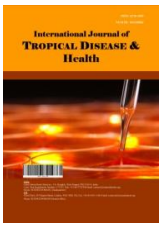

International Journal of TROPICAL DISEASE & Health

41(21): 1-9, 2020; Article no.IJTDH.63397
ISSN: 2278–1005, NLM ID: 101632866

Improving "*Fast*" Indicators of TB Infection Control through Targeted Health Workers Training; Findings from Facility Based Studies in Abia State, Nigeria

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Authors' contributions

This work was carried out in collaboration between both the authors. Author ECI designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript and supervised the implementation of the intervention. Author CNO managed the analyses and literature review of the study. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJTDH/2020/v41i2130395
Editor(s):
(1) Dr. Shankar Srinivasan, Rutgers - School of Health Professions, USA.
Reviewers:
(1) Luis Angel Rodriguez Chavez Medicina., Universidad Privada Antenor Orrego, Peru.
(2) Moreno Dutto, Italy.
Complete Peer review History: http://www.sdiarticle4.com/review-history/63397

Original Research Article

Received 01 October 2020
Accepted 07 December 2020
Published 26 December 2020

ABSTRACT

Aim: The aim of this study was to assess the effect of health workers training and implementation of the FAST strategy on the "FAST" indicators at Abia State University Teaching Hospital (ABSUTH); a tertiary referral facility. "FAST" strategy; a focused approach to stopping TB spread in congregate settings developed by TB Care1 stands for Finding TB cases Actively, Separating safely, and Treating effectively.
Study Design: This was a facility based interventional study using control group design methods with ABSUTH as the intervention facility while Federal Medical Centre Umuahia (FMCU) was the control.
Methodology: Health workers (74 across cadres; doctors, nurses, laboratory scientist and medical record staff) selected through stratified random sampling were trained to ensure daily cough surveillance and screening for TB among patients at the General outpatient, medical wards and HIV clinic of ABSUTH under supervision of a "FAST" focal person.Baseline "Fast Indicators" in the facility TB records of newly diagnosed TB patients 3 months before and 3 months after the training intervention were obtained.

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Results: At baseline the "FAST" strategy indicators recorded in the study facility include time to diagnosis > 1 week, time to treatment 3.5 days, presumptive TB cases 92, number of cases commenced on treatment were 22 while presumptive DRTB cases was 0.33. This study observed a significant positive difference in all the "FAST" indicators following the intervention. Time to diagnosis decreased by 52%, time to treatment decreased by 17% while the number of presumptive TB cases increased by over 100%. Number of TB cases diagnosed also increased by 100% as well as the cases commenced on treatment by 91%, while number of diagnosed DRTB cases increased by over 100%.These were all statistically significant (*P*=.013,.03, .032, and .049 except time to treatment *P*= 0.053).

Conclusion: The training intervention on 'FAST" strategy of TB infection Control significantly improved FAST Indicators in the intervention facility with attendant reduction in diagnostic delays and increased case notification.

Keywords: Health-workers; tuberculosis; training; "FAST" strategy.

1. INTRODUCTION

Tuberculosis (TB) though a long existent disease still constitutes a major health problem in Nigeria [1]. The disease is associated with social stigma which further compounds the problem. It has been reported that there were an estimated 10.0 million new cases of TB in 2017 [2]. *Mycobacterium tuberculosis* the commonly implicated causative organism of TB is carried in airborne particles, or droplet nuclei, that can be generated when persons with tuberculosis sneeze, cough, or speak [3].

The probability that a person who is exposed to M. tuberculosis will become infected depends primarily on: the concentration of infectious droplet nuclei in the air, which is influenced by the number of organisms generated by the TB patient, the amount of ventilation in the area of exposure and duration of exposure [2,3].

Estimates of the burden of TB in Nigeria relied solely on indirect assessment by the World Health Organization (WHO) based on existing TB surveillance data until 2012 when the first National TB prevalence survey was done. The survey became necessary because accuracy of such estimates largely depends on the quality of the routine surveillance information, which in itself is affected by the completeness of TB notification and instances of TB under-diagnosis [4]. Key findings of the survey included the high tuberculosis prevalence to case notification ratio which indicates low case detection.

The results of this survey led to the following resolutions: ensure universal access to treatment and microscopic services, deployment and expansion of new technologies such as GeneXpert, active case detection targeting high burden areas and high risk groups, engagement of all care providers in TB control, and strengthening of routine surveillance to include all points of contacts between patients and health care services [4]. The need for realization of these resolutions are pertinent as the TB burden in Nigeria is one of the highest in the world (318 per 100,000) but the case detection rate (16%) is one of the lowest in the world [5]. In 2019 Nigeria was among the 8 high burden countries that accounted for 2/3rd of global TB cases [6].

Health workers have been described as "all people engaged in actions whose primary intent is to enhance health" [7]. Health care workers and other staff are particularly at high risk of infection with TB because of frequent exposure to patients with infectious TB disease. Health care workers (HCWs) and staff may themselves be immunosuppressed due to HIV infection and be at higher risk of developing TB disease once infected [8].

FAST strategy is a focused approach to stopping TB spread in congregate settings. It is an acronym that stands for Finding TB cases Actively, Separating safely, and Treating effectively [9]. It is a strategy developed in 2013 by TB CARE 11 with the support of United State Agency for International Development (USAID). The strategy was adopted by the National Tuberculosis Leprosy and Buruli ulcer Control Programme(NTBLCP) in 2014 [10]. "FAST" focuses health care workers on the most important administrative TB transmission control intervention: effective treatment.It is in line with one of the WHO core response to the TB problem which is, controlling the spread of the infection [11]. "FAST" focuses attention on implementing and monitoring the administrative processes and procedures necessary to find and

rapidly diagnose unsuspected infectious TB and drug resistant TB cases, such that effective therapy may start within days, not weeks or months [9].

Health-care worker (HCW) education and training on TB infection and disease is an essential part of a TB infection control program and can increase adherence to TB infection control measures. Education and training should emphasize the increased risks posed by an undiagnosed person with TB disease in a health-care setting and the specific measures to reduce this risk [12]. The ability to adhere to TB infection control guidelines is lacking in several health facilities with the attendant effect of new infections amongst health workers especially those who are HIV positive as well as other patients who come to these facilities [13]. Crowded waiting areas as seen in several health facilities contribute to this problem which can be addressed to a great extent by separating coughing patients, diagnosing them promptly and commencing them on treatment [14].

The FAST indicators are time to diagnosis which is the time between when patient presents to the health facility to when a diagnosis of TB is made, time to treatment which the time between making a diagnosis and commencement of TB treatment, Other indicators are number of presumptive TB and Drug Resistant TB (DRTB) cases identified and number of TB and DRTB cases commenced on treatment [9]. Delayed diagnosis of TB, confirmation of DR-TB, and start of appropriate treatment contribute to the likelihood of nosocomial drug-resistant TB infections [15].

Health-care worker (HCW) education and training on TB infection and disease is an essential part of a TB infection control program and can increase adherence to TB infection control measures. Education and training should emphasize the increased risks posed by an undiagnosed person with TB disease in a health-care setting and the specific measures to reduce this risk [16]. A study by Demissie*et al* identified tuberculosis training and work experiences in health facility as determinant factor to knowledge. They also found out that tuberculosis related training and experience in tuberculosis clinic were predictors to practice [17].

Though the FAST strategy is new, the effect of the implementation of the strategy has been documented in some institutions. In a TB hospital in Veronesh Russia, prior to commencement of FAST, HCWs were exposed to DRTB patients for months as drug sensitivity testing was only done after treatment failure. With *FAST*, these patients were diagnosed and commenced on treatment within about 5days [18]. In addition, suspected TB patients were tested within 2 days of admission.

FAST strategy has also been applied to TB Infection Control (TBIC) in the Ndola district of Zambia. In the intervention sites, the average time to TB diagnosis and time to initiation of TB treatment was reduced by half. These are considered good process indicators for the reduction of nosocomial transmission. Furthermore, Ndola district reported a 5% increase in notified TB cases (all forms) [19].

It is against this backdrop that we carried out this study to validate the applicability of the FAST strategy in our setting and serve as a tool to improve TB Infection control in Abia State.

2. METHODOLOGY

This was a facility based interventional study using equivalent control group design methods. Abia State University Teaching hospital (ABSUTH) was the intervention facility while Federal Medical Centre Umuahia (FMCU) was the control.

Both Centres are tertiary health institutions in two urban cities where Nurses and postgraduate Doctors and other support staff are trained. They have similar cadre of staff including Doctors (Specialist in various fields Medical Officers, Resident doctors, House-officers) Pharmacists, Pharmacy technicians Nurses, Laboratory scientists, laboratory technicians, administrative staff, records staff, catering, cleaners, drivers and security staff.

Health workers were selected through stratified random sampling. A minimum sample size of 64 staff was statistically determined for the study using the sample size formula for comparing two proportions (independent samples) [20]. The sample size was proportionately assigned to the included groups of health workers (doctors, nurses, laboratory scientist/technicians, and medical record officers) in the General outpatient, laboratory, HIV clinic, TB unit, medical records and medical wards during the study period. The sampling frame was the list of all subset of these staff in the study group. A total of 74 staff were involved in the intervention.

The study group was trained on FAST strategy while the control group did not have the FAST strategy training intervention. These health workers were trained to ensure daily cough surveillance and screening for TB among patients at the General outpatient, medical wards and HIV clinic. The FAST training manual of TB1 Care was used as well Centre for Disease Control (CDC) tools for TBIC [21]. The Training lasted for two weeks and involved didactic lectures and videos on TBIC as well as brain storming sessions for the first two days with appointment of cough surveillance officers for each unit. Practical demonstrations under the supervision of the facility FAST focal person held at the selected units from day 3 to 13 where health workers were taught how to safely separate coughing patients without embarrassing them as well as fast track their care. The last day (day 14) was a plenary where experiences were shared and decisions taken on facility specific approaches including ensuring that the laboratory focal persons sent sputum results directly to the facility DOT focal person. Posters which promote "FAST" and cough etiquette were placed in these units in the intervention facility to remind participants of the strategy daily.

Data for the 3 quarters prior to the study was obtained from TB registers of both facilities for all newly diagnosed TB patients. These were used to calculate the baseline values of "FAST" indicators for both facilities as documented in the FAST strategy manual [9]. The average of the values obtained from these preceding 3 quarters was taken as the baseline values of the indicators for each facility. Tertiary health institutions were selected because they have high patient load. They are also more likely to have overcrowded waiting areas which can create room for transmission of tuberculosis. Patients are also likely to suffer more delays in terms of waiting time in tertiary institutions [22,23]. The diagnosis of TB and DR-TB was done in accordance with national guidelines with use of Acid Fast Bacilli (AFB) light microscopy and GeneXpert MTB/RIF technology.

At the end of the three months intervention period, the baseline data of "FAST" indicators collected at the beginning of the study from the TB registers were compared to the data that was collected at the end of the study.Data obtained were entered and analysed using IBM SPSS version 20. Difference between FAST indicators-outcome variables (decreased time to diagnosis, decreased time to treatment, number of presumptive TB and DRTB patients, number of patients commenced on TB treatment) in both study and control groups were tested using paired t-test. Percentage differences in the secondary outcome variables in both the study and control groups before and after intervention were also computed.

3. RESULTS

A total of 74 health workers were trained on the implementation of "FAST" strategy of TB infection control. Reported below are the findings of baseline and post-intervention values of "FAST" indicators in both the study and control facilities.

Table 1 shows baseline values of "FAST Indicators in the study facility.

Baseline time to diagnosis was>1 week while time to treatment was 3.6 days. Presumptive TB cases were 93, number of diagnosed TB cases was 26 while number of patients commenced on treatment was 22.For DRTB, the time to diagnosis was also greater than 1 week while presumptive cases were 2 and diagnosed cases 0.33.

Table 2 shows baseline values of "FAST Indicators- outcome variables in the control facility.

Baseline time to diagnosis was 2.8 days while time to treatment was > 1 week. Presumptive TB cases were 295 while number of patients commenced on treatment was 14. For DRTB, the time to diagnosis was also 2.8 days while Presumptive cases were 1.7 and diagnosed cases 1.

Table 3 shows a paired t-test analysis of the FAST indicators before and after the intervention for the study group. Time to diagnosis decreased by 52 %,(p=0.013) time to treatment decreased by 17% and the number of presumptive TB cases increased by over 100 %(*P*=0.016). The change in time to diagnosis and increase in number of presumptive TB cases were statistically significant. Number of cases diagnosed also increased by 100% as well as the cases commenced on treatment by 91%. Total number of presumptive DRTB cases increased from 2 to 7; an increase of over 200% while number of diagnosed DRTB increased by over 100%. These were all statistically significant (*P*=0.03, 0.032, 0.038 and 0.049 respectively).

Table 1. Baseline Data of "FAST" Indicators in study facility in the 3 quarters preceding training on FAST

Indicator-TB	1st Quarter	2nd Quarter	3rd Quarter	Average Pre-intervention Values(range)
Average time to diagnosis (days)	7	8	7	7.3(3-28)
Average time to treatment (days)	4	3.3	3.4	3.6 (2-10)
Total number of presumptive TB cases	92	90	96	93
Total number of diagnosed TB cases	16	28	26	23
Total number of TB patients started on treatment	14	28	24	22
Indicator- DRTB				
Average time to diagnosis	7	8	7	7.3(3-28)
Total number of presumptive DRTB cases	2	0	4	2
Total number of diagnosed DRTB	0	0	1	0.33

N/B Diagnosed DRTB cases are referred to facilities that provide treatment for DRTB

Table 2. Baseline Data of "FAST" Indicators in the control facility in the 3 quarters preceding the study

Indicator-TB	1st Quarter	2nd Quarter	3rd Quarter	Average Pre-study Values(range)
Average time to diagnosis (days)	3	2.5	3.5	2.8(2-5)
Average time to treatment (days)	9	8.5	6	7.8(2-42)
Total number of presumptive TB cases	340	336	209*	295
Total number of diagnosed TB cases	49	37	29	38
Total number of TB patients started on treatment	16	13	14	14
Indicator- DRTB				
Average time to diagnosis	3	2.5	3.5	2.8(2-5)
Total number of presumptive DRTB cases	No data	4	1	1.7
Total number of diagnosed DRTB cases	0	1	2	1

**low figures due to workers 5 weeks strike*

N/B Diagnosed DRTB cases are referred to facilities that provide treatment for DRTB

Table 3. Comparing "FAST" Indicators in Study Facility before and after the intervention

Indicator-TB	Pre-intervention Values	Post-intervention Value	% change in value	Paired-t value	P value
Average time to diagnosis (days)	7.3	3.5	52	8.69	0.013*
Average time to treatment (days)	3.6	3	17	4.12	0.053
Total number of presumptive TB cases	93	203	118	7.78	0.016*
No of diagnosed TB patients	23	46	100	6.12	0.03*
Total number of TB patients started on treatment	22	42	91	-5.44	0.032*
Indicator- DRTB					
Average time to diagnosis	7.3	3.5	52	8.69	0.013*
Total number of presumptive DRTB cases	2	7	250	5.00	0.038*
Total number of diagnosed DRTB	0.33	2	167	4.33	0.049*

**Statistically significant*

Table 4. Comparing "FAST" Indicators in Control Facility at the beginning and at the end of the study

Indicator-TB	Beginning of study value	End of study Value	% change in value	Paired t value	P value
Average time to diagnosis (days)	2.8	2.8	0	0.00	1.00
Average time to treatment (days)	7.8	7.8	0	0.00	1.00
Total number of presumptive TB cases	295	389	23	2.72	0.113
No of diagnosed TB cases	38	47	24	-1.49	0.27
Total number of TB patients started on treatment	14	15	-7	-.76	0.529
Indicator- DRTB					
Average time to diagnosis	2.8	2.8	0	0.00	1.00
Total number of presumptive DRTB cases	1.7	1	-41	0.56	0.63
Total number of diagnosed DRTB	1	1	0	0.000	1.00

The beginning and end of study values of "FAST" indicators for the control facility are presented in Table 4. There was 0% change in the values for time to diagnosis for both TB and DRTB, time to treatment of TB and number of diagnosed DRTB cases. Total number of presumptive TB and diagnosed TB cases increased by 23% and 24% respectively. This increase was due to lower baseline values as a result of strike in the control facility in the 3rd quarter preceding the study. This was however not statistically significant (*P*=0.113 and *P*= 0.270 respectively).

4. DISCUSSION

The intervention and control approach provides a stronger basis for comparison of outcomes. In terms of cadre of health workers included, this study is similar to others involving doctors, nurses, laboratory scientist/ technicians [24,25] but differed in the inclusion of medical records staff who are relevant in the active finding of coughing patients as documented in FAST strategy guidelines [9].

This study observed a significant positive difference in most of the "FAST" indicators following the intervention. Time to diagnosis in the study facility decreased by 52%, this was statistically significant compared to baseline unlike the control facility where there was 0% reduction in time to diagnosis. In a study on the implementation of FAST strategy in Russia [18], time to diagnosis reduced from weeks to less than 2 days while this study observed a decrease to 3.5 days. The difference between this and the Russia study is attributable to the fact that GeneXpert was available for diagnosis at that hospital. In the study facility sputum samples of smear negative cases and presumptive MDRTB cases are sent to another facility (about 40 kilometers away) that had geneXpert for diagnosis.

It can be inferred that installation of a geneXpert would further decrease the time to diagnosis. This finding served as a strong advocacy tool for request for installation of the genexpert in the intervention facility. Following the training intervention, time to treatment decreased by 17% from baseline values while there was no observed change in this indicator in the control site. This change must have been influenced by the decision (at the plenary session of the training) for the laboratory staff to send results to DOTS focal person immediately after diagnosis. The DOTS focal person then followed up on the case through phone numbers in the sputum examination forms. A study in Ethiopia observed that assigning focal persons to notify tuberculosis cases was an independent predictor of high case notification rates [25].

In this study, the number of presumptive TB cases (i.e. patients with signs and symptoms of TB) increased by over 100% following the intervention, reflecting increased case finding by the trained health workers. An interventional study involving 10 study and two control sites in Uganda documented an increase of over 60% in presumptive cases of TB compared to pre-intervention level at the intervention facilities [26]. The difference between the findings in this study and the Uganda study could be due to their

inclusion of multiple intervention facilities. This study however observed an increase of 23% in presumptive TB cases at the control facility. The increase was artefactual as the baseline value of this indicator in the control facility was lower due to industrial action by workers prior to the study leading to a "supposed" increase during the study period as a result of the fact that normal patient flow returned during the study period.

Furthermore, the number of TB cases diagnosed in the intervention facility also increased by 100% as well as the cases commenced on treatment by 91%. These were statistically significant and similar to the study in Uganda which observed, 6 times as many bacteriologically confirmed cases among intervention facilities compared with the pre-intervention phase. There was also 4.8-fold increase in the number of smear-positive patients who were initiated on treatment [26].

In addition the intervention in this study increased the number of presumptive DRTB cases by over 200% while number of diagnosed DRTB increased by over 100%. This could be attributed to increased knowledge of DRTB by the health workers following the training. In the control facility a decrease in presumptive DRTB cases was observed while there was no change in the number of diagnosed DRTB cases. These findings are corroborated by studies on "FAST "strategy [19,27,28]. In the study in Ndola district of Zambia, presumptive TB cases increased while a decrease was observed at the control provinces used in the study [19].

5. CONCLUSION

The training of the health workers reflected positively on the "FAST" indicators as it resulted in a decrease in time to diagnosis, decrease in time to treatment, an increase in the number of presumptive (TB and DRTB) patients, increase in diagnosed (TB and DRTB) patients as well as number of patients commenced on treatment for TB. The shortened time to diagnosis will enhance tuberculosis infection control in the waiting areas of the facility. Early diagnosis and treatment will help protect health workers and immunocompromised patients from nosocomial TB infection.

The Government should support implementation of the "FAST" Strategy in health institutions across the country through the National Tuberculosis, Leprosy and Buruli ulcer control Program (NTBLCP). Increase in diagnosis and prompt treatment using the FAST Strategy will be further enhanced by provision of geneXpert in more centres.

CONSENT

As per international standard or university standard written worker's consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

Ethical approval for the study was obtained from the Institutional Review Board of Abia State University Teaching Hospital, Aba.

COMPETING INTERESTS

Authors have declared that no competing interests exist

REFERENCES

1. Federal Ministry of Health Tuberculosis and Leprosy control program. Model for training of General Healthcare Workers on tuberculosis control. Abuja: Sounaprints. 2012;8-51.
2. World Health Organization. Global Tuberculosis Report 2018. Available:https://www.who.int/tb/publications/global_report/gtbr2018_main_text_28Feb2019.pdf?ua
3. World Health Organisation. WHO Policy on TB Infection Control in Health-Care Facilities, Congregate Settings and Households; 2009.
4. Joseph B, Joseph M. The health of the healthcare workers. Vol. 20, Indian Journal of Occupational and Environmental Medicine. Medknow Publications. 2016; 71-2.
5. Centre for Disease Control. TB Infection Control and Prevention; 2012. [Cited 2020 Aug 6] Available:http://www.cdc.gov/tb/topic/infectioncontrol/default.htm
6. World Health Organisation. Global TB Report 2020. Available:https://www.who.int/tb/publications/global_report/en/
7. Poz MRD, Kinfu Y, Dräger S, Kunjumen T. Counting health workers : definitions , data, methods and global results. World Health; 2006.

8. Centre for Disease Control. Tuberculosis infection control in the era of expanding HIV care and treatment. Addendum to WHO Guidelines for the prevention of tuberculosis in health Care facilities in Resource-Limited Settings; 1999.
9. TB Care II. FAST; A tuberculosis infection control strategy. 2013;1-11.
10. Federal Ministry of Health Department of Public Health NT and LCP. FAST; A Tuberculosis Infection Control Strategy [Internet]; 2014.
Available:https://www.google.com.ng/?gws_rd=ssl#q=Fast+tb+strategy+in+nigeria.
11. WHO guidelines on tuberculosis infection prevention and control 2019.
Available:https://apps.who.int/iris/bitstream/handle/10665/311259/9789241550512-eng.pdf?ua=1
12. Core Curriculum on Tuberculosis: What every Clinician should know. Sixth Edit. Atlanta: Centre for Disease Control; 2013. 189-226.
13. Jensen PA, Lambert LA, Iademarco MF, Ridzon R. Guidelines for preventing the transmission of Mycobacterium tuberculosis in health-care settings. 2005. MMWR Recomm Rep. 2005;54(RR-17):1–141.
14. Kumar V, Khajanchi M, Raykar NP, Gerdin M, Roy N. Waiting at the hospital door: A prospective, multicentre assessment of third delay in four tertiary hospitals in India. Lancet (London, England) 2015;385Suppl :S24. [Internet].
Available:http://www.ncbi.nlm.nih.gov/pubmed/26313071
15. Zelnick JR, Gibbs A, Loveday M, Padayatchi N, O'Donnell MR. Health-care workers' perspectives on workplace safety, infection control, and drug-resistant tuberculosis in a high-burden HIV setting. J Public Health Policy. Nature Publishing Group. 2013;34(3):388-402. [Internet]. [Cited 2020 Sep 28].
Available:http://www.palgravejournals.com/jphp/journal/v34/n3/abs/jphp201320a.html#close
16. Core Curriculum on Tuberculosis: What every Clinician should know. Sixth Edit. Atlanta: Centre for Disease Control. 2013; 189-226.
17. Demissie Gizaw G, Aderaw Alemu Z, Kibret KT. Assessment of knowledge and practice of health workers towards tuberculosis infection control and associated factors in public health facilities of Addis Ababa, Ethiopia: A cross-sectional study. Arch public Heal = Arch belges santé publique. 2015;73(1):15. [Internet]. [Cited 2020 Nov 1]
18. Barrera E, Livchits V, Nardell E. F-A-S-T : a refocused, intensified, administrative tuberculosis transmission control strategy. 2015;19:381–4.
19. TB CARE 1. Ndola District TBIC Demonstration Project. Final Report. Ndola; 2014.
20. Onwasigwe C. Principles and Methods of Epidemiology. Second Edi. Enugu: El Demark. 2010;143-157.
21. Centre for Disease Control. CDC - Tools for Tuberculosis Infection Control. 2014 [cited 2020 May 1].
Available:http://www.cdc.gov/globalaids/resources/pmtct-care/tuberculosis-infection-control.html
22. Khan K. Root Cause Analysis (RCA) of Prolonged Laboratory Turnaround Time in a Tertiary Care Set up. J ClinDiagn Res 2014;8(4):FC05-8. [Internet].[cited 2020 Oct 13]
Available:http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4064846&tool=pmcentrez&rendertype=abstract
23. Kumar V, Khajanchi M, Raykar NP, Gerdin M, Roy N. Waiting at the hospital door: A prospective, multicentre assessment of third delay in four tertiary hospitals in India. Lancet (London, England). 2015;385 Suppl :S24 Internet].
[Cited 2020 Oct 13]
Available:http://www.ncbi.nlm.nih.gov/pubmed/26313071
24. Mirtskhulava V, Whitaker JA, Kipiani M, Harris DA, Tabagari N, Owen-Smith AA, et al. Determinants of tuberculosis infection control-related behaviors among healthcare workers in the country of Georgia. Infect Control Hosp Epidemiol 2015];36(5):522-8. [Cited 2020 Sept 18
Available:http://www.ncbi.nlm.nih.gov/pubmed/25648218 28];14(1):593.
Available:http://www.biomedcentral.com/1472-6963/14/593
25. Temesgen C, Demissie M. Knowledge and practice of tuberculosis infection control among health professionals in Northwest Ethiopia; 2011. BMC Health Serv Res [Internet]; 2014.
[Cited 2020 Sep].

26. Solomon T, Shiferaw M, Abreham W, Tayu B, Klinkenberg E, Loha E. Assigning focal persons to notify more tuberculosis patients: lessons learned in southern Ethiopia. Public Heal action [Internet]. 2014;4(3):S18–24.
[Cited 2020 Oct 25]
Available:http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4542067&tool=pmcentrez&rendertype=abstract
27. Manabe YC, Zawedde-Muyanja S, Burnett SM, Mugabe F, Naikoba S, Coutinho A. Rapid improvement in passive tuberculosis case detection and tuberculosis treatment outcomes after implementation of a bundled laboratory diagnostic and on-site training intervention targeting mid-level providers. Open forum Infect Dis. 2015; 2(1):ofv030. [Internet]
[Cited 2020 Mar 24]
Available:http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4438908&tool=pmcentrez&rendertype=abstract
28. Useni S, Gidado M, Onazi J, Eneogu R, Chukwueme N, Ubochioma E, Akang G, Obot V, Omoniyi F. *FAST* Strategy - A Sustainable Administrative TB Infection Control Measure in Nigeria: Reducing Time to TB Diagnosis and Enrolment to Treatment, Science Journal of Public Health. 2016;4(4):352-358.
DOI: 10.11648/j.sjph.20160404.23

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/63397