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Three decades history of tuberculosis control in Kerbala/Iraq

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Abstract

Objective To assess tuberculosis control between 1988 and 2017 and evaluate the outcomes of treatment among the October patients put on DOTS in Karbala governorate since the initiation of DOTS strategy in 2000.

Methods Data on tuberculosis incidence between 1988 and 2017 were assessed. In addition, all quarterly reports were collected in addition to the annual reports to estimate the outcome indices of DOTS in the governorate. Evaluation indices included the incidence and death rates; case detection rate for smear positive and total tuberculosis patients; cure rate; treatment success rate; default rates; treatment failure rates; drug resistance rates; contact tracing during the study period between 2005 and 2014. These indices were compared to the available national indices in the whole country. The indices of treatment success and failure rates were compared to the available previous reported rates in the governorate and in Iraq. Analysis used SPSS-20 and Excel data sheet. Discussion with experts working for decades in TB control programs revealed some defect in determining these indices.

Results Between 1988 and 2017, there was a total of 8665 TB patients, while between 2005 and 2017, the total was 4055: 2592 pulmonary TB patients (62%) and 1541 extra-pulmonary tuberculosis patients (38%). Gender distribution showed male predilection (60.3%) and a mean age of patients was 41.88±19.74 year and one half of the patients were above 44 year of age, but the most frequent age group was 25–34 years.

Positive smear case detection rates were below the WHO planned goals ranging from 11.5% to 29.1%. The total reported deaths during the study period were 78 deaths. Defaulters were 97 patients at a rate of 2.39, while treatment failure cases amounted to 33 patients (a rate of 0.81%). Drug sensitivity test was introduced to country in 2010 and was done only in Baghdad till the introduction of Genexpert MTB/RIF test in January 2014 and a total of 72 patients were MDR cases. Case detection rate among contacts was 0.31%.

Conclusions The success in DOTS in Karbala is similar to the results in the whole country and in most developing countries and approaching the WHO set goals, while the case detection rates were behind. However, some defect areas need further support to prevent failure and aid continuous tuberculosis control and stop TB.

Keywords Tuberculosis; Directly observed therapy; Health evaluation; Program evaluation

Introduction

Tuberculosis (TB) is one of the most ancient diseases of mankind, as molecular evidence go back to over 17,000 years, or perhaps for several million years in Egyptian mummies.[1] According to World Health Organization (WHO), TB is a worldwide pandemic and is considered as the main infectious killing diseases worldwide and is just second to HIV in incidence. TB incidence has fallen by an average of 1.5% per year since 2000 and is now 18% lower than the level of 2000.[2]

WHO with its "STOP TB" strategy has given a vision to eliminate TB as a public health problem from the world by 2050.[3] In addition the Sustainable Development Goals (SDGs) for 2030 adopted by the United Nations in 2015, put one of the targets 'to end the global TB epidemic'.[2] The WHO End TB Strategy, which was approved by the World Health Assembly in 2014, calls for a 90% reduction in TB deaths and an 80% reduction in the TB incidence rate by 2030 compared with 2015.[2]

One of the SDGs for 2030 adopted in 2015 was to end the global TB epidemic.[2] In 2015, there were an estimated 10.4 million new (incident) TB cases worldwide, however globally, there was a 4.3 million gap between incident and notified case.[2] The rate of decline in TB incidence remained at only 1.5% from 2014 to 2015. This rate is below the goal of 4–5% annual decline by 2020 to reach the first milestones of the End TB Strategy.[2]

For mortality, there were an estimated 1.4 million TB deaths in 2015, and an additional 0.4 million deaths resulting from TB disease among people living with HIV. Over 95% of TB deaths occur in low- and middle-income countries.[4] This number of TB deaths fell by 22% between 2000 and 2015, however, TB remained one of the top 10 causes of death worldwide in 2015.[2] Many of these live in the world's poorest, most vulnerable communities or are among marginalized populations such as migrant workers, refugees and internally displaced persons, prisoners, indigenous peoples, ethnic minorities and drug users. The social impact of TB is great, as it renders these poor patients debilitated, emaciated and unable to work and is associated with loss of appetite leading to under-nutrition, which will further aggravate symptoms and leads to a vicious circle ending in suffering and death. Here, it is important to consider that most patients are in the main productive age groups and mostly males who represent the single 'money earner' especially in poor societies.

Two main problems are faced in TB control, the infectivity in spite of mild symptoms and compliance with a long troublesome therapy. A patient with TB can infect up to 15 other people through close contact over the course of a year.[3] For this, Case Detection Rate (CDR) is a key element in TB control and is a major deficit in most national control problem in developing countries.[5-7] New molecular techniques were added to improve CDR which depended on direct sputum slide examination and culture such as GeneXpert MTB/RIF which was introduced in Kerbala on January 26, 2014 and these tests have increased CDR.[8-11]

When TB is detected, the patient needs a 6-month treatment that involves taking several pills two to three times a week

and can be associated side-effects. For this reason, it difficult to ensure compliance, especially since the symptoms of the disease often disappears after the first few weeks. Additional superimposed fundamental problem results from incomplete treatment, multiple drug resistant forms of TB.[7]

The WHO declared TB as a global emergency in 1993, and Directly Observed Treatment, Short-course (DOTS) was the internationally accepted strategy to combat TB epidemic was started since early 1990s and was approved by the WHO and has been adopted in most countries around the world with great proved positive impact on disease control.[7, 12-20]

Many previous studies tried to evaluate the efficiency of DOTS in a retrospective comparative study between DOTS and Self-Administered Treatment in Southern India analyzed 150 case record files of patients with pulmonary TB. The treatment outcome in DOTS group was cured 70.7%, treatment completed 1.3%, failure 5.3%, deaths 10.7%, defaulters 8%, and transferred out 4%, whereas in Self-Administered Treatment group, cure was seen in 68% and 4% completed the treatment, 1.3% had treatment failure, and 26.7% were lost to follow-up which included deaths, defaulters, and those patients who switched over to other hospitals. However, the treatment success rate was similar (72%) in both groups.[21] Another study in Northeastern Nigeria in a health facility collected the quarterly reports between 2003 and 2012 and reported a total of 31, 198 new TB cases of all types during the period. Two-fifths (12,466) of these were smear positive pulmonary TB and 10,537 (33.8 %) and 8195 (26.2 %) for smear negative pulmonary TB and extra-pulmonary TB cases, respectively. An average CDR (CDR) of 19.1% and treatment success rate (TSR) of 85.5 % for smear positive pulmonary TB were reported for the specified years period.[13]

A prospective study followed 302 TB patients in Aligarh District, Uttar Pradesh/India in 2012/2013 and found that males formed 72.2% of the sample and were mostly in the age group of 15–30 years. More than one-half (53%) resided in urban areas; 63.6% were literate; and 45% had a high standard of living index (SLI). Treatment outcome was significantly associated with age group, literacy status, and SLI ($p < 0.05$). On logistic regression, the 31–45-years age group, literacy, and high SLI were found to be significantly associated with good outcome.[14]

However, great debate was raised around its efficiency since the beginning and continued all through these decades.[22, 23]

The WHO Eastern Mediterranean Region (EMRO) accounted for only 7% of the estimated global TB cases in 2016, while most cases occurred in East Asia Region (45%) and the WHO African Region (25%). The annual incident TB cases relative to population size (the incidence rate) varied widely among countries in 2016, from under 10 per 100 000 population in most high-income countries to 150–300 in most of the 30 high TB burden countries.[4]

High fertility in Iraq remains a continuous phenomenon with a total fertility rate of 4.3, where population almost tripled between 1970 (10 million) and 2010 and estimates that by 2030, it will have quadrupled to almost 50 million.[24] The country is still recovering from long period of wars, sanction, conflict and political turmoil that affect all the infrastructure foundations in the country. Historically speaking, TB remained as a major killer in Iraq in the previous century and with moderate to high burden of TB.[7] The main infectious killers in Iraq were TB, vibrio, malaria and birharziasis. The WHO estimated rate is decreasing from 167 to 43 per 10 000 population between 2002 and 2015.[7, 24, 25] The annual incidence of TB showed an increase from 90.8 per 100.000 in 1980 to 125.6 per 100.000 in the 1990s,[26] as a result of the economic sanction imposed on the country after Kuwait invasion. In 2011, 9248 cases of tuberculosis were reported, with a notification rate of 28 cases per 100,000 population. As a result of deteriorating socioeconomic conditions during the past decade, the incidence of tuberculosis has been on the rise.[24]

The implementation of DOTS in Iraq was started in October 2000 as pilot project in Al Sader District in Baghdad and then in 2004, it was expanded to include all the governorates.[7]

However, great difficulties and obstacles faced the program implementation.[7, 25] Many previous studies tried to evaluate the efficiency of DOTS in a retrospective comparative study in Southern India analyzed 150 case record files of patients with pulmonary TB. The treatment outcome in DOTS group was cured 70.7%, treatment completed 1.3%, failure 5.3%, deaths 10.7%, defaulters 8% and transferred out 4%, whereas in Self-Administered Treatment group, cure was seen in 68% and 4% completed the treatment, 1.3% had treatment failure, and 26.7% were lost to follow-up, which included deaths, defaulters and those patients who switched over to other hospitals. The treatment success rate was similar (72%) in both groups.[21]

Iraq, few studies investigated DOTS efficiency, but most of these studies lack the sound Tuberculosis DOTS was implemented in Al-Sader District in Baghdad. Treatment success rate of pulmonary TB was 82%, treatment failure 4.4%, defaulter rate 6% and death rate 1.2%. Sputum conversion rate after 2 months of treatment was 89.3%.[27] Later on, many published studies tried to evaluate DOTS program in Iraq,[7,24,25] and in different Iraqi governorates: Al-Sader district in Baghdad,[6] Najaf,[28,29] Babylon,[30] Dywania,[31] Misan,[32] Basrah,[33] Salah-Eldeen,[34] Baqoba,[35] and Anbar.[36] Most studies reported failure to reach WHO set target for case detection, while cure success and conversion of smear positive cases were high. Many previous studies reported high success of DOTs strategy in Kerbala,[37-39] in spite of the main obstacles facing the application.[40]

A Country Cooperation Strategy (CCS) plan was signed with the WHO and it included in its sixth strategic goal an objective of 'Accelerating implementation of the Stop TB Strategy through expanding and enhancing implantation of the DOTS strategy, strengthening capacity of the national tuberculosis program and other partners, improving surveillance and supporting operational and epidemiological research.'[24]

Material and methods

The study was descriptive and this entailed retrospective study of case files and record of positive TB cases at the respiratory diseases consultation clinic, Tuberculosis Control Centre, and Districts Health Sectors in Kerbala of the patients were not adopted for the study.

Results

In addition records at the Public Health Directorate in the governorate, Iraqi National TB control reports and annual reports

of the Iraqi Ministry of Health were investigated to determine relevant information to calculate the important indices of DOTS strategy between 2005 and 2017.

Evaluation indices included the CDRs, Sputum Conversion Rates, Cure Rate, Treatment Success Rate, Default Rates, and Contact tracing during the study period between 2005 and 2017. The indices of treatment success and failure rates were compared to the available previous reported rates in the city and in Iraq. These indices were compared to the available national indices in the whole country. Additionally, all quarterly reports were collected in addition to the annual reports to estimate the outcome indices of DOTS in the governorate. SPSS-20 was used in the analysis. In addition, discussion with experts working for decades in TB control programs in the governorate was conducted to point the main obstacles for application of the National TB control program in Kerbala governorate. The ethical approval to examine patients' case files was given by Kerbala Directorate of health and the ethical committee in Kerbala Medical College. The names revision of total TB cases in Kerbala governorate by type for the last 30 years between 1988 and 2017 showed a total of 8665 patients with Smear positive pulmonary TB forming 36.7%, and Smear negative pulmonary TB forming 29.0%, while extra-pulmonary TB forming 34.0%. The annual incidence of total TB cases was 288.8 case per year including: 105.9 case of smear positive pulmonary TB was 83.7 case of smear negative pulmonary TB and 99.2 case extra-pulmonary TB. The median endemic index increased from 69 patients in the first 5 years to 104, 99,148 and 124 in following periods but decreased to 81 in the last 5 years (Table 1, Fig 1).

The detailed information was available for the period between 2005 and 2017, where a total of 2592 pulmonary TB patients (62%) and 1541 extra-pulmonary tuberculosis patients (38%) were reported making a total of 4055 patients (Table 2). Gender distribution showed male predilection (60.3%) with a male to female ratio of 1.52:1.

The data obtained for age distribution were for the period between 2009 and 2017 where ENRS program was run. The mean age of patients was 41.88±19.74 year and the most frequent age group was 25–34 years and about one-half (45.8%) of the patients were above 44 year of age (Fig 2). On comparing the proportion of age groups distribution of Sputum Smear Positive tuberculosis patients in Kerbala governorate with available national distribution (between 2000 and 2009) showed almost similar distribution except the lower proportion those between 5 and 14 years of age (Figs 2, 3).

The method of determining cure or complete treatment in the DOTS quarterly reports according to the Iraqi National Tuberculosis Program (NTP) depended on negative sputum smear on the three main stations of patient examination or on the final station (Table 2).

The indices for DOTS evaluation showed that a total of 4055 patients were diagnosed with TB in the 13-year study period with a total CDR of 61.5% and the annual cases ranged between 250 and 422 patients.

Positive smear Case Detection rates were below the WHO planned goals ranging from 11.5% in 2017 and 29.1% in 2007, with a total rate of 22.2%. Similarly, the total TB Case Detection rates were below the goals and ranged between 50.0% in 2017 and 75.4% in 2005, with a total rate of 65.7% (Table 3).

The total reported deaths during the study period were 78 deaths which form 0.02% of the total TB cases or an annual rate of 6 deaths per year. There was 119 recurrent TB and these formed 7.72% of the total pulmonary TB. CDR ranged between 48% and 77% with a total of 59.3% (Table 3). Those who interrupted their treatment were 97 patients at a rate of 2.39 of total TB patients, while treatment failure cases amounted to 33 patients (a rate of 0.81%). Drug sensitivity test was introduced to country in 2010 and was done only in Baghdad till the introduction of Genexpert MTB/RIF test in 2014, and results mentioned prior to this date were for tests performed outside the country with a total of 72 patients who were sent to Baghdad to receive the second-line treatment for MDR mycobacteria. Case Detection rate among contacts was 0.31% (60 positive cases among 19322 contacts, Tables 3, 5).

On calculating the Smear Positive CDR per 100,000 population the rates ranged between 5.0 and 19.8 per 100,000 population while the rates for Smear Positive and new cases CDR were slightly higher (Table 4).

Geographical distribution of the incidence rate total TB cases showed great significant differences between the different districts in the governorate ranging between 7.12 per 10,000 population in Hussainia district and 42.2 in Kerbala centre districts (Table 6, Fig 4).

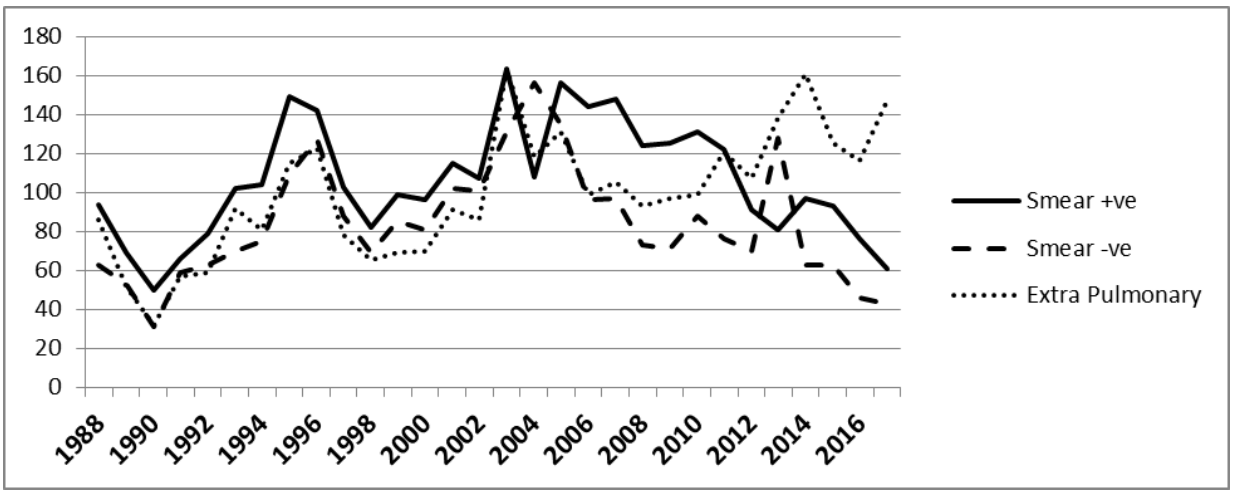

Fig. 1 **The distribution of total tuberculosis patients by type in Kerbala governorate between 1988 and 2017 (n=8665).**

Table 1. **The distribution of total tuberculosis patients by type in Kerbala governorate between 1988 and 2017 (n=8665).**

Year	Smear positive	Smear negative	Extra Pulmonary	Total	Median Endemic Index
1988	94	63	86	243	
1989	69	53	52	174	69
1990	50	31	32	113	
1991	66	59	57	182	
1992	79	63	59	201	
1993	102	70	92	264	
1994	104	75	81	260	104
1995	149	109	115	373	
1996	142	127	123	392	
1997	103	88	78	269	
1998	82	69	65	216	
1999	99	85	69	253	99
2000	96	81	70	247	
2001	115	102	91	308	
2002	107	101	86	294	
2003	163	131	163	457	
2004	108	156	118	382	148
2005	156	135	131	422	
2006	144	96	99	339	
2007	148	97	105	350	
2008	124	73	93	290	
2009	125	71	97	293	124
2010	131	88	99	318	
2011	122	76	121	319	
2012	91	70	107	268	
2013	81	128	138	347	
2014	97	63	161	321	81
2015	93	63	125	281	
2016	76	46	116	238	
2017	61	43	147	251	
Total	3177 (36.66%)	2512 (28.99%)	2976 (34.35%)	8665	

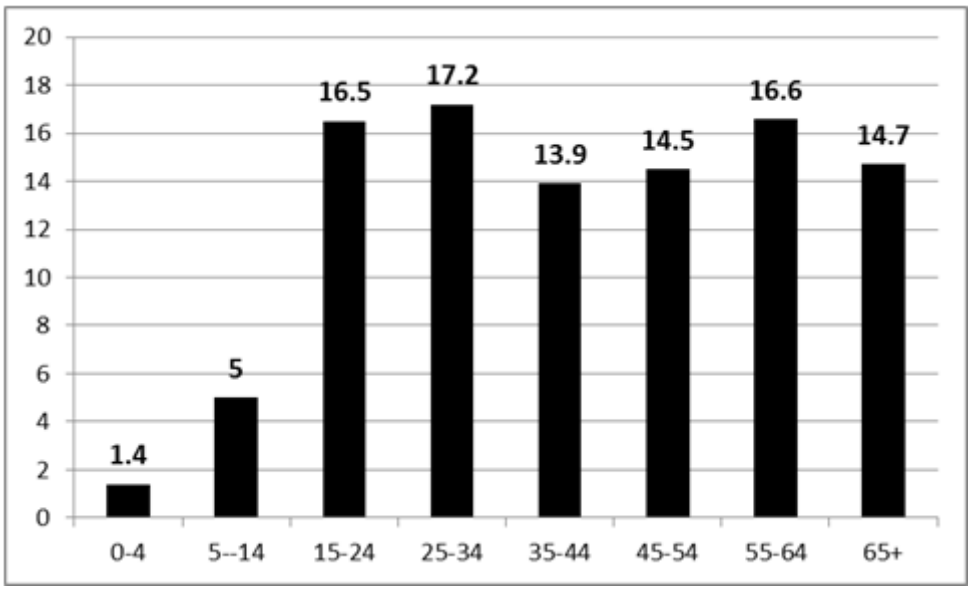

Fig. 2 **The age distribution of total tuberculosis patients by in Kerbala governorate between 2009 and 2017 (n=2456).**

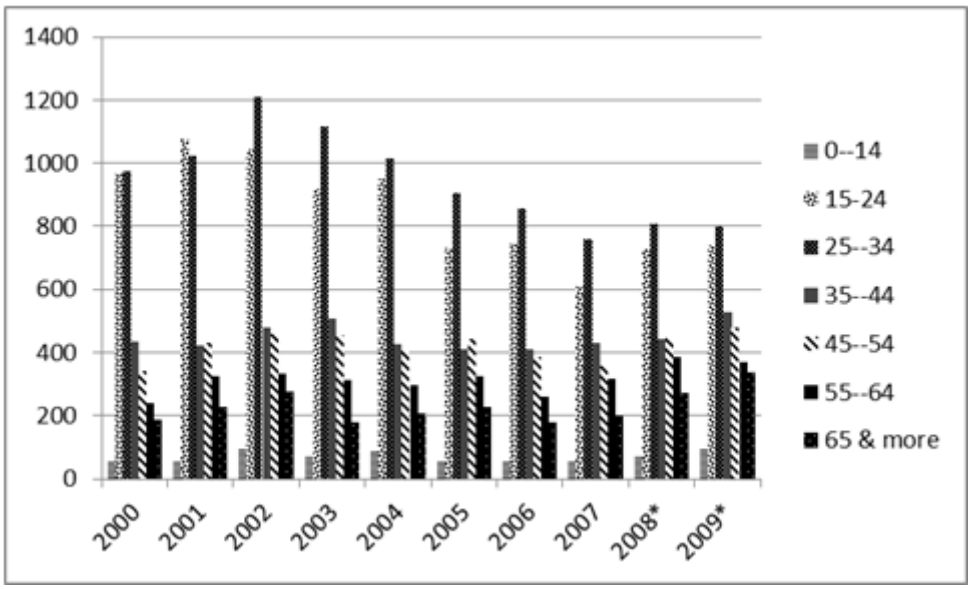

Fig. 3 **The age distribution by type of tuberculosis patients by in Kerbala governorate between 2009 and 2017 (n=2456).**

Table 2. **Determining cure rate complete treatment of TB cases in DOTS strategy according to the Iraqi National Tuberculosis Program.**

Result at 0 test	Result at 2m test	Result at 4m test	Result at 6m test	Decision
Positive	Negative	Negative	Negative	Cure
Positive	Negative	Not done	Negative	Cure
Positive	Not done	Not done	Negative	Complete*
Positive	Not done	Not done	Not done	Complete*
Negative	Negative	Negative	Negative	Complete*
Negative	Not done	Not done	Not done	Complete*

*Chest radiograph and clinical improvement.

Table 3. **The indices for DOTS evaluation among tuberculosis patients in Kerbala governorate between 2005 and 2017 (n=4055).**

Year	Positive Sputum Smear	Negative Sputum Smear	Extra-pulmonary TB	Total TB cases	Pulmonary TB Incidence per 100 000	Recurrent TB cases	Estimated TB cases	Post. Smear Case Detection Rate	Total cases Case Detection Rate (CDR)
2005	156	135	131	422	34.4	9	560	27.9	75.4
2006	144	96	99	339	27.4	6	510	28.2	66.5
2007	148	97	105	350	27.0	15	509	29.1	68.8
2008	124	73	93	290	21.0	7	500	24.8	58.0
2009	131	71	97	299	20.8	6	500	26.2	59.8
2010	131	88	99	318	21.8	11	500	26.2	63.6
2011	122	76	121	319	19.2	3	500	24.4	63.8
2012	91	70	107	268	15.1	9	456	20.0	58.8
2013	81	128	138	347	19.0	7	495	16.4	70.1
2014	97	63	161	321	14.1	11	517	18.8	62.1
2015	93	63	125	281	13.4	11	500	18.6	56.2
2016	84	48	118	250	11.0	12	520	16.2	48.0
2017	61	43	147	251	8.4	12	529	11.5	50.0
Total	1463	1051	1541	4055	0.0281	119	6596	22.2	61.5

Table 4. **The Case Detection Rate (CDR) per 100 000 population among tuberculosis patients in Kerbala governorate between 2005 and 2017 (n=4055).**

Year	Population	New S+	CDR/100000	New & S+ /CDR
2003	720000	126	17.5	18.0
2004	750000	108	14.4	14.0
2005	787072	156	19.8	20.0
2006	852000	144	16.9	17.0
2007	887858	148	16.7	17.0
2008	924000	124	13.5	14.0
2009	961638	125	13.0	13.0
2010	960000	131	13.6	14.0
2011	1000000	122	12.2	12.0
2012	1037537	91	9.0	9.0
2013	1122400	81	7.2	7.0
2014	1151152	97	8.4	8.0
2015	1180539	93	7.9	8.0
2016	1237347	84	7.0	7.2
2017	1283122	61	5.0	5.2
Total	14854665	1691	11.5	11.8

Table 5. **The indices for DOTS evaluation among tuberculosis patients in Kerbala governorate between 2005 and 2017 (n=4055).**

Year	Total contact examined	Discovered positive cases among contacts	Deaths	Death rate	Interrupted treatment cases	Interrupted treatment rate	Treatment failure cases	Treatment failure rate	Drug resistant cases
2005	2155	9	7	1.66	21	4.98	2	0.47	1
2006	1389	6	4	1.18	21	6.19	1	0.29	1
2007	1742	6	10	2.86	21	6.00	2	0.57	1
2008	1485	4	6	2.07	5	1.72	1	0.34	1
2009	1405	7	6	2.01	6	2.01	2	0.67	2
2010	1414	3	3	0.94	11	3.46	4	1.26	2
2011	1618	4	3	0.94	6	1.88	2	0.63	2
2012	1440	3	6	2.24	4	1.49	0	0.00	2
2013	1345	5	15	4.32	2	0.58	1	0.29	2
2014	1427	4	0	0.00	0	0.00	15	4.67	2
2015	1502	3	8	2.85	0	0.00	0	0.00	1
2016	1200	3	5	2.00	0	0.00	1	0.40	3
2017	1200	3	5	1.99	0	0.00	2	0.80	3
Total	19322	60	78	1.92	97	2.39	33	0.81	72

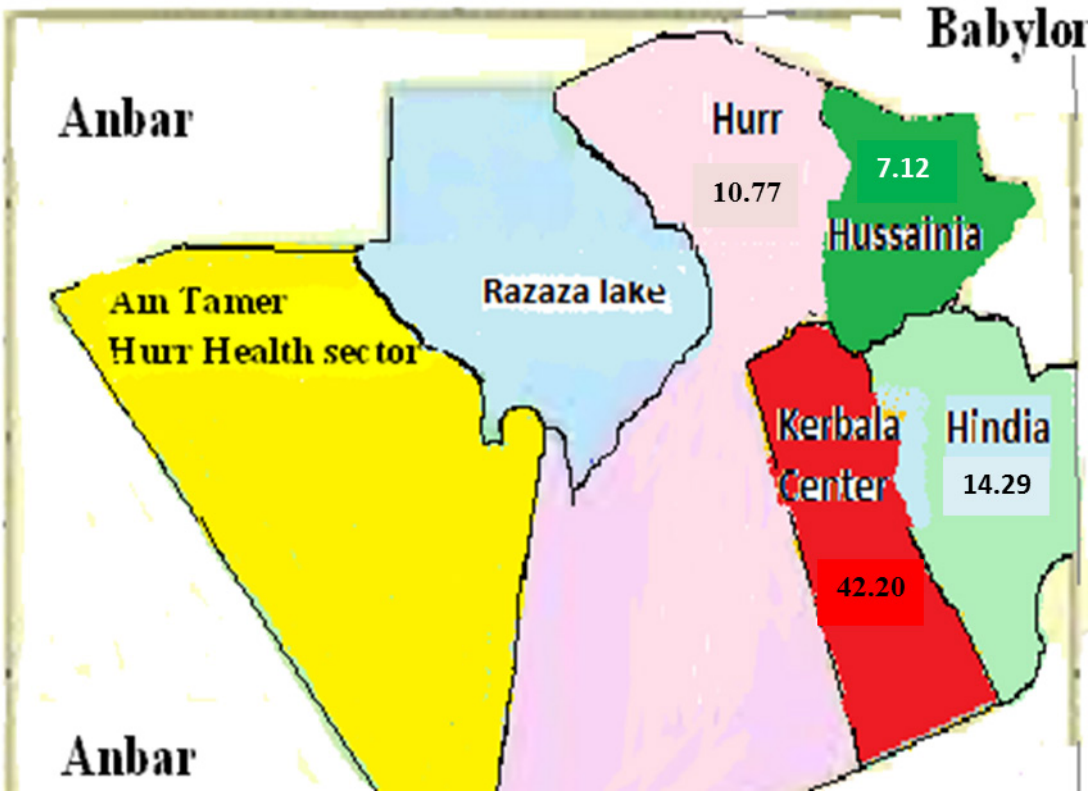

Fig. 4 **The geographical distribution of all tuberculosis patients in Kebala districts between 2005 and 2017.**

Table 6. **The distribution of tuberculosis cases among the different geographical districts in Kerbala governorate between 2005 and 2014.**

Year	Kerbala center	Kerbala center %	Hindia	Hindia %	Hussainia	Hussainia %	Hurr*	Hurr %
2005	306	72.51	77	18.25	39	9.24		
2006	255	73.91	48	13.91	42	12.17		
2007	247	67.67	84	23.01	34	9.32		
2008	231	77.78	38	12.79	28	9.43		
2009	159	52.13	65	21.31	24	7.87	57	18.69
2010	157	47.72	59	17.93	40	12.16	73	22.19
2011	157	48.76	62	19.25	33	10.25	70	21.74
2012	139	50.18	44	15.88	20	7.22	74	26.71
2013	152	42.94	70	19.77	41	11.58	91	25.71
2014	154	46.39	77	23.19	32	9.64	69	20.78
2015	159	54.5	55	34.59	26	16.35	52	32.70
2016	122	48.8	56	22.40	21	8.40	51	20.40
2017	118	45.0	63	24.0	18	7.0	64	24.02
Total	2356	56.73	798	19.22	398	9.58	601	14.47

*Hurr district was part of Kerbala centre till 2009.

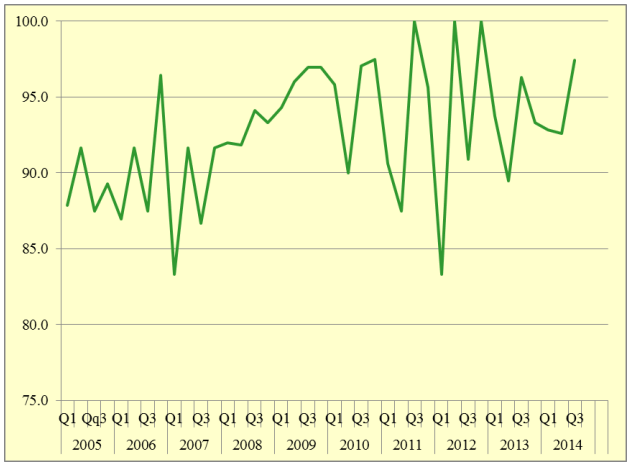

Fig. 5 **The quarterly cure rates of TB cases in Karbala from 2005 to 2015.**

The Cure Conversion rate for TB is calculated after 9 month course for each quarter of a year. High Sputum Conversion rates (83–100%) were found in all quarterly reports and these rates were consistent with the national rates (Fig 5). The results for the next 2 years were comparable and high, and the rates were all comparable to the high national rates.

Logistic regression model for data between 2009 and 2017 showed that the main significant predictors were age, gender, and type of referal. For defaulters, the 95% odds ratio was 9.9 for age group 55 year compared to young patients or above and 9.2 for females compared to males.

Discussion

The main defect appeared from this study was the low CDR which was previously reported in Iraq and most other developing countries. Similar low CDRs were reported by studies in Baghdad,[6] Najaf,[28] Salah-Eldeen/Tikirit - north of Baghdad,[34] Babylon governorate - central part in Iraq,[41] and in Missan governorate (South of Iraq).[42]

Low CDR was found in Sudan,[5] Iran,[19] Cameron,[17] India,[1, 43] and most developing countries.[4] Active educational plan needs to be started to increase awareness of public and private physicians about TB to reach the goals for CDR.[8, 32, 40] Similar rates were reported in other developing countries, such as Sudan where all rates were lagging behind WHO goals: case notification (30.8 per 100 000), case detection (10.3%), treatment success (79.6%), treatment failure (3.0%), default (8.1%), and death (8.0%).[5] A prospective study followed 302 TB patients in Aligarh District; Uttar Pradesh/India in 2012/2013 reported that treatment outcome was significantly associated with age group, literacy status, and SLI ($p < 0.05$). On logistic regression, the 31–45-years age group, literacy, and high SLI were found to be significantly associated with good outcome.[14]

On the other hand, a high cure and sputum conversion rates were reached with low MDR rates in almost all the study period of one decade and a half, and this was the good news concluded from the present study (Fig 5). Almost similar high success rates (>75%) were reported in an earlier study in Najaf governorate - central part of Iraq.[28] However, a study in Najaf in 2015 followed 52 TB patients and reported the DOTS treatment success rate 75% and the retreatment success rate was 49%.

Previously reported drug resistance TB (MDR-TB) among new cases in Iraq was 3%, and among retreatment cases it was 38%.[24] The drug resistant rate in this study was less than 2% and the reason for such low rate is probably related for including data for the period before Drug sensitivity test and Genexpert MTB/RIF test was introduced in Iraq in 2010 and 2014, respectively.[8-10] MDR is a significant problem resulting

from incomplete therapy and patient non-compliance.[7,8,28,44] A study among 42 MDR TB patients attending TB center in Baghdad in the last 3 months in 2012 found that 19% of the patients had a history of default from treatment.[11]

Other treatment outcomes: cured, completed treatment, defaulter, treatment failure, died, and transfer out of 56 patients were 69.6%, 9%, 16%, 3.6%, 0.0%, and 1.8%, respectively, whereas retreatment outcomes (cured, completed treatment, defaulter, treatment failure, died, and transfer out) were 50%, 0.0%, 50%, 0.0%, 0.0%, and 0.0%, respectively.[45]

The main age group affected was those between 15 and 44 years of age and this finding was similar to most reviewed studies in Iraq.[7,8,25,30] Productive age groups are the mostly affected age group in most mentioned Iraqi studies, however the male was lower than the global male:female (M:F) ratio for notifications of 1.7:1,[2] but was similar to most Iraqi studies which report a decreasing male to female ratio in recent years mostly due to the decreasing effect of considering TB as A social stigma.[6,25]

A very low mortality rates were found in the present study and these figures are believed to be far below the actual figures due to poor registration and loss of patients follow-up.

A separate assessment in the main governorate vital health statistics registration office revealed very few deaths were registered to be caused by TB during the study period.

The TB annual mortality rates in Iraq according to the annual statistical reports of the Ministry of Health ranged around 4–5% of total TB cases.[40,46]

The main obstacles facing DOTS implementation are related to the social and political domains that affect TB incidence in Iraq. Detailed shortcomings included inadequate and improperly distributed DOTS administrative units, absence of program decentralization, proper training of working personals, provision of financial support for families of TB patients, and provision of logistics for needed logistic for the program.

Most important obstacles reported by experts working in TB control center were those difficulties in diagnosing tuberculosis which is still a global problem especially among children; poor patients' compliance; the high proposed governorate inhabitants' number used to calculate the goals and other socioeconomic factors related to the political changes in the country.

Many previous studies tried to evaluate the efficiency of DOTS in a retrospective comparative study in Southern India analyzed 150 case record files of patients with pulmonary TB. The treatment outcome in DOTS group was cured 70.7%, treatment completed 1.3%, failure 5.3%, deaths 10.7%, defaulters 8% and transferred out 4%, whereas in Self-Administered Treatment group, cure was seen in 68% and 4% completed the treatment, 1.3% had treatment failure, and 26.7% were lost to follow-up which included deaths, defaulters and those patients who switched over to other hospitals. However, the treatment success rate was similar (72%) in both groups.[21]

Conclusions

The results of DOTS monitoring in Kerbala showed very good Sputum Conversion and Cure rate and were consistent with the national rates and the rates in most developing countries. However, some defect areas need further support to prevent failure and aid continuous tuberculosis control and stop TB. The obstacles are mainly facing case detection and patients' compliance to complete the DOTS course.

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