VALIDATION TEST FOR VERBAL AUTOPSY TOOL IN CAPTURING TB DEATH IN THE COMMUNITY IN METRO CITY, LAMPUNG PROVINCE

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ABSTRACT

The TB death rate and the TB prevalence are considered two indicators of infectious diseases measured to asses treatment progress to reach the MDGs target in 2015. Verbal autopsy is used to captured TB death cases happened at home. The sample of " true" TB and "non" TB tests were selected from three gold standard hospital in Metro city. Verbal autopsy was conducted by well trained nurses/midwives from Puskesmas, interviewing families having the death cases. Two reviewers set up diagnoses based on the results of the VA. A referee team would decide the final cause of death (COD) if the two diagnoses made by these two reviewers were unmatched. To avoid bias in this study, the blind technique was applied. The result of validation test shows out of 95 cases picked out from the three hospitals, only 65 of them were available for interview, 16 were defined to be TB cases and the other 49 cases were non TB, based as gold standard. There were 13 cases of well matched diagnoses between VA result and gold standard with Sensitivity value of 81 per cent (13 per 16). Twenty one death cases were defined TB through VA, the Positive Predictive Value was then 62 per cent (13 per 21). Those result is not much difference with the other place. The quality to determine the cause of death should be improved based on the ICD-10 mortality coding.

Key words: Validation, verbal autopsy, tuberculosis

ABSTRAK

Angka kematian karena TB dan prevalensi TB merupakan salah satu indikator penyakit menular yang diukur untuk menilai kemajuan pengobatan untuk mencapai target MDGs pada tahun 2015. Kuesioner autopsi verbal (AV) merupakan alat yang dipakai untuk menjaring kasus kematian (TB) yang terjadi di rumah. Sampel untuk uji coba kasus TB dan bukan TB diambil dari tiga rumah sakit (RS) di kota Metro yang dianggap sebagai gold standard. Perawat/bidan dari Puskesmas yang sudah dilatih melakukan AV, mewawancarai keluarga dengan kasus kematian tersebut. Dua orang pemeriksa menegakkan diagnosis berdasarkan data AV yang diperoleh. Tim referee memutuskan diagnosis apabila ditemukan ketidaksesuaian diagnosis dari ke dua pemeriksa tadi. Untuk mencegah bias pada studi ini, maka diterapkan blind technique. Hasil uji validasi menunjukkan kasus yang berhasil diwawancarai 65 dari 94 kasus yang diperoleh dari ke tiga RS di atas. Dari hasil gold standard 16 kasus adalah TB dan sisanya 49 kasus bukan TB. Terdapat 13 kasus yang cocok antara hasil diagnosis AV dan gold standard dengan nilai Sensitivitas 81 persen (13 per 16). Sebanyak 21 kasus kematian didiagnosis TB melalui AV, sehingga Positive Predictive Value 62 persen (13 per 21). Hasil tersebut tidak banyak berbeda dengan hasil di tempat lain untuk tujuan yang sama. Kualitas penentuan diagnosis penyebab kematian harus ditingkatkan sesuai pengkodean mortalitas ICD-10.

Kata kunci: Validasi, autopsi verbal, tuberkulosis

INTRODUCTION

In connection with monitoring progress toward the Millennium Development Goals (MDGs) targets relevant to tuberculosis (target 8, i.e. have halted by 2015, and begun to reserve, the incidence of malaria and other major diseases), TB prevalence and death rates have been selected as two indicators for TB monitoring progress. MDG related to TB has targeted to reduce both prevalence and death rate to 50% of the year 2000 estimates by 2010 (WHO, 2005–2006).

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Valid and reliable mortality statistics related to TB are best derived from efficient cause of death reporting through the process of vital registration. Establishment of sentinel sites for special surveillance of TB mortality is the approach to provide data for monitoring MDG target related to TB progress including provision of TB mortality. This special surveillance of TB mortality should be part or complement to routine monitoring and evaluation mechanism.

The National Institute of Health Research and Development (NIHRD) under the MOH in collaboration with the World Health Organization (WHO) Indonesia have proposed to conduct a special surveillance of TB mortality, which is mainly aimed to strengthen epidemiological surveillance and estimates for TB mortality in Indonesia, inline with the Millennium Development Goals (MDGs) monitoring purposes.

Parallel to this activity, NIHRD in collaboration with WHO, AusAID and School of Population Health University of Queensland is conducting an Indonesia Mortality Registration System Strengthening Project (IMRSSP) which is mainly aimed to develop cause of death (COD) reporting mechanism within the vital registration process, to routinely generate cause specific mortality statistics. The tools for these particular activities have been developed and therefore planned to be used in the special surveillance of TB mortality.

Prior to the actual cause of death data collection, tool testing will be conducted to assess the specificity and sensitivity of the Verbal Autopsy questionnaire used in IMRSSP (5+ years questionnaire), which will be further modified and used in capturing TB death in the TB mortality surveillance study.

This study is aimed to assess the sensitivity, positive predictive value (PPV) and specificity of Verbal Autopsy tools (5+ years old VA questionnaires and TB diagnostic criteria) for capturing TB death. The results of this study will provide significant inputs to optimize and adjust the study tools to be further utilized in the TB mortality surveillance.

METHODS

The study was conducted in Metro city, Lampung province at 2008 as one of the project sites of Tb-sentinel. The study was divided into two main phases, phase one was the selection and verification of 'true' and 'non' TB death cases; and phase two was verbal autopsy interview and defining cause of death based on verbal autopsy interview followed by calculation of specificity and sensitivity of VA tools.

Ninety four death cases including 'true' TB and 'non' TB death cases were involved in this study.

Phase One, the selection and verification of 'true' TB and 'non' TB deaths.

Mortality data were derived from selected hospitals in the project sites, i.e., three public hospitals: Ahmad Yani Hospital, Mardi Waluyo Hospital and Moslem Hospital in Metro City North Lampung District. Ninety four cases of 'true' TB and 'non' TB in 2007–2008 were listed. 'True' TB cases include respiratory tuberculosis both with or without bacteriology and histology confirmation. The diagnose was defined by medical doctor in the hospital based on clinical examination mostly supported by lung rontgen examination but not always confirmed with BTA+ examination. 'Non' TB cases were selected from non TB different diagnoses related to lung organ. 'True' and 'non' TB cases for the study were limited to cases with the addresses in the project site area (Metro city). After the data were reviewed by the research team, finally only 65 cases were defined as study cases. Diagnoses certified by hospital for these cases are ascribed as 'gold standard' diagnoses

Phase Two, VA interview and defining cause of death based on verbal autopsy interview followed by calculation of specificity and sensitivity of VA tools.

Verbal autopsy interviews were carried out by the 12 trained interviewers, who are already involved in the TB-Sentinel, using the modified Verbal Autopsy Questionnaires. The interviewers are nurses/midwives recruited from health centers in Metro city. To familiarize with the modified questionnaire, one day refresher training for the interviewers was conducted prior to field work. Verbal autopsy interview result for any death case was then sent to verbal autopsy reviewer. Two verbal autopsy reviewers (medical doctors) were assigned to ascertain the most probable cause of death for each case. Verbal autopsy reviewers were medical doctors who were involved in TB sentinel (one of TB sentinel project sites) and were already trained for this work. For cases with unmatched cause of death diagnosed by the two reviewers, were then sent to referee team (two medical doctors of TB sentinel). The team judged unmatched cases and decided final cause of death. Blind techniques was applied for the
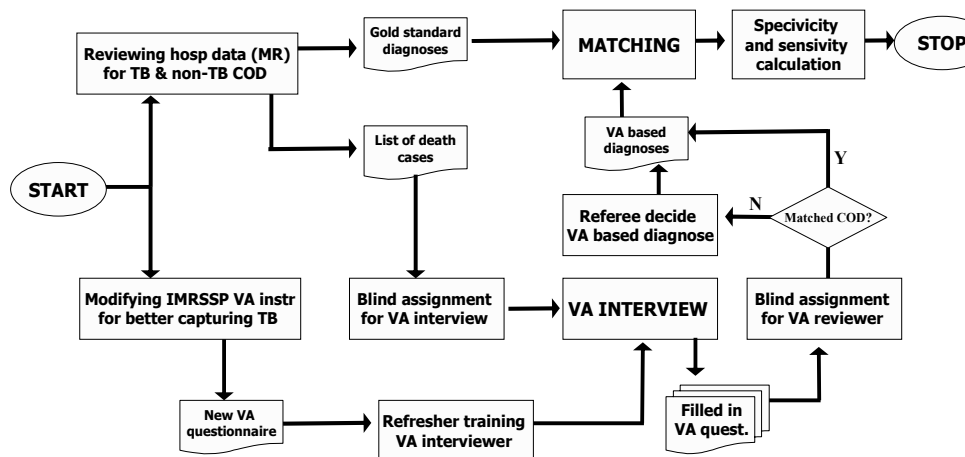
Figure 1. Flowchart Specificity and Sensitivity Calculation for VA questionaire in capturing TB death

interviewer, VA reviewer, as well as referee team to avoid any bias which may occur during the test. The specificity and sensitivity was then assessed eventually after matching diagnoses between VA based COD (matched COD between two VA reviewer and final COD decided by referee) and hospital based COD ('gold standard'), see Figure 1.

Sensitivity and Positive Predictive Value (PPV) are the most widely used statistics used to describe a diagnostic test. Sensitivity is defined as the probability of TB diagnosed by VA tool among TB death cases diagnosed in the hospital (gold standard). Positive Predictive Value is defined as the probability of TB diagnosed by VA tool and also by hospitals among Tb deaths cases diagnosed by VA. Take a look at the following table, the definition of sensitivity and PPV are written as sensitivity = $a/(a+c)$, and PPV = $a/(a+b)$. The other diagnostic test is specificity is defined as the probability of non-TB diagnosed by VA tool among non-TB deaths cases diagnosed in the hospital (gold standard) in Table 1 as follows.

Table 1. Table Calculation of Sensitivity, Specificity and PPV of VA Questionnaire to Capcure TB Mortality.

		Gold standard (hospital diagnosis)		
		TB	Non-TB	Total
Verbal Autopsy based diagnoses	TB	a	b	a+b
	Non-TB	c	d	c+d
	Total	a+c	b+d	a+b+c+d

Sensitivity = a/a+c, PP Value = a/a+b, Specificity = d/b+d

RESULT AND DISCUSSION

The determination of cause of death known as autopsy or postmortem examination is one of the medical procedures performed by a pathologist who can reveal it for the legal and medical purposes (Stoppler MC, 2011). The clinical diagnosis set up by medical doctors (general practitioners) may be different from the autopsy result (Ravakhah K, 2006). Clinical diagnosis are not always easy; a pathologist reported in his study result at the end of 20th century that 20–40 per cent of cases examined through autopsy were cases which were not clinically diagnosed (Dobbs, David, 2005).

Accurate information of cause of death is very important to keep improving quality public health service and to plan effective public health programs. The death certificate is the main source of statistic data to identify the public health problems, monitor the progress and to alocate the funding (CDC, 2001). For the purpose of health statistic, the clinical autopsy data input is not adequate, due to (the wide gap in) the imbalance ratio between the number of pathologists and patients (Roulson J, *et al.*, 2005).

Therefore to meet the statistic need fo accurate cause of death throughout the world, there has been developed and implemented the approach of verbal autopsy to diagnose the cause of death in society. In developing countries this VA can be used to replace clinical autopsy. This was initiated and supported by the WHO from 1992 through 2004, and has been implemented and validated first in Tanzania, then in China, India, Malawi, Ethiopia and Cameroon. The

Table 2. Cause of Death (Cod) Defined by Hospital vs Cod Defined by Medical Doctor Based on Verbal Autopsy

Cases No	VA Reviewer 1	VA Reviewer 2	Referee Team Diagnose	VA based diagnose	Hospital diagnose Gold standard
(1)	(2)	(3)	(4)	(5)	(6)
1-01	TB Paru	TB Paru		TB Paru	TB Paru
2-02	Hypertensive Heart Diseases	Stroke	Stroke	Stroke	Chronic obstructive pulmonary diseases
3-03	TB Paru	TB Paru		TB Paru	AdenoCa paru
5-04	Ischaemic Heart Diseases	Hypertensive Heart Diseases	Hypertensive Heart Diseases	Hypertensive Heart Diseases	Hypertensive Heart Diseases
6-05	Coma Diabetikum	TB Paru	TB Paru	TB Paru	TB Paru
7-06	CHF	CHF		Congestive Heart Failure	Congestive Heart Failure
8-07	TB Paru	TB Paru		TB Paru	TB Paru
9-08	Malaria	CHF	CHF	Congestive Heart Failure	Congestive Heart Failure
10-09	Hepatitis	Hepatitis		Hepatitis	Congestive Heart Failure
12-10	Myocard Infarction	Atherosclerosis	Myocard Infarction	Myocard Infarction	Decompensatio Cordis
13-11	Diabetes mellitus	Diabetes mellitus		Diabetes Mellitus	Decompensatio Cordis
15-12	Stroke	Stroke		Stroke	Stroke non hemoragik
16-13	MCI	MCI		Myocard Infarction	Congestive Heart Failure
17-14	Colic Abdomen	Disentri	Diare	Diare	PPOK
18-15	Stroke	HHD	Hypertensive Heart Diseases	Hypertensive Heart Diseases	Bronchopneumonia
20-16	Gagal jantung	Gagal Jantung		Decompensatio cordis	Bronchopneumonia
21-17	Anemia	Bulimia	HIV/AIDS	HIV/AIDS	Anoreksia ec Disfagia TB
22-18	HHD	CHF	Hypertensive Heart Diseases	Hypertensive Heart Diseases	Hypertensive Heart Diseases
23-19	TB Paru	TB Paru		TB Paru	Bronchopneumonia
24-20	Myocard Infarction	Hypertensive Heart Diseases	Hypertensive Heart Diseases	Hypertensive Heart Diseases	Hypertensive Heart Diseases
25-21	Hypertension	Congestive Heart Failure	Congestive Heart Failure	Congestive Heart Failure	Bronchopneumonia
26-22	Myocard Infarction	TB Paru	TB Paru	TB Paru	TB Paru
27-23	Myocard Infarction	Congestive Heart Failure	Congestive Heart Failure	Congestive Heart Failure	Congestive Heart Failure
28-24	Keracunan Ikan Tongkol	Keracunan ikan Tongkol		Keracunan Ikan Tongkol	PPOK *(Direct cause)*

Cases No	VA Reviewer 1	VA Reviewer 2	Referee Team Diagnose	VA based diagnose	Hospital diagnose Gold standard
(1)	(2)	(3)	(4)	(5)	(6)
29-25	Hypertensive Heart Diseases	Hypertensive Heart Diseases		Hypertensive Heart Diseases	Hypertensive Heart Diseases
32-26	Myocard Infarction	Ischaemic Heart Diseases	Myocard Infarction	Myocard Infarction	Decompensatio cordis
35-27	Myocard Infarction	TB Paru	TB Paru	TB Paru	Bronchopneumonia
36-28	Gagal Ginjal	Hepatorenal Syndrom	Cirrhosis hepatis	Cirrhosis hepatis	Decomp Cordis
38-29	Pneumoni	Pneumoni		Pneumonia	Bronchopneumonia
39-30	TB Paru	Efusi Pleura	TB Paru	TB Paru	Decompensatio Cordis
40-31	Congestive Heart Failure	Congestive Heart Failure		Congestive Heart Failure	Decompensatio Cordis
43-32	Hypertension	Congestive Heart Failure	Congestive Heart Failure	Congestive Heart Failure	Decompensatio Cordis
44-33	Congestive Heart Failure	Status Asmatikus	Congestive Heart Failure	Congestive Heart Failure	Decompensatio Cordis
45-34	TB Paru	TB Paru		TB Paru	Decompensatio Cordis
46-35	Myocard Infarction	Cardiomyopati post partum	Myocard Infarction	Myocard Infarction	Decompensatio Cordis
47-36	Myocard Infarction	Hypertension	Myocard Infarction	Myocard Infarction	Decompensatio Cordis
48-37	Stroke	Stroke		Stroke	Decompensatio Cordis
49-38	Diabetes mellitus	Diabetes mellitus		Diabetes Mellitus	Decompensatio Cordis
50-39	Hypertension	Congestive Heart Failure	Congestive Heart Failure	Congestive Heart Failure	Decompensatio Cordis
52-40	TB Paru	TB paru		TB Paru	TB Paru
56-41	Diabetes mellitus	Diabetes mellitus		TB Paru	TB Paru
59-42	Status Asmaticus	TB Paru		TB Paru	Asma
60-43	TB Paru	TB Paru		TB Paru	TB Paru
61-44	Diabetes mellitus	Stroke	Benign prostate hypertrophy	Benign prostat hypertrophy	Decompensatio Cordis
62-45	TB Paru	TB Paru		TB Paru	TB Paru
68-46	Myocard Infarction	Hypertension	Myocard Infarction	Myocard Infarction	Decompensatio Cordis
69-47	Hypertension	Congestive Heart Failure	Congestive Heart Failure	Congestive Heart Failure	Atrial septal heart disease (ASHD)
71-48	TB Paru	TB Paru		TB Paru	PPOK
72-49	Cardiomyopati	Hypertension	Congestive Heart Failure	Congestive Heart Failure	Decompensatio Cordis
73-50	TB Paru	Diabetes mellitus		TB Paru	TB Paru

Cases No	VA Reviewer 1	VA Reviewer 2	Referee Team Diagnose	VA based diagnose	Hospital diagnose Gold standard
(1)	(2)	(3)	(4)	(5)	(6)
74-51	Myocard Infarction	Jantung Rematik	Myocard Infarction	Myocard Infarction	Decompensatio Cordis
76-52	Myocard Infarction	Hypertensive Heart Diseases	Myocard Infarction	Myocard Infarction	Asma
78-53	Myocard Infarction	Sepsis	Sepsis	Sepsis	TB Paru
81-54	TB Paru	TB Paru		TB Paru	TB Paru
82-55	Hypertension	Congestive Heart Failure		Congestive Heart Failure	Decompensatio Cordis
84-56	Myocard Infarction	Myocard Infarction		Myocard Infarction	Myocard Infarction
85-57	TB Paru	TB Paru		TB Paru	TB Paru
86-58	TB Paru	TB Paru		TB Paru	TB Paru
87-59	TB Paru	TB Paru		TB Paru	TB Paru
88-60	TB Paru	TB Paru		TB Paru	TB Paru
89-61	Nefrotic Syndrome	Chronic Nephritic		Chronic Nephritic	Asma
90-62	Congestive Heart Failure	Congestive Heart Failure		Congestive Heart Failure	Decompensatio Cordis
92-63	Myocard Infarction	Myocard Infarction		Myocard Infarction	Decompensatio Cordis
93-64	Myocard Infarction	Myocard Infarction		Myocard Infarction	Myocard Infarction
94-65	Stroke	Stroke		Stroke	Stroke

results in India, China and Tanzania shows that the information obtained from the surveilance on the cause of death in population through VA may result in statistics that affects the policy, implementation, monitoring and evaluation (Anker, Martha, 1999) and therefore can be used to evaluate health intervention, identify treatment seeking behaviour, provide health care service (The World Health Report, 2006).

In Indonesia, the validity test has been conducted twice to test the VA questionaires used to get information of death caused by lung TB. The first was done in Jakarta prior to TB Sentinel project, to test the sensitivity and specificity of the questionnaires to be used to collect cause of death (COD) information of each death case happened at home in the community. The next was done in the areas targetted by the TB Sentinel Survey, among others in the city of Metro.

Sensitivity and PPV for VA questionnaire in capturing TB death were calculated based on summary table derived from contrasting VA based diagnoses with hospital based diagnoses as gold standard (column 5 vs. column 6 of Table 1). Table 2 is the summary table, showing agreement and dis-agreement of diagnoses of hospital based and VA based diagnoses in Metro city. Out of 16 death cases defined as 'true' TB by hospital, 13 cases are able to be decided as the same 'true' TB based on VA interview, and 3 cases are missed to be defined as 'true' TB. This gives sensitivity as 13/16 or 81 percent. The PPV value is 13/21 or 62 percent. On the other hand, out of 49 cases of 'non' TB defined by hospital, 41 cases are defined also as 'non' TB by VA interview. This gives specificity of 41 per 49 or 84 percent.

Table 3. Specificity and sensitivity of VA questionnaire to capture TB mortality

		Gold standard (hospital diagnosis)		
		TB	Non-TB	Total
Verbal Autopsy based diagnoses	TB	13	8	21
	Non-TB	3	41	44
	Total	16	49	65

Sensitivity = 13/16 = 81.2% PP Value = 13/21 = 61.9% Specificity = 41/49 = 83.7%

The validity of the Verbal Autopsy can be effected by a few factors such as the type of illness suffered before the death, the characteristics of the dead person, and other factors related to COD, as well as the format and contents of the questionaires and performance in situ (Chandramohan D, 1994; Quigley MA, 2000). In addition, the interview using the VA approach has a certain drawback, in which a given disease should have a characteristic and symptom; this is not fully the case with TB, unless it is certified with the Acid Resistant Bacille (*Basil Tahan Asam*) examination which constitutes the accurate diagnose of lung TB (Martinez H, 1993). Another important point to consider is that the death cases to be tested should be retrieved from the hospital medical record and should be the death cases caused by TB (supported by positive BTA examination). It should also be noted that TB has a role of underlying COD instead of intervening antecedent cause or contributor cause of death.

The results of the survey using simple VA approach to identify the death cases of adults in Ethiopia shows that they can reveal the diagnosis information of COD which is effectively useful to lead health intervention in the rural area in which information is hardly available if not unavailable. One of the infectious diseases which can be diagnosed is TB despite the algorithme used is not quite sensitive yet is more specific compared to injuries, maternal death, meningitis, acute febrile illness (Kidest Lulu, 2005).

The sensitivity and specificity calculation for VA questionnaires conducted at the beginning of the project in 2006 based on the hospital medical record in Central Jakarta and East Jakarat shows the sensitivity 76 percent, PPV 68 percent and specificity 73 percent (Sarimawar Djaja *et al.*, 2007). The sensitivity and specificity calculations done in Metro city and DKI Jakarta shows that the validity in Metro city is higher than that of DKI Jakrarta at the beginning of the project (81 per cent vs. 76 percent). Validity study over several centers overseas shows that TB sensitivity is above 75 percent and PPV value ranges between 60–74 percent (Chandramohan, 2007). The PPV value of Metro is 62 percent, lower than that of DKI Jakarta which is 68 percent. Besides Metro, the validity test was also conducted in three other places, i.e. Gorontalo, Papua, and Pontianak. The sensitivity in Metro is higher compared to that of Gorontalo, Papua, and Pontianak (81 per cent vs 74, 77, 61 per cent), while its PPV value is the lowest compared to the three places (62 per cent vs. 71, 97, 86 per cent). Although the sensitivity and PPV values of the survey in Metro and four other places varied, the test results in Metro and these four other areas are still within the range of those of several other center overseas. The value of sensitivity and spscificity autopsy verbal TB questionnaire can go up and down, it depends on the accuracy of doctor's diagnose which is influenced by doctor's experiences to detect tuberculosis of lung and also how the respondents could explain the signs and symptoms of tuberculosis of lung to the interviewers (Sarimawar Djaja, 2007).

CONCLUSION AND SUGGESTION

The result of validity test of Verbal Autopsy as a tool to capture TB death in the community conducted in Metro is not much different from that done in several other domestic centers as well as overseas for the same purpose. The well organized VA questionnaires containing variables to diagnose the TB death are adequate tools to obtain information on TB death in community, where more death cases happen at home than in health care facilities. For the death cases that happen in the hospitals, the quality of recording in the medical record and the diagnosis determining the COD should be improved based on the International Classification of Diseases 10 (ICD-10) mortality coding.

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