



History:

Received: October 2, 2020
Accepted: Nov. 19, 2020
First Published: Dec. 27, 2020
Collection year: 2020
Status: Published

Identifiers and Pagination:

Year: 2020
Volume: 12
First Page: 82
Last Page: 90
Publisher ID: 19204159.12.82
DOI:
<http://dx.doi.org/10.21065/19204159.12.82>

Corresponding author:

Umer Farooq DVM., MPH, Manager eye bank, Al-Shifa Trust Eye Hospital, Jhelum Road, Rawalpindi, Pakistan. Tel.: +923483311321 | +923125398226 | umervet@gmail.com

Citation:

Umer Farooq, Ayesha Babar, Ume Sughra et al. Multidrug-Resistant Tuberculosis among children under 15 years of age in Khyber Pakhtunkhwa province and Federally Administered Tribal Areas Pakistan. J App Pharm. Vol. 12: 2020. p. 82

Original Research Article

MULTIDRUG-RESISTANT TUBERCULOSIS AMONG CHILDREN UNDER 15 YEARS OF AGE IN KHYBER PAKHTUNKHWA PROVINCE AND FEDERALLY ADMINISTERED TRIBAL AREAS PAKISTAN

Umer Farooq¹, Ayesha Babar², Ume Sughra³, Fazal Noor⁴, Taha Nazir⁵

1. Manger Eye Bank, Al-Shifa Trust Eye Hospital, Jhelum Road, Rawalpindi, Pakistan.
2. Associate professor of Public Health, Al-Shifa Trust Eye Hospital, Jhelum Road, Rawalpindi, Pakistan.
3. Associate professor of public Health, Research associate Al-Shifa Research Centre, Al-Shifa Trust Eye Hospital, Jhelum Road, Rawalpindi, Pakistan.
4. Post Graduate Resident (General Surgery), Pakistan Institute of Medical Sciences (PIMS) G-8, G Area Sector G-8/3, Islamabad Pakistan.
5. Advance Multiple Incorporation ,Mississauga ON Canada

ABSTRACT

Background: Tuberculosis is re-emerging in the form of drug resistant causing deaths of humans throughout the world. In 2015, WHO estimates, this disease developed in 10.4 million and causes death in 1.8 million human population. Moreover, new challenges like TB/HIV co-infection, MDR-TB is resisting to the preventive measures for controlling TB worldwide. Emergence of MDR-TB is becoming a global threat now.

Objectives: To find out the frequency and associated factors of MDR-TB among children under 15 years of age in KPK province and FATA Pakistan.

Methods: Cross sectional and quantitative study design was applied. Data was collected from patient's registration files (n = 100) at four (4) PMDT sites of National Tuberculosis control program Pakistan in Khyber Pakhtunkhwa Province and FATA.

Results: Children having previously history for TB treatment failure were found 4-9 times more probable (95% CI, Odds Ratio 4.08,8.864) to develop MDR-TB while 64-84% of other previously treated patient by private sectors are not likely to developed MDR-TB (95% CI, Odds Ratio 0.158,0.366) than all other types of previously treated cases. National TB control program Pakistan may be able to use these findings to develop strategic programs to address the treatment failure.

Conclusion: The public and private health care providers need proper monitoring and surveillance, which may potentially improved the overall quality of health care services and assure the treatment of the resistant TB among children under 15 years of age in developing countries. We may then achieve the Millennium Development Goals of World Health Organization.

Keywords: Tuberculosis, children, Pediatric, epidemiology, drug resistance, DOT Plus, overcrowding, childhood illness, respiratory tract infection, PMDT.

INTRODUCTION

MDR-TB remains a public health crisis, health security threat and cause of failure to all therapeutic measures controlling TB globally. An estimated 10.4 million peoples ill with

Funding:

The authors received no direct funding for this research.

Competing Interests:

The authors declare no competing interests

Additional information is available at the end of the article.

Tuberculosis and about 1.8 million deaths were reported worldwide (1.) Moreover, globally more than half million people exposed to MDR-TB and about one quarter of a million will die if not (2)

Data reports from different surveys and surveillance have suggested the global MDR-TB incidence exceeds half a million new cases occurring every year (3) . The incidence of MDR-TB in children has never been quantified worldwide because the bacteriological confirmation of MDR-TB is more difficult to in children than in adults. While estimated MDR-TB incidence in children might help to know the magnitude and assign resources to control the disease(4).Children make one quarter of the word population, and 40% of children belongs to low-income countries(5). MDR-TB is under-diagnosed among different age groups due to the resources and costs required for diagnosis and limitation of testing facilities in many countries (6). Under-diagnosis and improper treatments leads to increased incidence of paediatric drug resistant TB (4), Due to lack of inter-sectoral coordination both at national and international level the investigators are unable to estimate the population of children developing active TB annually due to drug resistance.

MDR-TB affects a person of any age, and one of the most vulnerable group is children under 15 years of age. Through research investigations, it has been reported that risks of MDR-TB in children and adults are approximately similar in many geographical settings, which later on sustained by advance studies that aimed to quantify the global incidence of MDR-TB in children(7).

About 60% of the total TB incidence occur in India, Indonesia, china, Pakistan, Nigeria and South Africa. Pakistan is homeland of 207.774 million peoples, making it a 5th populous country in the world (8). Tuberculosis in Pakistan is a major public health problem. Pakistan rank 4th in 22 high Multi-drug resistant Tuberculosis burden countries in the world (9), in 2010-11 a nationwide population based survey, including all types and ages estimated TB prevalence of 341 per 100,000 populations of Pakistan. It is stated that 41% of the Pakistani population are under 15 years age and it is estimated that 10-15% of TB(10) cases and 8-20% TB deaths occur in the childhood age below 15 years. Childhood TB is considered as one of the major communicable disease causing high morbidity and mortality among children in Pakistan (11).

WHO, 2017 estimated 11% primary and 41% secondary cases of drug resistant tuberculosis in Pakistan which constitute 15000 MDR-TB cases. During the reporting year, National TB control program Pakistan notified five hundred and eighty nine (589) children under 15 years of age also found to have MDR-TB in Pakistan.

Estimated Population of Khyber Pakhtunkhwa (KP) Province and Federally administered tribal areas (FATA) are 30.5 and 5.0 million respectively as of 25th August 2017. In Khyber Pakhtunkhwa province at least 50,000 Tuberculosis cases have been recorded(10).

Most of the studies on MDR-TB among children under 15 years of age have been conducted in developed countries. Therefore, it is essential to reveal on these risk factors not yet studied in Pakistan. Aim of this study is to assess factors leading to the development of MDR-TB among children under 15 years of age in Khyber Pakhtunkhwa and FATA Pakistan. The study has provided with key data onto analysis from (PMDT) sites of National tuberculosis control program (NTP) Pakistan.

Objectives:

1. To find out the frequency of MDR-TB among children.
2. To determine the factors of the MDR-TB in Khyber Pakhtunkhwa and Federally Administered Tribal Areas Pakistan.

MATERIAL AND METHODS

Cross sectional quantitative study, on MDR-TB among children under 15 years of age was carried out KPK province and FATA Pakistan. Khyber Pakhtunkhwa runs along the border with Afghanistan. Peshawar is the Capital, bounded by Afghanistan to the west and north, Punjab Province to the southeast, and Baluchistan Province to the southwest.

The total duration of this study was six months from March -August 2018. All MDR - TB patients up to December 2017 under 15 years of age from four (4) PMDT sites of National Tuberculosis Control Program Pakistan (NTP) in Khyber Pakhtunkhwa were included in this research study. The 100% subjects were included; which is the selection of all available study participants who fulfil the selection criteria. A total ninety-four (94) patients have MDR-TB were selected from four PMDT sites of the national tuberculosis control program Pakistan. To get have an adequate sample for this research study six (6) MDR-TB patients under 15 years were include from Rawalpindi district Pakistan. The final total sample consist of 100 MDR-TB Patients under 15 years of age in country Pakistan. All primary and secondary MDR-TB cases under 15 years of age, both male and female genders were included in the study from Khyber Pakhtunkhwa and FATA Pakistan, along with Afghani nationals who are resident currently in Pakistan. MDR-TB patients not registered at PMDT site were excluded in the study. Patients having more than 15 years of age, patients with one episode of previous treatment and smear negative were not included in the study.

About 10% of the patient selected randomly were re-interviewed using the DR-TB registration form of the TB control program Pakistan to validate the accuracy of the data collection.

National tuberculosis control program Pakistan use WHO recommended DR-registration form for MDR-TB patients. DR-registration form is a comprehensive form having all the information on patient's personal information, physical examination, history of previous treatments, other medical conditions, medical and social history , HIV status, close contact screening history, Laboratory tests, DST susceptibility testing administration of drugs and treatment outcome. All the relevant data related this research was extracted from DR-registration form.

Codebook of this research study was developed first and then data was entered using the IBM SPSS statistics version 20.0. After cleaning the data for any consistency and duplicate entries. Data was validated for the missing values and numbers. MDR-TB was the key outcome of interest and primary MDR-TB cases which are new cases of MDR-TB (getting directly infection), and secondary MDR-TB cases which are the patients got treatment previously for TB which are Previously treated relapse, previously treated default, previously treated failure, other previously treated(private sector) and unknown previous history are the main risk factors for MDR-TB.

A descriptive analysis of the characteristics of the study population was performed. The association between the characteristics of study population with MDR-TB was explored by calculating the odd ratios for categories of variables and testing them for statistical significance of the deviation of odd ratios by applying Chi-square test. Mantel-Haenszel estimates of association between the previous treatments and MDR-TB were calculated adjusted by all possible factors (including age, sex, geographical location, education and the country of birth) and possible interaction and effect modification were assessed. The association between independent variable and MDR-TB was assessed using binary logistic regression, p-Value less than 0.05 was considered significant.

The study was conducted in Khyber Pakhtunkhwa and FATA Pakistan following all the ethical codes of conduct. Approval was obtained from Al-Shifa School of Public Health, Al-Shifa trust eye hospital Rawalpindi and national tuberculosis control program Pakistan. Ethical issues highlighted by the Institution review board (IRB) were strictly observed during the research process. There were no personal biases relative to the study that could risk the scientific objectivity of the research; or any conflict of interest relevant to research on MDR-TB. It was assured to both the National Tuberculosis control program Pakistan (NTP) and PMDT Site that the shared data of the patients will be not spread to any other organization or person. The data will be kept in separate folder and discarded after research completion and dissertation.

RESULTS

Sociodemographic characteristics include age, gender, nationality, geographical location, education status and PMDT site of the National Tuberculosis control program Pakistan. There were 20% Male and 80% Female in the study sample having MDR-TB. Out of the total 3% of the children were having age 0-5 years and 97% of the study population were of 6-14 years of age. There were 94% Pakistani and 6% Afghani nationals living in Pakistan. A total 34% MDR-TB patients going to school and 66% study participants not going to school as shown, below.

Table-1: Descriptive characteristics of Study population

S	Variables		Frequency %
1	Gender	Male	20 %
		Female	80 %
2	Age	0-5 Years	40 %
		6-14 Years	60 %
3	Education	Attending school	14 %
		Not attending school	68 %
4	Nationality	Pakistan	94 %
		Afghani	6 %
5	Location	KPK	89 %
		FATA	11 %

PMDT site of NTP: During this research study, it was found out that Lady reading hospital (LRH) Peshawar had provided MDR-TB treatment to 87% of the study population. The LRH is at the top of the list PMDT site in Khyber Pakhtunkhwa. Next to LRH is Ayub medical teaching hospital (ATH) which provide treatment to 7% of the patients, about 5% of the patients were treated for MDR-TB at Swat Teaching Hospital (STH) and only 1% of the patients get treatment at Mufti mehmood memorial teaching Hospital (MMMHD) D.I Khan. For detailed information, see Figure-1.

The geographical distribution of the MDR-TB patients show 89% of the study population belongs to Khyber Pakhtunkhwa and only 11% of the patients were from Federally administered tribal area (FATA) Pakistan. There were 8% of the study, having other diseases along with MDR-TB. About 40% of the study participants completed their treatment on MDR-TB, while 43% of the total patients cured from MDR-TB, 27% of MDR TB patients were still on treatment during the study period and 14% of the Patient died due to MDR-TB. For more detail, see Figure-2.

Factors Associated with MDR-TB:

Chi-Square of Independence Test:

Chi square of was carried out between the independent variables; new, previously treated (relapse), previously treated (default), previously treated (failure), other previously treated (private sector), Previous history unknown and outcome variable; MDR-TB.

Independent variables in the study including New cases, previously treated (relapse), previously treated (default) and previous history unknown shows no significant association with MDR-TB. While children having previously history for TB treatment failure were found having four (4) times (95% CI 1.454-11.483, OR 4.08) more likely probable in developing MDR-TB. While 84% of other previously treated patient (private sector) are not likely to developed MDR-TB (95% CI, 0.034-0.729, OR 0.158) than other types of previously treated cases. Which shows that the private sector provide more protection to the patients to get MDR-TB as compared to other previously treated cases. For more detail, see Table No 2.

Table-2. Chi-Square of independence among independent variables and MDR-TB

Independent variables	Chi-Square value	Odd Ratio (95% CI)	P-Value
New	2.273	-	0.256
Previously treated(Relapse)	0.773	-	0.883
Previously treated(Default)	0.510	-	1
Previously treated(Failure) ⁱ	7.736	4.086 (1.45-11.48)	0.012
Other previously treated(private sector) ⁱⁱ	6.868	0.158 (0.03-0.72)	0.018
Previous history unknown	1.042	-	0.702

ⁱ Significant association

ⁱⁱ Significant association

BINARY LOGISTIC REGRESSION ANALYSIS:

Direct logistic regression was carried out to measure the impact of independent variables on the likelihood of patients with MDR-TB. The model contains two (2) independent variables which were; previously treated (failure), previously treated (private sector).

The full model containing the predictor was statistically significant χ^2 (2, N=100) = 24.560, p-value

less than 0.001, indicating that the model was able to distinguish the MDR-TB patients with previously treated (failure), previously treated (private sector) and those with other previously treatments. The model as a whole explained between 23.0 % (cox and Snell R square) and 31.2% (Nagelkerke R squared) of the variance in MDR-TB patients with previously treated (failure), and correctly classified 71.3% of cases. The Strongest predictors were; previously

treated (failure) with an Odds ratio of 8.86 .This indicating that there are approximately 9 times more risk for a TB patient to get MDR-TB with previously treated (failure) on TB. While an odds ratio for previously treated (private sector) for TB is 0.366; which means that 64% of TB patients previously treated (private sector) are not likely to get MDR-TB after getting last treatment for TB from private sector. For details, see Table No. 3

Table-3: Binary logistic regression model for previously treated (failure) and previously treated (private sector):

Associated Risk Factors	Odds Ratio	d.f (95% CI)	P-Value
Previously treated(Failure) ⁱ	8.864	1 (2.722,28.857)	0.0005
Other previously treated(private sector) ⁱⁱ	0.366	1 (0.141,0.953)	0.040

DISCUSSION

The estimated population of KPK and FATA is 35.5 million(8) and 41% of this population is under 15 years of age, which accounts for 14.6 million(12). The estimated prevalence of MDR-TB children in this study sample is 6.5/100,000 children population under 15 years of age, equal to the prevalence 6.5-7.8, found in study on high tuberculosis prevalence in children exposed at home to drug resistance tuberculosis in urban Karachi Pakistan (13).

MDR-TB equally effects population of all age including children. Most of the studies were conducted on adults to find out risk factors causing MDR-TB and overlooked paediatric TB(14).

Mortality rate due to MDR-TB is 14% this study. This mortality rate is lower than 41.5% mortality(15). another study by PMDT unit lady reading hospital Peshawar Pakistan found 23.5% death rate(16) and 16% death rate found in policy brief of DR-TB patients enrolled by NTP(17). The reason for lower mortality rate is under 15 years age group in current study while other studies include all MDR-TB patients irrespective of age.

Continued treatment failure to detect and treat child cases of TB and MDR-TB will result in the unnecessary deaths of large number of children. In order to control mobility and mortality due to MDR-TB in children there should be easy accessibility, availability, affordability and effective prompt treatment should be provided by the state at all level of health facility specially at primary level(4).

There is need to develop effective preventive therapy and extensive research on child MDR-TB Yuen et al. recently published estimates of how many children might be targeted for preventive therapy(18). There is need to identify risk factor causing secondary MDR-TB cases in children even at household level.

Understanding MDR-TB risk factors are very critical in epidemic prevention. The increase in prevalence rate of MDR-TB among children is of great concern among public health practitioner (19). MDR-TB is associated with increased risk of death during the treatment.

One of the limitation of this study is MDR-TB treatment success was not followed by the NTP. Therefore, it cannot be estimated whether the patients completing treatment or cured progressed into treatment success. Total deaths recorded in the study were 14% maximum deaths occurred with previously treated with failure.

This research study brings in together the research concepts related to the risk factors of MDR-

TB in order to enhance the better understanding of all possible preventive and treatment strategies for MDR-TB among children under 15 years of age in Khyber Pakhtunkhwa province and Federally Administered Tribal Areas (FATA) of Pakistan.

The results of this study can add in the already existing pool of knowledge regarding MDR-TB among children under 15 years and can serve as a benchmark for further studies at national level. This study to the best of our knowledge is the first study of its own kind, which has a comparison of patient cured, treatment completed and mortality among MDR-TB patients due to different associated risk factors among children under 15 years in Khyber-Pakhtunkhwa, and FATA Pakistan.

There should be an urgent need to increase people awareness regarding the treatment of MDR-TB. Strong commitment and collaboration among health service providers, continuing and coordinated care of patients with TB treatment guidelines are key to success in the battle against MDR-TB.

MDR-TB is a major public health problem in Pakistan. Khyber Pakhtunkhwa is high-risk area regarding the DR-TB in Pakistan. Keeping in view the current alarming situation of MDR-TB in Pakistan and especially in KPK and FATA, the following recommendations will improve the battle against MDR-TB in the country; there is an urgent need for health promotion both at professional and community level. Strong commitment and collaboration among health service providers. More involvement of private sector through public private partnership to combat MDR-TB.

CONCLUSION

The burden of MDR-TB among children in Khyber Pakhtunkhwa and FATA appears to be high and not stable over the time. Laboratory confirmation of MDR-TB in children remains a challenge in Pakistan and leads to an underestimation of the real burden of MDR-TB among children. Children with previously treated for TB with failure need to be given higher attention regarding MDR-TB in children. Early detection, diagnosis and treatment of patients with TB should be a priority in the control of MDR-TB in children. There should be an urgent need to increase people awareness regarding the treatment of MDR-TB. Strong commitment and collaboration among health service providers, continuing and coordinated care of patients with TB treatment guidelines are key to success in the battle against MDR-TB.

REFERENCES

1. Knight GM, McQuaid CF, Dodd PJ, Houben RMGJ. Global burden of latent multidrug-resistant tuberculosis: trends and estimates based on mathematical modelling [published correction appears in *Lancet Infect Dis*. 2020 Apr;20(4):e50]. *Lancet Infect Dis*. 2019;19(8):903-912. doi:10.1016/S1473-3099(19)30307-X
2. Ahmad AM, Akhtar S, Hussain SF, Rizvi N. Risk factors for multidrug-resistant tuberculosis in urban Pakistan : A multicenter case – control study. *Int J Mycobacteriology* [Internet]. 2012;1(3):137–42. Available from: <http://dx.doi.org/10.1016/j.ijmyco.2012.07.007>
3. Nahid, Payam et al. "Treatment of Drug-Resistant Tuberculosis. An Official ATS/CDC/ERS/IDSA Clinical Practice Guideline." *American journal of respiratory and critical care medicine* vol. 200,10 (2019): e93-e142. doi:10.1164/rccm.201909-1874ST.
4. Ahmad, N., Ahuja, S. D., Akkerman, O. W., Alfenaar, J. C., Anderson, L. F., Baghaei, P., Bang, D., Barry, P. M., Bastos, M. L., Behera, D., Benedetti, A., Bisson, G. P., Boeree, M. J., Bonnet, M., Brode, S. K., Brust, J., Cai, Y., Caumes, E., Cegielski, J. P., ... Menzies, D. (2018). Treatment correlates of successful outcomes in pulmonary multidrug-resistant tuberculosis: an individual patient data meta-analysis. *Lancet* (London, England), 392(10150), 821–834. <https://doi.org/10.1016/S0140->

- 6736(18)31644-1
5. Brust JCM, Shah NS, Mlisana K, et al. Improved Survival and Cure Rates With Concurrent Treatment for Multidrug-Resistant Tuberculosis-Human Immunodeficiency Virus Coinfection in South Africa. *Clin Infect Dis*. 2018;66(8):1246-1253. doi:10.1093/cid/cix1125
6. Zetola NM, Modongo C, Moonan PK, et al. Clinical outcomes among persons with pulmonary tuberculosis caused by *Mycobacterium tuberculosis* isolates with phenotypic heterogeneity in results of drug-susceptibility tests. *J Infect Dis*. 2014;209(11):1754-1763. doi:10.1093/infdis/jiu040
7. Zumla A, George A, Sharma V, Hon R, Herbert N, Oxley A, et al. The WHO 2014 Global tuberculosis report — further to go. *Lancet Glob Heal* [Internet]. 2015;3(1):e10–2. Available from: [http://dx.doi.org/10.1016/S2214-109X\(14\)70361-4](http://dx.doi.org/10.1016/S2214-109X(14)70361-4)
8. Yang C, Luo T, Shen X, et al. Transmission of multidrug-resistant *Mycobacterium tuberculosis* in Shanghai, China: a retrospective observational study using whole-genome sequencing and epidemiological investigation. *Lancet Infect Dis*. 2017;17(3):275-284. doi:10.1016/S1473-3099(16)30418-2
9. Moonan PK, Teeter LD, Salcedo K, et al. Transmission of multidrug-resistant tuberculosis in the USA: a cross-sectional study. *Lancet Infect Dis*. 2013;13(9):777-784. doi:10.1016/S1473-3099(13)70128-2
10. Khan PY, Yates TA, Osman M, et al. Transmission of drug-resistant tuberculosis in HIV-endemic settings [published correction appears in *Lancet Infect Dis*. 2019 Mar 6;:]. *Lancet Infect Dis*. 2019;19(3):e77-e88. doi:10.1016/S1473-3099(18)30537-1
11. Huang H, Ding N, Yang T, et al. Cross-sectional Whole-genome Sequencing and Epidemiological Study of Multidrug-resistant *Mycobacterium tuberculosis* in China. *Clin Infect Dis*. 2019;69(3):405-413. doi:10.1093/cid/ciy883
12. Mahsud-dornan S. Pakistan , Population Programmes and Progress. 2007;76(May):122–3.
13. Amanullah F, Ashfaq M, Khowaja S, Parekh A, Salahuddin N, Lotia-Farrukh I, et al. High tuberculosis prevalence in children exposed at home to drug-resistant tuberculosis. *Int J Tuberc Lung Dis*. 2014;18(5).
14. Suryavanshi, Nishi et al. "Willingness to Take Multidrug-resistant Tuberculosis (MDR-TB) Preventive Therapy Among Adult and Adolescent Household Contacts of MDR-TB Index Cases: An International Multisite Cross-sectional Study." *Clinical infectious diseases : an official publication of the Infectious Diseases Society of America* vol. 70,3 (2020): 436-445. doi:10.1093/cid/ciz254
15. Van Cutsem G, Isaakidis P, Farley J, Nardell E, Volchenkov G, Cox H. Infection Control for Drug-Resistant Tuberculosis: Early Diagnosis and Treatment Is the Key. *Clin Infect Dis*. 2016;62 Suppl 3(Suppl 3):S238-S243. doi:10.1093/cid/ciw012
16. Naveed A, Latif A, Ullah U, Ullah Z, Iqbal Z, Khan MY, et al. Management of Drug Resistant Tuberculosis in a teaching hospital before and after implementation of Programmatic Management of Drug Resistant Tuberculosis. 2018;24(1):10–6.
17. Nazir T, Abraham S, Islam A. Emergence of potential superbug mycobacterium tuberculosis, lessons from new delhi mutant-1 bacterial strains. *Int J Health Sci (Qassim)*. 2012;6(1):87-94. doi:10.12816/0005977
18. Nazir T, Nida T, Hameed A, Islam A (2015) Drug Resistant Pattern of *M. tuberculosis* - An Emerging Threat for Public Health. *Prensa Med Argent* 2015, 101:6.
19. Zignol M, Sismanidis C, Falzon D, Glaziou P, Dara M, Floyd K. Multidrug-resistant tuberculosis in children: Evidence from global surveillance. *Eur Respir J*. 2013;42(3):701–7.



© 2019 The Author(s). This open access article is distributed under a Creative Commons Attribution (CC-BY) 4.0 license.

You are free to:

Share — copy and redistribute the material in any medium or format. Adapt — remix, transform, and build upon the material for any purpose, even commercially. The licensor cannot revoke these freedoms as long as you follow the license terms. Under the following terms: Attribution — You must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use. No additional restrictions. You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits