Supporting information

S1 Table: Search terms and strategy

Databases	Search terms and strategy	Number of studies
PubMed	("patients"[MeSH Terms] OR "patient*"[Text Word]) AND ("Delayed Diagnosis"[MeSH Terms] OR "diagnostic delay*"[Text Word] OR "Time-to-Treatment"[MeSH Terms] OR "treatment delay*"[Text Word] OR "patient delay*"[Text Word] OR "health system delay*"[Text Word] OR "health service delay*"[Text Word] OR "provider delay*"[Text Word] OR "doctors delay*"[Text Word] OR "total delay*"[Text Word]) AND ("tuberculosis"[MeSH Terms] OR "tuberculosis*"[Text Word] OR "pulmonary tuberculosis*"[Text Word]) AND ("Ethiopia"[MeSH Terms] OR "Ethiopia*"[Text Word]) **#2 AND #3 AND #4 AND #6**	56
Embase	(Patient AND diagnostic delay OR treatment delay OR patient delay OR health system delay OR health service delay OR provider delay OR doctor's delay OR total delay AND tuberculosis OR pulmonary tuberculosis AND associated factor OR determinant OR barrier AND Ethiopia)	247
Google scholar	Patient* AND "diagnostic delay*" OR "treatment delay*" OR "patient delay*" OR "health system delay*" OR "health service delay*" OR "provider delay*" OR "total delay*" AND tuberculosis* OR "pulmonary tuberculosis*" OR AND "associated factor*" OR determinant* AND Ethiopia*	398
Science direct	"diagnostic delay" OR "treatment delay" OR "health system delay" OR "total delay" AND tuberculosis OR "pulmonary tuberculosis" AND "associated factor" AND Ethiopia	156
Scopus	patient* AND "diagnostic delay*" OR "treatment delay*" OR "patient delay*" OR "health system delay*" OR "health service delay*" OR "provider delay*" OR "total delay*" AND tuberculosis* OR "pulmonary tuberculosis*" AND "associated factor*" OR determinant* AND Ethiopia*	78
Springer link	Patient* AND "diagnostic delay*" OR "treatment delay*" OR "patient delay*" OR "health system delay*" OR "health service delay*" OR "provider delay*" OR "total delay*" AND tuberculosis* OR "pulmonary tuberculosis*" AND "associated factor*" OR determinant* AND Ethiopia*	96

S2 Table. Quality assessment result of the studies included in the systematic review and meta-analysis (Newcastle-Ottawa quality assessment scale) for Cross-Sectional Studies

Author/year	Study design	Selection	Comparability	Outcome
Ayalew et al/2018	CS	***	**	***
Belay et al/2010	CS	****	**	***
Gebreegizaber et al/2014	CS	***	*	**
Yimer et la/2010	CS	***	**	***
Asefa et al/2012	CS	****	**	***
Hussen et al/2011	CS	***	**	***
Adenager et al/2012	CS	****	**	***
Seid et al/2017	CS	****	**	**
Tedla et al/2019	CS	***	*	**
Haboro et al/2017	CS	****	**	***
Asres et al/2016	CS	****	**	**
Yimer et al/2003	CS	***	**	***
Datiko et al/2017	CS	***	*	**
Bogale et al/2016	CS	***	**	***

CS: refers to cross-sectional

Selection: scored a maximum of five stars

Comparability: scored a maximum of two stars

Outcome: scored a maximum of three stars

- A score of ≥ 7 out of 10 were considered as achieving high Quality

S3 Table. List of excluded references and reasons for exclusion.

No	excluded references	Reasons
1	*Shiferaw MB, Zegeye AM. Delay in tuberculosis diagnosis and treatment in Amhara state, Ethiopia. BMC health services research. 2019; 19(1):232.*	**2**
2	*Fuge TG, Bawore SG, Solomon DW, Hegana TY. Patient delay in seeking tuberculosis diagnosis and associated factors in Hadiya Zone, Southern Ethiopia. BMC research notes. 2018; 11(1):115.*	**1**
3	*Mesfin MM, Newell JN, Walley JD, Gessessew A, Madeley RJ. Delayed consultation among pulmonary tuberculosis patients: a cross sectional study of 10 DOTS districts of Ethiopia. BMC Public Health. 2009;9(1):53.*	**3**
4	*Sorsa A, Jerene D, Negash S, Habtamu A. Use of Xpert Contributes to Accurate Diagnosis, Timely Initiation, and Rational Use of Anti-TB Treatment Among Childhood Tuberculosis Cases in South Central Ethiopia. Pediatric Health, Medicine and Therapeutics. 2020; 11:153.*	**2**
5	Abdu M, Balchut A, Girma E, Mebratu W. Patient Delay in Initiating Tuberculosis Treatment and Associated Factors in Oromia Special Zone, Amhara Region. Pulmonary medicine. 2020;2020.	**1**
6	Yimer SA, Holm-Hansen C, Storla DG, Bjune GA. Tuberculosis management time: an alternative parameter for measuring the tuberculosis infectious pool. Tropical Medicine & International Health. 2014; 19(3):313-20.	**1**
7	Mekonnen YA, Abebe L, Fentahun N, Belay SA, Kassa AW. Delay for first consultation and associated factors among tuberculosis patients in Bahir Dar town administration, North West Ethiopia. American Journal of Health Research. 2014;2(4):140-5.	**1**
8	Getahun G, Erchafo B, Gebretsadik LA, Chaka M. Patient Delay and Associated Factors Among Pulmonary Tuberculosis Patients at Hadiya Zone Public Health Facilities in South Ethiopia, 2017. European Journal of Clinical and Biomedical Sciences. 2018; 4(4):55-62.	**1**
9	Yimer SA, Norheim G, Namouchi A, Zegeye ED, Kinander W, Tønjum T, et al. Mycobacterium tuberculosis lineage 7 strains are associated with prolonged patient delay in	**1**

seeking treatment for pulmonary tuberculosis in Amhara Region, Ethiopia. Journal of clinical microbiology. 2015; 53(4):1301-9.

10 Shiferaw MB, Yismaw G. Magnitude of delayed turnaround time of laboratory results in Amhara Public Health Institute, Bahir Dar, Ethiopia. BMC health services research. 2019; 19(1):240. **3**

11 Tadesse T, Demissie M, Berhane Y, Kebede Y, Abebe M. Long distance travelling and financial burdens discourage tuberculosis DOTs treatment initiation and compliance in Ethiopia: a qualitative study. BMC public health. 2013; 13(1):424. **3**

12 Ambaw F, Mayston R, Hanlon C, Alem A. Is depression associated with pathways to care and diagnosis delay in people with tuberculosis in Ethiopia? Global Mental Health. 2019;6. **1**

13 Getnet F, Demissie M, Worku A, Gobena T, Seyoum B, Tschopp R, et al. Determinants of Patient Delay in Diagnosis of Pulmonary Tuberculosis in Somali Pastoralist Setting of Ethiopia: A Matched Case-Control Study. International journal of environmental research and public health. 2019;16(18):3391. **1**

14 Yirgu R, Lemessa F, Hirpa S, Alemayehu A, Klinkenberg E. Determinants of delayed care seeking for TB suggestive symptoms in Seru district, Oromiya region, Ethiopia: a community based unmatched case-control study. BMC infectious diseases. 2017; 17(1):292. **1**

15 Alema HB, Hailemariam SA, Misgina KH, Weldu MG, Gebregergis YS, Mekonen GK, et al. Health care seeking delay among pulmonary tuberculosis patients in North West zone of Tigrai region, North Ethiopia. BMC infectious diseases. 2019; 19(1). **1**

16 *Gebeyehu E, Azage M, Abeje G. Factors associated with patient's delay in tuberculosis treatment in Bahir Dar City administration, Northwest Ethiopia. BioMed Research International. 2014; 2014.* **1**

17 *Hamza A, Ababa A. Delay in tuberculosis diagnosis among tuberculosis patients at the three hospitals: asella, robe and abomsa of arsi zone, oromia regional state, March, 2015. Open Access Library Journal. 2015;2(12):1* **6**

18 Asres M, Gedefaw M, Kahsay A, Weldu Y. Patients' delay in seeking health care for tuberculosis diagnosis in East Gojjam zone, Northwest Ethiopia. The American journal of tropical medicine and hygiene. 2017; 96(5):1071-5. **1**

19 Madebo T, Lindtjorn B. Delay in treatment of pulmonary tuberculosis: an analysis of symptom duration among Ethiopian patients. MedGenMed: Medscape general medicine. 1999:E6. **3**

20 Mekonnen YA, Abebe L, Fentahun N, Belay SA, Kassa AW. Delay for first consultation and associated factors among tuberculosis patients in Bahir Dar town administration, North West Ethiopia. American Journal of Health Research. 2014; 2(4):140-5. **1**

21 Demissie M, Lindtjorn B, Berhane Y. Patient and health service delay in the diagnosis of pulmonary tuberculosis in Ethiopia. BMC public health. 2002;2(1):23. **6**

22 Ehlers VJ, Aragaw GS. An audit of diagnosis and treatment of tuberculosis in Ethiopia. African Journal of Primary Health Care & Family Medicine. 2014; 6(1):1-6. **3**

23 Alene M, Assemie MA, Yismaw L, Gedif G, Ketema DB, Gietaneh W, et al. Patient delay in the diagnosis of tuberculosis in Ethiopia: a systematic review and meta-analysis. BMC infectious diseases. 2020;20(1):1-9. **4**

24 Tefera KT, Mesfin N, Reta MM, Sisay MM, Tamirat KS, Akalu TY. Treatment delay and associated factors among adults with drug resistant tuberculosis at treatment initiating centers in the Amhara regional state, Ethiopia. BMC infectious diseases. 2019;19(1):489. **5**

25 Zeleke ZZ, Trifa ZM. Treatment delay among smear positive pulmonary tuberculosis patients in South Ethiopia: a cross-sectional study. Science Journal of Public Health. 2014; 2(5):402-9. **6**

26 Awoke N, Dulo B, Wudneh F. Total Delay in Treatment of Tuberculosis and Associated Factors among New Pulmonary TB Patients in Selected Health Facilities of Gedeo Zone, Southern Ethiopia, 2017/18. Interdisciplinary perspectives on infectious diseases. 2019. **6**

27 *Mesfin MM, Newell JN, Madeley RJ, Mirzoev TN, Tareke IG, Kifle YT, et al. Cost implications of delays to tuberculosis diagnosis among pulmonary tuberculosis patients in Ethiopia. BMC Public Health. 2010;10:173* **1**

28 Gebreegziabher SB, Bjune GA, Yimer SA. Total delay is associated with unfavorable treatment outcome among pulmonary tuberculosis patients in west Gojjam zone, Northwest Ethiopia: a prospective cohort study. PloS one. 2016; 11(7):e0159579. **6**

29 Cambanis A, Yassin MA, Ramsay A, Bertel Squire S, Arbide I, Cuevas LE. Rural poverty and delayed presentation to tuberculosis services in Ethiopia. Tropical Medicine & International Health. 2005; 10(4):330-5. **1**

30	Gele AA, Bjune G, Abebe F. Pastoralism and delay in diagnosis of TB in Ethiopia. BMC public health. 2009; 9(1):5.	**6**
31	Tegegn A, Yazachew M. Delays in tuberculosis treatment and associated factors in Jimma Zone, Southwest Ethiopia. Ethiopian Journal of Health Sciences. 2009; 19(1).	**7**
32	Getnet F, Demissie M, Worku A, Gobena T, Tschopp R, Seyoum B. Longer Delays in Diagnosis and Treatment of Pulmonary Tuberculosis in Pastoralist Setting, Eastern Ethiopia. Risk Management and Healthcare Policy. 2020; 13:583.	**7**
33	Mesfin MM, Tasew TW, Tareke IG, Kifle YT, Karen WH, Richard MJ. Delays and care seeking behavior among tuberculosis patients in Tigray of northern Ethiopia. Ethiopian Journal of Health Development. 2005; 19(I):7.	**8**
34	Wondimu T, Kassahun W, Getachew S. Delay in initiating tuberculosis treatment and factors associated among pulmonary tuberculosis patients in East Wollega, Western Ethiopia. Ethiopian Journal of Health Development. 2007;21(2):148-56.	**8**

Reasons for exclusion:

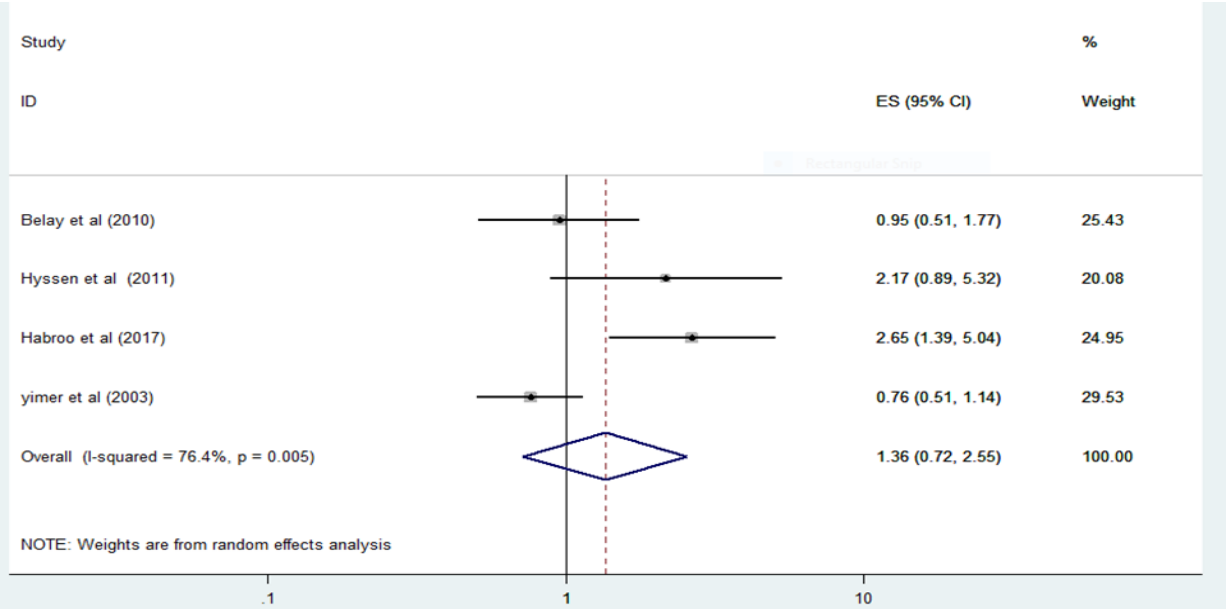
1. only patient delay with or without its associated factors
2. Studies include children
3. Not related to the outcome variable
4. meta-analysis
5. Study done on MDR-TB patients
6. The outcome of interests was not reported
7. Different operational definition of health system delay
8. Do not report the IQR

S4 Table. Associated factors reported by included studies on health system delay in the treatment of tuberculosis patients in Ethiopia.

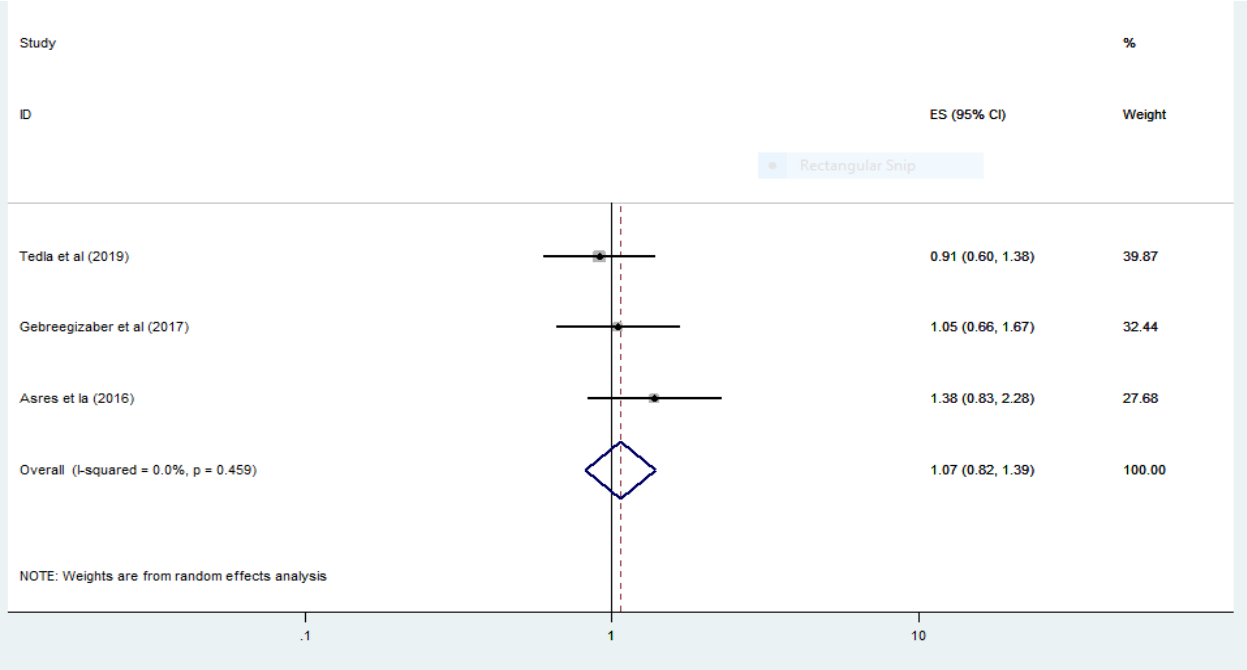
Associated factors	Positive association	Preventive(Negative) association
First visit health facility	Health center: 4.83 (2.33-10.43) Clinic/health post: 19.70 (6.18-62.79) Private facility: 2.49 (1.07-5.84) [Belay et al] *Health center: 5.1 (2.1, 12.5)* *Private: 3.5 (1.3, 9.7)* *Health post:109 (12, 958)* [*Yimer et al]* *Health post /private clinic/drug shop: 19.* *7(12.63-34.52)* [*Hussen et al]* *Health center: 1.3(1–1.9)* *Private clinic: 1.5(1–2.2)* [*Tedla et al]*	
Type of TB	EPTB: 2.08 (1.08-4.04) [Belay et al] Smear-negative PTB: 1.88 (1.32–2.68) [Gebregizaber et al]	
Occupation		House wife: 0.10 (0.02–0.40) [Gebregizaber et al] *Unemployed: 0.41 (0.24, 0.70)* *[Adenager et al]*
HIV		*Positive: 0.2 (0.1, 0.5)*

		[*Yimer et al]*
Residence	*Rural: 2.87(1.01-8.10)* [*Hussen et al]*	
Educational status	*Illiterate: 3.47(1.16-10.30)* [*Hussen et al]* *Illiterate: 2.1(1.3–3.6)[Tedla et al]*	*Illiterate: 0.42(0.20–0.92)* *Grade 1–8: 0.38(0.18–0.81)* *[Seid et al]*
distance from the health facility	*≤10Km: 2.01 (1.22, 3.48)* *[Yimer et al]*	
Number of visited HCF	*Visited one HC: 2.34(1.69,3.24)* *[Asres et al]* *> 2 types: 3.4 (1.910, 6.069)* *[Haboro et al]* *> 2 types: 3.2(1.2-7.86)[Hussen et al]*	*1:* 0*.21(0.2–0.46)[Tedla et al]*
Ever tried other drugs and not cured	*Yes: 4.0 (2.144, 7.465)* *[Haboro et al]*	
Type of lab diagnosis		*Chest X-ray: 0.32(0.16–0.68)* [*Seid et al]*
Haemoptysis		*Yes: 0.61 (0.39, 0.94)* *[Adenager et al]*

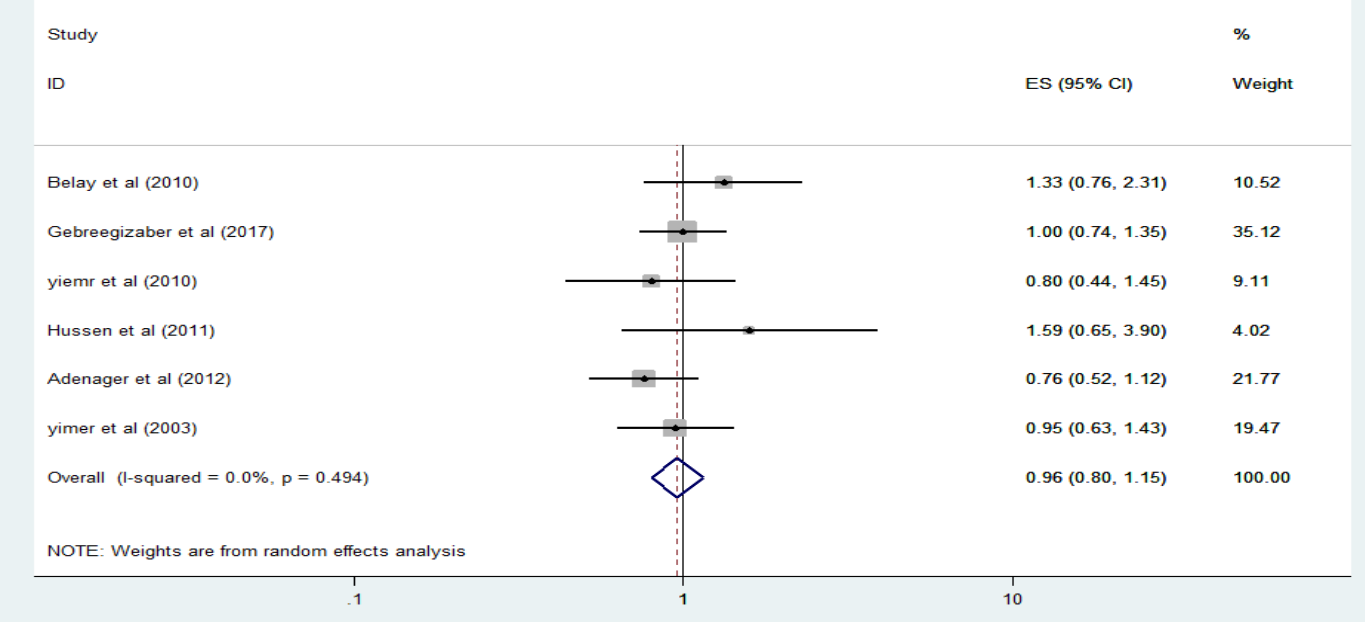
A.


Study
ID
ES (95% CI)
%
Weight
Belay et al (2010)
0.95 (0.51, 1.77)
25.43
Hyssen et al (2011)
2.17 (0.89, 5.32)
20.08
Habroo et al (2017)
2.65 (1.39, 5.04)
24.95
yimer et al (2003)
0.76 (0.51, 1.14)
29.53
Overall (I-squared = 76.4%, p = 0.005)
1.36 (0.72, 2.55)
100.00
NOTE: Weights are from random effects analysis
.1
1
10

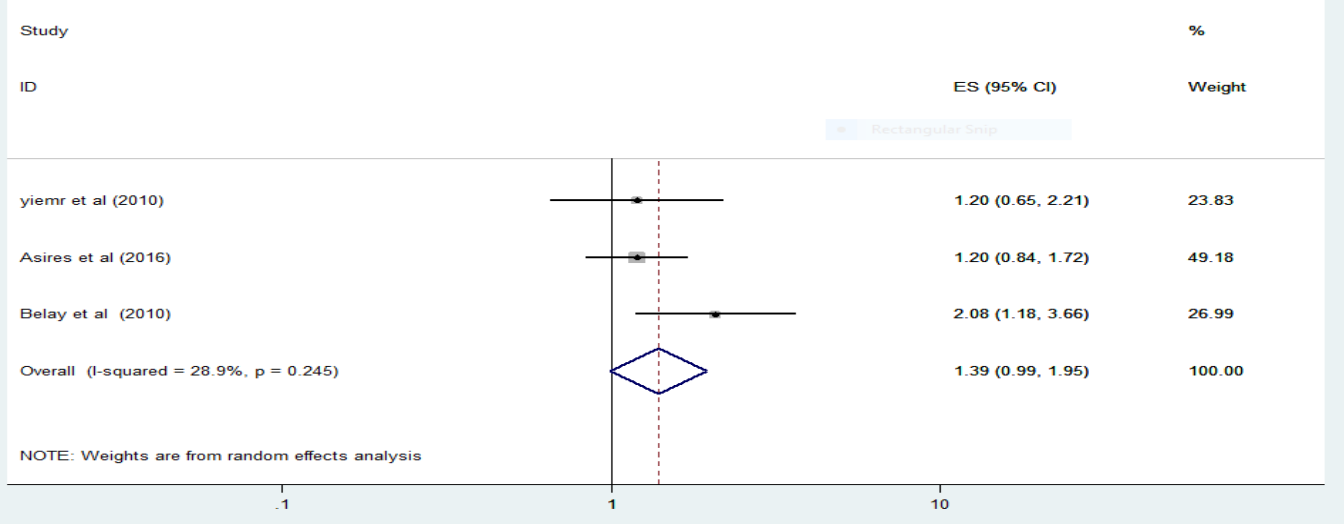
B.


Study
ID
ES (95% CI)
%
Weight
Tedla et al (2019)
0.91 (0.60, 1.38)
39.87
Gebreegizaber et al (2017)
1.05 (0.66, 1.67)
32.44
Asres et la (2016)
1.38 (0.83, 2.28)
27.68
Overall (I-squared = 0.0%, p = 0.459)
1.07 (0.82, 1.39)
100.00
NOTE: Weights are from random effects analysis
.1
1
10

C.



D.



S5 Fig. 3: Forest plots of meta-analysis of factors associated with health system delay among TB patients in Ethiopia. This figure shows forest plots for the meta-analysis of five factors associated with health system delay. Notes: **A**-distance; **B**- HIV**; C- Sex; D**- type of TB.