Mobilising elementary and secondary school students for tuberculosis case finding in Anhui, China

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Objectives: To evaluate the implementation of a FIDELIS (Fund for Innovative DOTS Expansion through Local Initiatives to Stop TB) project in Anhui Province, China.

Design: A survey card was designed for students to identify individuals who might have tuberculosis (TB) in their family. Teachers provided health education on TB before distributing the survey cards. Survey cards identifying individuals with respiratory symptoms for ≥ 3 weeks were sent by the teachers to village doctors who were trained to visit symptomatic individuals and advise them to undergo sputum examination. Data were routinely collected in the implementation of the FIDELIS project, and quarterly reports from the National Tuberculosis Programme were analysed. The detection of new smear-positive TB cases before and after FIDELIS, as well as with and without FIDELIS, were compared.

Results: In the first year, a total of 2387405 students were involved and 23079 symptomatic individuals were examined, among whom 2307 (10.3%) were diagnosed with smear-positive TB. Case detection in FIDELIS counties increased by a factor of 3.5 during the FIDELIS period compared with before FIDELIS, and that in non-FIDELIS counties by a factor of 3.1 ($P = 0.001$).

Conclusion: It was feasible to massively mobilise students for TB case finding through collaboration between the health care and education systems.

Tuberculosis (TB) is a major public health issue in China, which, according to World Health Organization (WHO) estimates, ranks second among the world's 22 high-burden countries.¹ Organising TB services in Anhui, a province located in central China, has been challenging. The national TB prevalence survey conducted in 2000 included 13 sites in Anhui, where the prevalence of all forms of active TB and smear-positive TB was respectively 504 and 153 per 100000 population.² Although Anhui Province has implemented the DOTS strategy since 2002, the TB case detection rate in Anhui has remained very low: in 2003, only 5902 new smear-positive TB patients were detected, with a registration rate of 9.2/100000.³

FIDELIS (Fund for Innovative DOTS Expansion through Local Initiatives to Stop TB) aimed to increase detection of new smear-positive TB cases while maintaining high cure rates using the DOTS strategy.⁴⁻¹⁰ To strengthen TB case finding in Anhui, a proposal entitled 'Mobilising elementary and secondary school students to increase case finding of TB in poor and marginalised areas in Anhui Province' was submitted to FIDELIS and approved for funding. We conducted a

study to assess project implementation and case finding of new smear-positive TB during the FIDELIS project, and report the results of this study.

METHODS

Anhui Province

Anhui Province has a land mass of 139000 km², 17 prefectures, 84 counties/cities, 1709 townships, 32370 villages and a population of 62.6 million in 2001. Of the total population, 44.7 million (71.4%) live in rural areas and 25 million (39.8%) are poor by national or provincial standards. In 2001 the GDP per capita was US\$637.¹¹

Of the 84 counties/cities, 73 (87%) had implemented the DOTS strategy by 2004, when the FIDELIS project was launched. DOTS coverage reached 100% in March 2005. The Anhui Provincial TB Institute was responsible for TB services in the province. The county TB dispensary, under the county Center for Disease Control and Prevention (CDC), was the nodal point for sputum examination, diagnosis, treatment, registration and reporting of TB.

Activities of the FIDELIS Anhui Project

The core activity of the FIDELIS Anhui Project was to mobilise students of elementary and junior high schools to identify individuals who might have TB within the family. A 3-page survey card was designed for this purpose (Figure). The first page collected basic information on the student's family, whether any family member had had TB in the past and whether any family member had a cough or had produced sputum for ≥ 3 weeks. The second page indicated that those who had a cough or had produced sputum for ≥ 3 weeks might have TB, and that free services were provided at the county TB dispensaries. The third page was for students to write down their weekly class schedule so that they could keep the survey card with the message of TB.

Teachers provided health education on TB before distributing the survey cards, and collected them within a week of distribution. Survey cards identifying symptomatic individuals were sent by the teachers to the village doctors, who were trained to visit individuals with symptoms and, if necessary, advise them to submit sputum to the township health centres for examination. Three sputum samples were collected from each symptomatic individual. Sputum smear was prepared at the township hospital and read at county TB dispensaries. Confirmed TB patients were registered for anti-tuberculosis treatment according to national TB guidelines.¹²

AFFILIATIONS

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KEY WORDS

tuberculosis; epidemiology; case finding; China; student

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线索调查卡

学校: _____ 编号: _____

班级: _____

学生姓名: _____

性别: _____ 年龄: _____

家庭地址: 县 _____ 乡 _____ 村 _____ 村民组 _____

家庭成员: 关系 _____ 有无患过病 _____ 有无咳嗽、咯血超过三周

有 无 有 无

有 无 有 无

有 无 有 无

联系电话: _____

信息关于 TB

安徽 FIDELIS 项目
安徽省结核病防治所 印制
安徽省 结核病 所
地址: 合肥市潜山路 397 号
电话: 0551-366 8290

课程表

	一	二	三	四	五
上午					
下午					

Family information

Information about TB

Class schedule

粘合处

FIDELIS 项目线索调查卡、档案手工制作图

FIGURE Survey card used in the Anhui FIDELIS project. The left page collected basic information on the student's family, whether any family member had had TB in the past, and whether any family member had had a cough or had produced sputum for ≥ 3 weeks. The middle page indicated that those who had had a cough or had produced sputum for ≥ 3 weeks might have TB and that TB services were provided free of charge at the county TB dispensaries. The third page on the right was used by students to write down their weekly class schedule. TB = tuberculosis.

An official document was jointly issued by the Provincial Health Department and the Education Department. A task force of health authorities and a technical group were established at both provincial and county levels for project implementation. A coordinator was identified at all levels. A task force organised within the township government coordinated the operation and communication between township hospitals and schools, under the supervision of the county coordinators.

The FIDELIS project was implemented from May 2004 to April 2005 (Phase I) in 24 counties: 11 were poor by national/provincial standards and 15 were in mountainous regions. Of the 24 counties selected, 18 (75%) had implemented the DOTS programme prior to the FIDELIS project. The population in the 24 counties was 15.4 million, of which 6.9 million were poor, with an average annual income of US\$270. Thereafter, the project was scaled up to another 28 counties from November 2005 to October 2006 (Phase II). The population in the 52 counties was 40.8 million, of which 1.7 million were poor, with an average annual income of US\$274. Of the 52 counties implementing Phase II of the FIDELIS project, all had implemented the DOTS-based programme prior to the start of Phase II.

Incentive mechanism

The following incentives were used in the project: US\$0.50 was given to the laboratory technicians for each smear-positive case identified; US\$1 was given to the township doctors for each school trained to implement the project; US\$1 was given to the township doctors for transportation of each sputum sample from township to county; and US\$4 were given to the village doctors

for each smear-positive case managed, regardless of the outcome of treatment. Every 6 months, the performance of each county was evaluated and the top eight counties were provided with incentives according to predetermined criteria: US\$500 for the counties that ranked first and second, US\$300 for those that ranked third to fifth, and US\$200 for those that ranked sixth to eighth.

The Union consultant (CYC) and technical staff of the Union China office (LXZ) carried out monitoring visits on a quarterly basis. During the technical visits, the laboratory and treatment registers were cross-checked. Five smear-positive cases were randomly selected for microscopic confirmation, and one of the five cases was visited. The provincial team and the prefecture and county staff adopted the monitoring procedures carried out by the Union consultants for their routine monitoring visits to ensure that the data reported were accurate. A total of 626 health workers were involved in monitoring and supervision to strengthen project implementation. During the monitoring visits, the sputum register, treatment cards and treatment register were also cross-checked, and data reported were validated. Data collected from non-FIDELIS counties were not verified as stringently as those from FIDELIS counties.

Data management and analysis

Reports on case finding and treatment outcome designed by FIDELIS were used for data collection in FIDELIS counties, but only the data related to case finding were extracted, as this was the objective of the study. The reports collected aggregate data on the number of new smear-positive cases detected during the FIDELIS project, and on the number of new smear-positive cases detected the same month in the previous year. County coordinators

collected data to prepare these reports on a monthly basis. The information was used in this study to compare case finding of new smear-positive TB during and prior to the FIDELIS project. Information on the number of health workers trained, schools involved, survey cards distributed, distributed survey cards returned, symptomatic persons recorded, symptomatic individuals verified, verified individuals examined, smear-positive TB patients diagnosed and new smear-positive TB patients diagnosed was collected by township and county coordinators and compiled by staff at the Anhui Provincial TB Institute.

To compare case finding in FIDELIS and non-FIDELIS areas, quarterly National TB Programme (NTP) reports¹³ were used, because there were no monthly reports in non-FIDELIS areas; case finding during the period from January 2003 to March 2004 (pre-FIDELIS) was compared with that from April 2004 to June 2005 (FIDELIS). To evaluate the impact of health education, a random sample of TB patients was selected in participating county TB dispensaries in late 2004 to assess their source of information about TB.

STATA version 12 (StataCorp LP, College Station, TX, USA) was used for statistical analysis. Categorical variables were analysed using Pearson's χ^2 test. The level of significance was set at $\leq 5\%$.

As the study used aggregate data routinely collected during the FIDELIS project and data routinely reported to the NTP with no personal identifier, it did not require ethical approval.

RESULTS

A total of 76 project meetings were organised at county level through collaboration between the education and health care systems. Table 1 shows the number of training activities held and the number of persons trained. Four train-the-trainer workshops were held at provincial level, with 204 health workers trained; 295 training workshops were held at county level and 1406 at township level, with a total of 33 869 health workers trained.

All schools in the catchment areas participated in the project: 6955 schools were involved in Phase I and 18 055 in Phase II. A total of 162 286 teachers were trained. In Phase I, 2 132 229 students were trained and given a survey card, accounting for 89.3% of the students in the participating schools: the corresponding figures in Phase II were respectively 6 279 451 and 91.9%. In Phase I, 2 050 157 (96.2%) students returned the survey card and 5 995 771 (95.5%) in Phase II. The number of persons screened (recorded on the survey card) in Phase I was 5 722 342, representing 37.1% of the total population in the catchment area; the corresponding figure in Phase II was 20 955 260 (51.3%; Table 2).

Of the 40 662 symptomatic individuals recorded in Phase I, 23 079 (56.8%) were confirmed as having a cough or having produced sputum for ≥ 3 weeks; all of these 23 079 (100%) individuals confirmed as having symptoms underwent sputum examination; the corresponding figure for Phase II was 126 286 individuals recorded as symptomatic, 87 283 (69.1%) confirmed and 67.1%

TABLE 2 Distribution of survey cards and results of case finding

	Phase I*	Phase II*
A Counties covered, <i>n</i>	24	52
B Population of participating counties, <i>n</i>	15 443 456	40 815 033
C Schools in participating counties, <i>n</i>	6955	18 055
D Schools involved, <i>n</i>	6955	18 055
E Proportion of schools involved, %	100	100
F Students in schools involved, <i>n</i>	2 387 405	6 829 850
G Survey cards distributed, <i>n</i>	2 132 229	6 279 451
H Proportion of students with survey cards (G/F), %	89.3	91.9
I Distributed survey cards returned, <i>n</i>	2 050 157	5 995 771
J Proportion of distributed survey cards returned (I/H), %	96.2	95.5
K Persons recorded on survey cards, <i>n</i>	5 722 342	20 955 260
L Proportion of population recorded (K/B), %	37.1	51.3
M Symptomatic persons recorded, <i>n</i>	40 662	126 286
N Symptomatic individuals verified, <i>n</i>	23 079	87 283
O Proportion of symptomatic individuals verified (N/M), %	56.8	69.1
P Verified individuals examined, <i>n</i>	23 079	58 536
Q Proportion of verified individuals examined (P/N), %	100	67.1
R Smear-positive TB patients diagnosed, <i>n</i>	2 370	4 228
S Proportion of individuals examined positive (R/P), %	10.3	7.2
T New smear-positive TB patients diagnosed, <i>n</i>	1 809	3 855
U Proportion of new smear-positive TB among all smear-positive cases (T/R), %	76.3	91.2

*Phase I, May 2004–April 2005 in 24 counties; Phase II, November 2005–October 2006 in 52 counties, including the 24 counties in Phase I.

examined. Of the 23 079 individuals examined in Phase I, 2 370 (10.3%) were smear-positive, of whom 1 809 (76.3%) were new smear-positive TB patients and 561 (23.7%) had previously received treatment for TB. Of the 58 536 individuals examined in Phase II, 4 228 (7.2%) were smear-positive, among whom 3 855 (91.2%) were new smear-positive TB patients and 373 (8.8%) had previously received treatment for TB.

Table 3 shows TB case finding in the FIDELIS catchment area during and in the year prior to the FIDELIS project. The number of new smear-positive TB cases identified in 1 year increased by a factor of 3.8 in Phase I, and by 26% in Phase II. The increase in case detection was the highest (by a factor of 5) in the first quarter of Phase I, and decreased to only 9% in the last quarter of Phase II.

Case detection in FIDELIS counties increased by a factor of 3.5 during the FIDELIS period compared with before the project period, and that in non-FIDELIS counties by a factor of 3.1 ($P = 0.001$, Table 4).

To evaluate the impact of health education, 527 TB patients were randomly selected in participating county TB dispensaries for interview in late 2004. Of the 527 patients interviewed, 239 (41.6%)

TABLE 1 Training workshops held and persons trained in FIDELIS projects, Anhui, China, 2004–2007

Level of training	Training workshops	Number of health workers trained				Teachers trained	Students trained
		County	Township	Village	Subtotal		
Province	4	204	—	—	204	—	—
County	295	656	4015	3 692	8 363	3 808	—
Township	1 406	—	2527	22 775	25 302	28 715	94 911
School	19 228	—	—	—	—	129 763	9 217 255
Total	20 933	860	6542	26 467	33 869	162 286	9 312 246

TABLE 3 Comparison of new smear-positive case detection at county tuberculosis dispensaries before and during FIDELIS

	Pre-project	Project	Difference	% increase
Phase one				
1st quarter	229	1 146	917	400
2nd quarter	274	1 277	1003	366
3rd quarter	387	1 417	1030	266
4th quarter	542	1 622	1080	199
Subtotal	1 432	5 462	4030	281
Phase two				
1st quarter	2833	4 501	1668	59
2nd quarter	4043	5 742	1699	42
3rd quarter	4680	5038	358	8
4th quarter	4584	4991	407	9
Subtotal	16 140	20 272	4132	26

TABLE 4 Numbers of new smear-positive tuberculosis cases in Phase I FIDELIS counties compared with non-FIDELIS counties in Anhui Province, China

	January 2003– March 2004	April 2004– June 2005	Difference	% increase	P value
Non-FIDELIS (60 counties)	4565	14 353	9788	214	0.001
FIDELIS (24 counties)	1966	6823	4857	247	

had obtained information on TB from students in the family or in their neighbourhood, 180 (31.4%) from posters, 60 (10.5%) from other TB patients, 49 (8.5%) from television and 46 (8.7%) from other sources.

DISCUSSION

This study demonstrates that smear-positive case detection increased substantially in both FIDELIS and non-FIDELIS counties in 2003–2005, but the increase in case detection in Phase I FIDELIS counties was greater than that in non-FIDELIS counties. Anhui was in a DOTS expansion phase in 2003–2005, with substantial increases in financial and human resources in both FIDELIS and non-FIDELIS counties. It is therefore difficult to demonstrate the contribution of FIDELIS separately from that of other interventions. The increase in TB case detection was not due to reporting of TB through the internet-based reporting system,¹⁴ because Anhui started to do so only in 2006. The intensity of supervision and monitoring in FIDELIS counties was higher than in non-FIDELIS counties. As the quality of data in FIDELIS counties was strictly examined by Union consultants and provincial staff, but this was not the case in non-FIDELIS counties, the difference in increases in case detection between FIDELIS and non-FIDELIS counties might be larger than observed.

In Phase I (FIDELIS), the proportion of examined individuals with a positive smear was 10.3%, in line with the assumption that one person will be smear-positive among 10 individuals examined;⁵ in Phase II, this figure decreased to 7.2%, indicating that most prevalent TB cases had probably already been detected in Phase I. The proportion of previously treated smear-positive cases among all smear-positive TB cases was 27.7% in Phase I, indicating that a high proportion of TB patients had not achieved permanent cure on anti-tuberculosis treatment before the FIDELIS project; this figure decreased to 8.8%, indicating an improvement

in the quality of TB services after implementation of the project. The increase in case detection was greatest at the beginning of Phase I and then decreased toward the end of Phase II (Table 3), likely indicating that most TB cases prevalent in the community before the FIDELIS project had been detected and cured in Phase I.

There were both direct and indirect effects of using the survey cards to identify symptomatic individuals who might have TB. Symptomatic individuals in students' families were identified directly and were advised to undergo sputum examination. Simultaneously, knowledge about TB was disseminated into the community through the students, thus indirectly raising awareness about TB and potentially contributing to TB case detection.

This study shows that it is feasible to mobilise students to identify symptomatic individuals who might have TB in their families. Several factors were critical in implementing the project: 1) government commitment at provincial, prefecture and county levels was crucial in mobilising both the health and education departments in the implementation of the project; 2) a task force was established to supervise and monitor the project at all levels; 3) external technical assistance was helpful in streamlining implementation strategy; 4) more than 30 000 health workers were mobilised for project implementation; 5) a very large number of teachers were trained in health education and distribution of survey cards; 6) the operational procedures were simple and easy to implement; and 7) a proper incentive mechanism was in place.

The quality and strength of the collaboration between the health system and the education system was satisfactory, reflected by the fact that 1) about 90% of students were provided with a survey card; 2) more than 95% of the survey cards distributed were collected; 3) a high proportion of symptomatic individuals were confirmed; and 4) a high proportion of individuals confirmed with symptoms underwent sputum examination. As a result, the number of new smear-positive TB cases detected increased substantially during the FIDELIS project compared with before the project. Furthermore, knowledge about TB disseminated through students in the community was likely to have had a sustainable effect after the project.

We concluded that it was feasible to massively mobilise students for TB case finding through collaboration between the health and education systems, and recommend that this mobilisation should be repeated every 3–5 years.

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Objectifs : Evaluer dans le Province d'Anhui, Chine, la mise en œuvre du projet FIDELIS (Fund for Innovative DOTS Expansion through Local Initiatives to Stop TB).

Schéma : Une carte d'enquête a été élaborée pour les étudiants afin d'identifier les individus chez qui une tuberculose (TB) pourrait exister au sein de la famille. Les enseignants ont garanti une éducation-santé sur la TB avant la distribution des cartes de l'enquête. Les cartes de l'enquête identifiant des individus souffrant de symptômes respiratoires depuis ≥ 3 semaines ont été envoyées par les enseignants aux médecins du village qui avaient été entraînés à rendre visite et à donner des conseils en matière d'examen des crachats aux individus symptomatiques. Les données colligées en routine dans la mise en œuvre du projet FIDELIS ainsi que les rapports trimestriels du pro-

gramme national de la tuberculose ont été analysés. Les nouveaux cas de TB à frottis positif détectés avant et après FIDELIS ainsi qu'avec ou sans FIDELIS ont été comparés.

Résultats : Au cours de la première année, 2 387 405 étudiants ont été impliqués et 23 079 individus symptomatiques ont été examinés, et chez 2307 (10,3%) une tuberculose (TB) à bacilloscopie positive a été diagnostiquée. La détection des cas dans les comtés FIDELIS a augmenté d'un facteur de 3,5 dans la période FIDELIS par comparaison avec la période précédant FIDELIS et d'un facteur de 3,1 par rapport aux comtés sans FIDELIS ($P = 0,001$).

Conclusion : Il s'avère réalisable de mobiliser de façon massive les étudiants pour le dépistage des cas de TB grâce à une collaboration entre le système des soins de santé et le système éducatif.

Objetivos: Evaluar la introducción de un proyecto FIDELIS (Fondo por la Ampliación Innovadora del DOTS mediante Iniciativas Locales para Detener la Tuberculosis) en Anhui Province, China.

Método: Se elaboró una tarjeta de encuesta destinada a los estudiantes, encaminada a detectar la presencia de casos de tuberculosis (TB) en sus familias. Los profesores suministraron educación sanitaria en materia de TB antes de distribuir las tarjetas de la encuesta. Las tarjetas que detectaron personas con síntomas respiratorios de ≥ 3 semanas de evolución se enviaron a los médicos del municipio, los cuales habían recibido instrucciones de visitar a las personas sintomáticas y aconsejarles que aportaran muestras de esputo para examen. Se analizaron los datos recogidos sistemáticamente durante la introducción del proyecto FIDELIS y en los informes trimestrales del Programa Nacional contra la Tuberculosis. Se compararon los datos

sobre la detección de casos nuevos de TB con baciloscopia positiva antes y después de la ejecución del proyecto y en entornos donde no se introdujo la iniciativa.

Resultados: Durante el primer año participaron en el proyecto 2 387 405 estudiantes, se examinaron 23 079 personas sintomáticas y se diagnosticaron 2307 casos de TB con baciloscopia positiva (10,3%). La detección de casos en los condados que aplicaron el proyecto aumentó de 3,5 veces durante el período de aplicación en comparación con los datos previos y fue 3,1 veces superior a la detección observada en los condados que no aplicaron la iniciativa ($P = 0,001$).

Conclusión: Mediante la colaboración del sistema de atención de salud y el sistema educativo fue posible movilizar a los estudiantes en favor de la detección de casos de TB.