecting complete information for female deaths and deceased were Illegible for work. And since this study was focused on all age category and all gender

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type, it is recommended to conduct a related study on different age category and gender by using this study as a ground.

ETHICAL CONSIDERATION

The first Ethical clearance and approval were granted by Mekelle University, college of health sciences ethical clearance committee and the second was from KA-HDSS head office.

CONFLICT OF INTEREST

The authors have no conflict of interest

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