



# Asthma as a hidden disease in rural China: opportunities and challenges of standard case management

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**Objective:** To assess the implementation of standard case management of asthma in Huaiyuan County, Anhui Province, China, in 2008.

**Design:** The study project began with the local adaptation of international asthma guidelines, followed by a situation analysis, pre-intervention study, training and intervention. Inhaled beclomethasone (US\$15 for a 200-puff [250 µg/puff] inhaler) was prescribed for patients with persistent asthma. Treatment outcome was assessed at 1 year after enrolment.

**Results:** Asthma was never diagnosed in the participating facilities before the project was introduced. Of the 95 patients diagnosed with persistent asthma, 72 (75.8%) were prescribed inhaled beclomethasone, and 23 (24.2%) were not, because they either refused to use inhaled beclomethasone or did not return after the initial visit. At 1 year evaluation, of the 72 patients with persistent asthma treated with inhaled corticosteroids, 12 (16.7%) improved, 7 (9.7%) remained stable, none were worse, 1 (1.4%) had died, and 52 (72.2%) were lost to follow-up. Of the 52 patients lost to follow-up, 25 (48%) were found to be alive but had stopped using inhaled beclomethasone.

**Conclusion:** Asthma is more frequently disabling and costly than had been recognised earlier. Asthma patients can be provided the care that they require, but affordable access to inhaled corticosteroids remains a challenge.

Asthma affects 235 million people worldwide.<sup>1</sup> The prevalence of asthma is substantial, not only in industrialised countries but also in developing countries.<sup>1,2</sup> The number of disability-adjusted life years (DALYs) lost due to asthma worldwide has been estimated to be 15 million per year, accounting for 1% of all DALYs lost.<sup>3</sup> Unfortunately, quality-assured inhaled corticosteroids are neither commonly available nor affordable in most resource-limited settings.<sup>4</sup>

In China, asthma prevalence varies widely among settings, with an estimated mean prevalence of 2.1%.<sup>3</sup> To date, inhaled corticosteroids have not been included in the list of essential drugs in China, which has one of the highest asthma case-fatality rates in the world.<sup>3</sup>

A comprehensive lung health project funded by the World Bank and implemented by the International Union Against Tuberculosis and Lung Disease (The Union) aimed to reduce the burden of lung disease by improving comprehensive case management of priority cases.<sup>5</sup> Standard case management of asthma, together with smoking cessation among tuberculosis (TB) patients and standard case management of pneumonia in children, was implemented in

Anhui Province, China. In the present study, we report the results of standard case management of asthma in Anhui Province.

## METHODS

The project was implemented in 2008 in Huaiyuan County, Anhui Province, China (population 1.3 million), which comprises 19 townships. Each township has one township health centre, with on average four medical assistants trained in internal medicine. The majority of the medical assistants had had 3 years of medical training after junior high school and some after senior high school. The Huaiyuan County Hospital and the five township health centres of Longkang (population 62920), Machen (population 81096), Tangji (population 67400), Shuangqiao (population 55973) and Baoji (population 81246) were included in the study project.

The project was implemented as follows:

- 1 Local adaptation of international asthma guidelines: staff of the Anhui Provincial TB Institute and a local expert advisory group reviewed The Union Asthma Guide<sup>6</sup> and suggested appropriate adaptations.
- 2 Situation analysis: project staff reviewed consecutive patient records for April 2008 at selected institutions to evaluate care provided for the treatment of asthma. Available drugs and their prices were recorded.
- 3 Pre-intervention study: an asthma treatment card recommended by The Union<sup>5</sup> was provided to health workers of enrolled facilities in May 2008, before training.
- 4 Training was conducted in late May 2008 by staff of the Anhui Provincial TB Institute and the local expert advisory group.
- 5 Intervention: standard case management of asthma was implemented in June–December 2008. A facility project coordinator was appointed at each facility to coordinate the implementation of the project.
- 6 Supervision and monitoring: staff of the Anhui Provincial TB Institute and the local expert advisory group supervised and monitored the facilities on a regular basis (monthly at the county level and every 2 months at the provincial level). During each visit, supervisors met with two enrolled patients to confirm the diagnosis of asthma.
- 7 Recording and reporting: patient-based individual information was recorded on the asthma treatment card and in the asthma register, which were used for case management and outcome analysis.

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## KEY WORDS

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### Diagnosis and treatment of asthma

Asthma was diagnosed on the basis of both clinical symptoms and peak flow measurement. Confirmed asthma was defined as a patient with symptoms typical of asthma and peak expiratory flow (PEF) variability  $\geq 20\%$ . Probable asthma was defined as a patient with symptoms typical of asthma and a history of disease characteristic of asthma, after exclusion of other diagnoses, but without confirmation of PEF variability  $\geq 20\%$ . Those with confirmed or probable asthma were enrolled for treatment.

### Treatment of asthma

Inhaled beclomethasone was procured directly from a manufacturer in Taian City, Shandong Province, China, and provided to enrolled facilities. Patients paid 100 Chinese Yuan (US\$15) for a 200-puff beclomethasone inhaler (250  $\mu\text{g}$ /puff).

Patients were prescribed a 7-day course of oral prednisolone 0.5 mg/kg/day at the initial visit if they presented with an asthma attack, followed by inhaled beclomethasone for those with persistent asthma. The initial dosage was determined by the severity of the disease.<sup>5</sup> Adult patients with mild persistent asthma were prescribed 500  $\mu\text{g}$  inhaled beclomethasone per day (1 puff of 250  $\mu\text{g}$  twice/day), moderate persistent asthma 1000  $\mu\text{g}$ /day (2 puffs twice/day), and severe persistent asthma 2000  $\mu\text{g}$ /day (4 puffs twice/day). The dosage of inhaled beclomethasone was stepped down after 3 months of treatment if the asthma was under control, while step-up was advised if the asthma was not under control or was worsening.

### Annual evaluation

Treatment outcome was assessed at 1 year after enrolment, and was categorised as follows:

- 1 Improved: decrease in asthma severity AND no or fewer unplanned visits compared with initial evaluation
- 2 Stable: same asthma severity AND no or fewer unplanned visits compared with initial evaluation
- 3 Worse: increase in asthma severity OR more unplanned visits compared with initial evaluation
- 4 Died: whatever cause of death
- 5 Lost: did not attend annual follow-up appointment or present within 2 months following the appointment
- 6 Transferred: transferred to another health facility and outcome unknown.

### Data collection and analysis

The data recorded on the asthma treatment cards were entered into EpiData Entry (EpiData Association, Odense, Denmark). Stata (Stata Corp, Houston, TX, USA) was used for statistical analysis. Categorical variables were analysed using the Pearson's  $\chi^2$  test.  $P < 0.05$  was considered statistically significant.

### Ethics

As the information collected was a part of routine health services, the project was not considered to require review by an ethics committee. All individual patient information was handled only by those providing care to patients, and no individual identifiers were provided to individuals outside the health service.

## RESULTS

During the situation analysis it was observed that asthma had never been diagnosed in the participating facilities in Huaiyuan County before the project was introduced. Patients presenting

with cough and difficult breathing were usually diagnosed with chronic bronchitis and treated with a combination of antibiotics, systemic steroids, xanthine derivatives and/or oral beta-2 agonists. Inhaled corticosteroids were not available prior to the project. Inhaled salbutamol was available at the county general hospital. Prednisolone was widely available at the village level at a very

**TABLE 1** Characteristics of persistent asthma patients treated with inhaled beclomethasone compared with those who were not

	Total n (%)	No treatment n (%)	Treatment n (%)	P value
Total	95 (100)	23 (100)	72 (100)	
Sex				
Male	46 (48.42)	9 (39.13)	37 (51.39)	0.306
Female	49 (51.58)	14 (60.87)	35 (48.61)	
Age group, years				
<15	9 (9.47)	5 (21.74)	4 (5.56)	0.134
15–29	6 (6.32)	1 (4.35)	5 (6.94)	
30–44	23 (24.21)	5 (21.74)	18 (25.00)	
45–59	24 (25.26)	3 (13.04)	21 (29.17)	
$\geq 60$	33 (34.74)	9 (39.13)	24 (33.33)	
Ever asthma				
Yes	91 (95.79)	22 (95.65)	69 (95.83)	0.97
No	4 (4.21)	1 (4.35)	3 (4.17)	
Ever allergy				
Yes	41 (43.16)	11 (47.83)	30 (41.67)	0.296
No	47 (49.47)	12 (52.17)	35 (48.61)	
Unknown	7 (7.37)	0	7 (9.72)	
Family allergy				
Yes	45 (47.37)	6 (26.09)	39 (54.17)	0.019
No	42 (44.21)	16 (69.57)	26 (36.11)	
Unknown	8 (8.42)	1 (4.35)	7 (9.72)	
Smoking				
Never	67 (70.53)	16 (69.57)	51 (70.83)	0.993
Ex-smoker	8 (8.42)	2 (8.70)	6 (8.33)	
Current	20 (21.05)	5 (21.74)	15 (20.83)	
Passive smoking				
Yes	49 (51.58)	11 (47.83)	28 (41.05)	0.670
No	39 (41.05)	11 (47.83)	38 (52.78)	
Unknown	7 (7.37)	1 (4.35)	6 (8.33)	
Trigger factor				
Yes	74 (77.89)	15 (65.22)	59 (81.94)	0.030
No	13 (13.68)	3 (13.04)	10 (13.89)	
Unknown	8 (8.42)	5 (21.74)	3 (4.17)	
Solid fuel cooking				
Yes	78 (82.11)	22 (95.65)	56 (77.78)	0.141
No	12 (12.63)	1 (4.35)	11 (15.28)	
Unknown	5 (5.26)	0	5 (6.94)	
Solid fuel heating				
Yes	19 (20.00)	9 (39.13)	10 (13.89)	0.008
No	76 (80.00)	14 (60.87)	62 (86.11)	
Emergency visit, times				
0	1 (1.05)	1 (4.35)	0	0.344
1–4	24 (25.26)	4 (17.39)	20 (27.78)	
5–10	30 (31.58)	9 (39.13)	21 (29.17)	
11–30	18 (18.95)	4 (17.39)	14 (19.44)	
$\geq 30$	22 (23.16)	5 (21.74)	17 (23.61)	
Hospitalisation, times				
0	48 (50.53)	19 (82.61)	29 (40.28)	0.005
1–2	31 (32.63)	2 (8.70)	29 (40.28)	
3–6	14 (14.74)	2 (8.70)	12 (16.67)	
Unknown	2 (2.11)	0	2 (2.78)	
Asthma confirmed*				
Yes	79 (83.2)	19 (82.6)	60 (83.3)	0.531
No	13 (13.7)	4 (17.4)	9 (12.5)	
Unknown	3 (3.2)	0	3 (4.2)	

\*Peak expiratory flow variability  $\geq 20\%$ .

low price (100 tablets for less than US\$0.50), and was frequently used by patients who had shortness of breath. During the pre-intervention period, no patient was diagnosed with asthma and no asthma treatment cards were completed.

After training, a total of 105 asthma patients were identified from June to December 2008. The asthma severity of the 105 patients was intermittent in 9 (8.6%), mild persistent in 5 (4.8%), moderate persistent in 35 (33.3%) and severe persistent in 55 (52.4%), with incomplete evaluation in 1 (1%).

Table 1 shows that of the 95 patients with persistent asthma, 49 (51.6%) were female; 33 (34.7%) were aged  $\geq 60$  years; 91 (95.8%) had a history of asthma prior to the current episode; 41 (43.2%) had a history of allergy (allergic rhinitis or eczema); 45 (47.4%) had a family history of allergy; 67 (70.5%) had never smoked, 8 (8.4%) were ex-smokers, and 20 (21.1%) were current smokers; 49 (51.6%) had passive exposure to tobacco smoke at home; 74 (77.9%) had identified asthma trigger factors; and 78 (82.1%) used solid fuels (coal or biomass) for cooking. All except one patient had had one or more emergency visits in the previous year (42.1% had had more than 10 emergency visits); 45 (47.4%) had had one or more periods of hospitalisation in the previous year; and 79 (83.2%) had confirmed asthma, with a variable PEF rate of  $\geq 20\%$ .

Of the 95 patients, 72 (75.8%) were prescribed inhaled beclomethasone and 23 (24.2%) were not, because they either refused to use inhaled beclomethasone or did not return after the initial visit. Table 1 compares patients who were treated with inhaled beclomethasone and those without. Those with a family history of asthma ( $P = 0.019$ ), with identified trigger factors ( $P = 0.030$ ), who did not use solid fuel for heating ( $P = 0.008$ ) or who had a history of hospitalisation in the previous year ( $P = 0.005$ ) were significantly more likely to receive inhaled beclomethasone.

Table 2 shows the classification of asthma severity determined by the medical assistants as per the Union Asthma Guide.<sup>6</sup> Of the 72 patients with persistent asthma, four (5.6%) cases with severe persistent asthma were misclassified as moderate persistent asthma by medical assistants, and one (1.4%) was not classified.

Of the 72 patients treated with inhaled beclomethasone, four were children (age  $< 15$  years); of these, two (50%) were prescribed an adequate dose; the dosage for one child was too high (4 puffs for a child with mild persistent asthma), and for one it was too low (2 puffs for a child with severe persistent asthma). Table 3 shows the prescription of inhaled beclomethasone for the 68 persistent asthma patients aged  $\geq 15$  years: 63 (92.6%) were prescribed an adequate dosage, but for five it was too low (4 patients with severe persistent asthma were prescribed 4 puffs and 1 with severe persistent asthma 2 puffs).

At 1 year evaluation, of the 72 patients with persistent asthma treated with inhaled corticosteroids, 12 (16.7%) improved, 7 (9.7%) remained stable, none were worse, 1 (1.4%) had died and 52 (72.2%) were lost to follow-up. The patient who died had suffered

**TABLE 3** Prescription of inhaled beclomethasone by medical assistants for persistent asthma patients aged  $\geq 15$  years

	2 puffs	4 puffs	8 puffs	Total
Mild	3	0	0	3
Moderate	0	30	0	30
Severe	1	4	30	35
Total	4	34	30	68

bone fractures a few months after enrolment. This 59-year-old female had not been able to work for 4 years prior to enrolment due to shortness of breath. She took oral prednisolone and some unknown drugs from time to time to relieve the symptoms. Significant improvement was obtained soon after initiating inhaled beclomethasone. She returned to farming but suffered fractured bones 2 months later, and subsequently died of infection.

Of the 19 patients who had not died or been lost to follow-up, emergency visits in the year prior to the initial evaluation were reported a mean of 32.4 times (median 8, range 1–300), and those at 1 year evaluation were reported a mean of 1.4 times (median 0, range 0–10, paired *t*-test,  $P = 0.03$ ); hospitalisations in the year prior to initial evaluation were reported a mean of 0.8 times (median 0, range 0–4) and those reported at 1 year evaluation 0.2 times (median 0, range 0–2, paired *t*-test,  $P = 0.03$ ).

Of the 52 patients lost to follow-up, 25 (48%) were found to be alive but had stopped using inhaled beclomethasone. Among these 25 patients, emergency visits in the year prior to the initial evaluation were reported a mean of 10.3 times (median 6, range 2–50), and those at a later point in time, when the patients had been traced by health workers, were reported a mean of 0.1 times (median 0, range 0–2, paired *t*-test,  $P < 0.01$ ); hospitalisations in the year prior to initial evaluation were reported a mean of 1.8 times (median 2, range 0–6) and those at a later point in time, when the patients were traced by health workers, were reported 0.4 times (median 0, range 0–2, paired *t*-test,  $P < 0.01$ ).

## DISCUSSION

Asthma was a hidden disease in Huaiyuan County. The majority of patients with persistent asthma had PEF rate variability  $\geq 20\%$  and did not smoke, suggesting that the diagnosis was accurate. Almost all had emergency room visits, and about half had been hospitalised for asthma in the year prior to the project, implying that the financial burden for both asthma patients and the health care system was considerable. As medical personnel were not trained to diagnose and treat asthma, and inhaled corticosteroids were not available, asthma was wrongly diagnosed as chronic bronchitis, antibiotics were used unnecessarily and systemic steroids were heavily overused. Long-term use of systemic steroids resulted in severe adverse effects, including osteoporosis, as demonstrated by the patient who died with bone fractures after enrolment.

The project demonstrated that it is feasible to train medical assistants in the diagnosis and treatment of asthma at township level in China.

The classification of symptom severity in a sample of asthma patients in the Asia-Pacific region was intermittent in 51%, mild persistent in 20%, moderate persistent in 17% and severe persistent in 13%.<sup>7</sup> By contrast, in the current project, most patients were classified as having severe persistent asthma, probably indicating that patients with mild persistent asthma may have been less likely to seek care and were under-diagnosed. As systemic steroids were very cheap and widely available at village level, it was possible

**TABLE 2** Asthma severity determined by medical assistants compared with severity as determined per the Union asthma guide<sup>5</sup>

Severity determined by medical assistant	Union asthma guide			Total
	Mild	Moderate	Severe	
Mild	5	0	0	5
Moderate	0	31	4	35
Severe	0	0	31	31
Unknown	0	0	1	1
Total	5	31	36	72

that patients with mild persistent asthma used systemic steroids intermittently as relievers when they experienced an asthma attack and sought care only if the asthma attack could not be controlled by such inadequate self-management.

The affordability of essential asthma drugs has been the main barrier in asthma care.<sup>4,8</sup> In this project, 200-puff inhaled beclomethasone (250 µg/puff) cost 100 Chinese Yuan (US\$15), which was too expensive for the majority of asthma patients in Huaiyuan. Consequently, 24.2% of persistent asthma patients refused to pay for inhaled beclomethasone at diagnosis. Prescription of a course (7 days) of oral prednisolone at 0.5 mg/kg/day on the initial visit, resulting in improvement of asthma symptoms, probably partly accounted for their refusal to purchase the inhaled corticosteroids. Patients furthermore indicated that inhaled corticosteroids were costly and that they preferred traditional oral tablets.

The high proportion of patients who failed to visit the health service posed a potential challenge to provision of good quality care. Of those patients lost to follow-up, half were found to be alive but had stopped using inhaled beclomethasone. They reported a reduction in the frequency of unplanned visits after using inhaled corticosteroids but had stopped mainly because it was not affordable. Half of them could not be traced. However, they may not have been able to afford regular visits to health facilities and consequently have suffered from inadequate treatment, or their health may have improved and they therefore no longer felt the need to return to the health care facility. It was not possible to determine the reasons in this study, and these need further investigation.

In a technical assistance visit to Sudan by one of the authors (CYC), it was observed that 200-puff inhaled beclomethasone (250 µg/puff) made in Shanghai, China, was available at 5.5 Sudanese pounds (about US\$2.50) at a private pharmacy in Gezira State in 2009. The reason for the unreasonably high cost of inhaled beclomethasone in China is beyond the scope of this paper; we believe that this was a fundamental and common problem of the health care system in China, which is market-based, profit-oriented and incentive-driven and may therefore not serve the needs of the vulnerable and the poor.<sup>9,10</sup> To improve asthma management in Anhui Province, China, it is essential to make inhaled beclomethasone accessible and affordable for asthma patients. As the

first step, inhaled corticosteroids should be included in the essential drugs list. The Chinese government launched health care reforms in 2009, which will hopefully re-direct the health care system to meet the needs of asthma patients.<sup>11,12</sup>

In conclusion, although our study results should be interpreted with caution due to the lack of a comparison group, this project clearly demonstrated that asthma was more frequent, more disabling and more costly than had previously been recognised in this rural province of China. Moreover, it also demonstrated that patients can be given appropriate care if standard case management is introduced into routine practice. However, affordable access to inhaled corticosteroids remains a major challenge.

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**Objectif :** Evaluation de la prise en charge standardisée des cas d'asthme dans le Comté de Huaiyuan, Province d'Anhui en 2008.

**Schéma :** Le projet a débuté par une adaptation locale des directives internationales concernant l'asthme et s'est poursuivi par une analyse de la situation, une étude préalable à l'intervention, une formation et l'intervention. On a prescrit aux patients atteints d'asthme chronique de la béclométhasone en aérosol (15 US\$ pour un doseur de 200 bouffées ; 250 µg/bouffée). On a évalué le résultat du traitement 1 an après l'enrôlement.

**Résultats :** Avant la mise en route du projet, l'asthme n'avait jamais été diagnostiqué dans les services qui y ont participé. Un asthme chronique a été diagnostiqué chez 95 patients et la béclométhasone en aéro-

sol a été prescrite chez 72 d'entre eux (75,8%), et ne l'a pas été chez 23 (24,2%), soit parce qu'ils l'avaient refusée soit parce qu'ils n'étaient pas revenus après la consultation initiale. Lors de l'évaluation à un an, parmi les 72 participants à qui la béclométhasone avait été prescrite pour leur asthme chronique, il y a eu 12 améliorations (16,7%), 7 états stables (9,7%), aucune aggravation, 1 décès (1,4%) et 52 perdus de vue (72,2%). Parmi ces derniers, 25 (48%) se sont avérés encore en vie mais avaient cessé de prendre la béclométhasone en aérosol.

**Conclusion :** L'asthme s'avère plus souvent source d'invalidité et de dépenses que ce que l'on avait cru. Il faut que ces patients bénéficient des soins dont ils ont besoin. Un accès financièrement supportable aux aérosols de corticostéroïdes reste une défi.

**Objetivo:** Evaluar la aplicación del manejo normalizado de los casos de asma en el condado Huaiyuan de la provincia de Anhui en China, en el 2008.

**Método:** El proyecto comenzó con la adaptación de las directrices internacionales sobre el asma. Se practicó luego un análisis de la situación, un estudio previo a la intervención, el adiestramiento del personal y por último la intervención misma. Se recetó beclometasona inhalada a los pacientes con asma persistente (US \$15 por un inhalador con 200 dosis de 250 µg por dosis). El desenlace terapéutico se evaluó un año después de la inclusión en el estudio.

**Resultados:** Antes de la ejecución del proyecto nunca se había diagnosticado un caso de asma en los establecimientos de salud que participaron. De los 95 pacientes en quienes se diagnosticó asma persistente, 72 recibieron beclometasona inhalada (75,8%); en 23 casos (24,2%) no se recetó beclometasona, sea porque rehusaron su uso o

porque no regresaron después de la primera consulta. En la evaluación después de un año de tratamiento, 12 de los 72 pacientes con diagnóstico de asma persistente que recibieron corticoesteroides inhalados presentaban mejoría (16,7%), siete pacientes permanecían estables (9,7%) y ninguno se había degradado. Un paciente había fallecido (1,4%) y 52 pacientes se habían perdido durante el seguimiento (72,2%). De los 52 casos perdidos durante el seguimiento, se encontraron 25 pacientes vivos (48%), pero habían suspendido el uso de la beclometasona inhalada.

**Conclusión:** El asma es con mayor frecuencia discapacitante y más costosa de lo que se ha reconocido hasta el momento. Es posible aportar a los pacientes asmáticos el tratamiento que necesitan; no obstante, el suministro de corticoesteroides inhalados abordables constituye aun un obstáculo.