



Standard case management of asthma in Sudan: a pilot project

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Setting: A pilot project for asthma management in selected hospitals in Khartoum and Gezira States, Sudan.

Objective: To assess standard case management of asthma in 2007–2008.

Design: Local adaptation of guidelines, followed by situational analysis, pre-intervention study, training and implementation. Treatment outcome was assessed 1 year after patient enrolment.

Results: Situational analysis revealed that inhaled beclometasone was not available in the public sector. During the project, 2068 patients were enrolled: severity of asthma was intermittent in 185 (9.0%), mild persistent in 231 (11.2%), moderate persistent in 640 (31.0%), severe persistent in 812 (39.3%) and unclassified in 200 (9.7%). Of the 1654 patients with persistent asthma who were treated with inhaled corticosteroids, 1157 (70.0%) had treatment cards available for outcome assessment. Of these, 652 (56.4%) did not attend their annual evaluation, among whom 1 (0.1%) died and 651 (56.3%) were lost to follow-up. Of the 505 patients who attended their annual evaluation, 417 (82.6%) improved, 32 (6.3%) were stable and 56 (11.1%) were worse. The frequency of emergency visits and hospitalisation decreased substantially among those who presented for the 1 year follow-up assessment.

Conclusion: The results of standard case management of asthma were encouraging; however, a high proportion of patients did not return for long-term management.

The burden of asthma, a highly neglected disease that affects 235 million people globally, is substantial in terms of morbidity and economic costs.^{1,2} High proportions of children are reported to have asthma symptoms in Sudan, including 12% of children in Khartoum.^{2,3} Asthma ranks as the third most frequent cause of hospitalisation following pneumonia and malaria, and there has been a striking increase in the number of emergency visits, from 20000 in 1998 to 105000 in 2004.⁴

To address this problem, a manual based on the Asthma Guide of the International Union Against Tuberculosis and Lung Disease (The Union) was published in 2000, providing a technical package on the standard case management of asthma that could be fully integrated into existing national health services.⁵ It recommended diagnosis using simple tools (symptoms and peak flow meter), treatment with two essential drugs (inhaled beclometasone and inhaled salbutamol)⁶ and a standardised information system for the registration of patients with persistent asthma.

Asthma has never been a public health priority in Sudan. Lack of peak flow meters for diagnosis, numer-

ous stock outs and inconsistent distribution of essential asthma drugs are frequent; also, the workforce is unprepared to tackle chronic asthma and the long-term management of asthma patients.⁷ A survey conducted in 2003 revealed that 95% of patients paid the full cost for expensive drugs, <2% of them received regular treatment from a single facility and there was no asthma management plan.² This highlighted the fact that despite some progress, asthma management continues to be inadequate in Sudan.

In 2006, a comprehensive approach to lung health (CAL) project funded by the World Bank and managed by The Union was implemented in Benin, China and Sudan.^{8–10} As one of its objectives, the CAL project aimed to reduce the burden of lung diseases through the improvement of case management of patients with persistent asthma. The project was implemented in Sudan at the first referral level by the Epi-Lab and the National Sudan team. We assessed the implementation of standard case management of asthma in Sudan in 2007–2008 and report the results of this assessment in the present study.

METHODS

Study design: retrospective record review

Setting

This project started in five selected hospitals in Khartoum State in 2007, and was extended to five other sites in Gezira State and four in Khartoum State in 2008. Most hospitals were first referral level district hospitals, with a catchment area of 100000 population; each hospital had an emergency room, an asthma clinic, a medical officer for the clinical evaluation of asthma, a nurse or sister to provide health education, and one clerk statistician or medical assistant for recording and reporting. Having a consultant in the hospital was helpful for training and in implementing the project, but was not mandatory.

Study population

All asthma patients attending project sites in Gezira and Khartoum States from 2007 to 2008 were included in this assessment. Patients usually presented with an exacerbation of symptoms.

Situational analysis

Medical records of asthma patients visiting health facilities in April 2006 were reviewed to obtain baseline information on the diagnosis and treatment of asthma, the type of drug used and its cost, as well as recording and reporting practices.

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KEYWORDS

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Pre-intervention

In May 2006, The Union asthma treatment card and register were provided to health workers for case management without training.

Training

In August 2006, training was provided jointly by the World Health Organization, The Union and the Epi-Lab on the standard case management of asthma. Diagnosis of asthma was based on clinical symptoms and peak expiratory flow (PEF) measurements. PEF measurements before and after inhaled bronchodilator were performed at the initial visit and/or the first follow-up visit after initial management of an asthma attack. Severity was categorised as intermittent, mild persistent, moderate persistent and severe persistent asthma (Table 1). Inhaled beclomethasone was prescribed for all patients with persistent asthma. The initial dosage of inhaled beclomethasone was determined according to asthma severity per the Union asthma guide.² Step-down of dosage of inhaled beclomethasone was recommended after 3 months of treatment if the asthma was under control, and step-up was advised if the asthma was not under control or getting worse.

Project implementation

Implementation was started in January 2007. Inhaled beclomethasone and inhaled salbutamol were provided to patients free of charge. Supervision and in-service training were provided by the Epi-Lab staff. An asthma treatment card was used for managing patients with persistent asthma. Patient characteristics were recorded at enrolment, including history of asthma and allergy, smoking, domestic exposure to combustion of solid fuels and unplanned visits to health facilities (emergency visits and/or hospitalisation) in the year prior to enrolment. Symptom severity, PEF measurement results, unplanned visits since previous consultation,

and both inhaled and oral corticosteroids prescribed were recorded on each follow-up visit. The evaluation of case management was based on the result at 1 year follow-up of all registered patients with persistent asthma. Patients who did not attend their annual evaluation were categorised as died, lost or transferred; those patients who did attend their annual evaluation were categorised as improved, stable or worse based on the evolution of asthma severity and of unplanned visits (emergency visits or hospitalisation) since their enrolment in long-term management. Definitions of outcomes are shown in Table 1.

Data collection and analysis

Asthma treatment cards maintained at each site were assessed periodically during project implementation. Data recorded on the cards were entered into the computer using EpiData Entry 3.1 (The EpiData Association, Odense, Denmark). Stata, version 12 (StataCorp LP, College Station, TX, USA) was used for statistical analysis. Factors associated with asthma severity were analysed using the Pearson's χ^2 test for categorical variables. Kruskal-Wallis equality-of-populations rank test was applied to analyse the association between frequency of unplanned visits and asthma severity, as frequency of unplanned visits was a continuous variable with a skewed distribution. $P < 0.05$ was considered statistically significant. Furthermore, relevant determinants associated with asthma severity were entered into multinomial logistic regression models in which the outcome variable had three categories: mild persistent, moderate persistent and severe persistent. Determinants remaining significant in the multinomial logistic regression models were retained and a final fitted model was determined by backward elimination using the likelihood ratio test.

Ethics

The information collected was part of routine health services. All individual patient information was handled only by those providing care for the patients. Personal identification was removed during data entry and patient confidentiality was strictly maintained. The project was therefore not considered to require review by an ethics committee but depended on a memorandum of understanding signed between the Ministries of Health of Khartoum and Gezira States and Epi-Lab.

RESULTS

Situational analysis

Thirteen asthma patients registered in April 2006 were reviewed. Cough, wheeze, breathlessness and chest tightness were the most frequent presenting symptoms, but symptom severity and asthma severity were rarely evaluated. Peak flow meters were not available, and reversibility of airflow limitation and functional impairment were not assessed. Patients with an asthma attack were usually treated with a combination of salbutamol nebulisation, intravenous aminophylline, systemic steroids, antibiotics and oxygen. The duration of drug administration was not recorded and no follow-up evaluation was carried out. Inhaled beclomethasone was not available in the public sector; it was available in the private sector and local pharmacies, but was expensive and not affordable for the general population.

Pre-intervention phase

After the asthma cards had been distributed to the health workers, 113 cards were collected from the sites. The mean age of the 113 patients was 34 years, and 52% were female. Diagnosis was

TABLE 1 Definition of asthma severity and treatment outcome at 1-year follow-up

Asthma severity	
Intermittent	Intermittent (<weekly) symptoms and absence of airflow limitation (best PEF \geq 80% of predicted)
Mild persistent	Mild persistent (weekly) symptoms and absence of airflow limitation (best PEF \geq 80% of predicted)
Moderate persistent	Moderate persistent (daily) symptoms and less than severe airflow limitation (best PEF \geq 60% of predicted), or moderate airflow limitation (best PEF 60–79% of predicted) and less than severe persistent symptoms (<continuous)
Severe persistent	Severe persistent (continuous) symptoms, regardless of level of airflow limitation (PEF), or severe airflow limitation (best PEF <60% of predicted), regardless of symptom severity
Treatment outcome	
Improved	Decrease in asthma severity AND no or fewer unplanned visits as compared with initial evaluation
Stable	Same asthma severity AND no or fewer unplanned visits as compared with initial evaluation
Worse	Increase in asthma severity OR more unplanned visits as compared with initial evaluation
Died	Regardless of cause of death
Lost	Did not attend annual follow-up appointment or within 2 months following the appointment
Transferred	Transferred to another health facility and outcome unknown

PEF = peak expiratory flow.

TABLE 2 Factors associated with asthma severity, 2007–2008, Khartoum and Gezira States, Sudan

	Total n (column %)	Mild persistent asthma n (column %)	Moderate persistent asthma n (column %)	Severe persistent asthma n (column %)	P value*
Total	1683 (100)	231 (13.73)	640 (38.0)	812 (48.3)	
Sex					0.010
Male	687 (40.8)	84 (36.4)	241 (37.7)	362 (44.6)	
Female	996 (50.2)	147 (63.6)	399 (62.3)	450 (55.4)	
Age group, years					<0.001
<25	290 (17.3)	69 (30.1)	114 (17.8)	107 (13.2)	
25–44	701 (41.8)	91 (39.7)	293 (45.8)	317 (39.2)	
45–64	519 (31.0)	51 (22.3)	181 (28.3)	287 (35.5)	
≥65	167 (10.0)	18 (7.9)	52 (8.1)	97 (12.0)	
Ever asthma					<0.001
Yes	1504 (89.6)	191 (83.0)	559 (87.3)	754 (93.2)	
No	175 (10.4)	39 (17.0)	81 (12.7)	55 (6.8)	
Smoking					0.097
Never	1442 (87.5)	194 (86.6)	567 (89.7)	681 (86.0)	
Ever	206 (12.5)	30 (13.4)	65 (10.3)	111 (14.0)	
Passive exposure to tobacco smoke					0.504
Yes	734 (45.9)	127 (54.5)	321 (52.9)	416 (54.0)	
No	864 (54.1)	94 (42.5)	286 (47.1)	354 (46.0)	
Solid fuel use					0.832
Yes	866 (56.6)	118 (57.3)	337 (57.3)	411 (55.8)	
No	665 (43.4)	88 (42.7)	251 (42.7)	326 (44.2)	
Emergency visit in past year, median [mean]	3 [12.7]	3 [8.7]	3 [9.6]	4 [16.3]	0.004
Asthma confirmed†					<0.001
Yes	1199 (71.2)	141 (61.0)	437 (68.3)	621 (76.5)	
No	484 (28.8)	90 (39.0)	203 (31.7)	191 (23.5)	

*Factors associated with asthma severity were analysed using Pearson's χ^2 test for categorical variables; the frequency of unplanned visits was analysed using the Kruskal-Wallis equality-of-populations rank test. $P < 0.05$ was considered statistically significant.

†Peak expiratory flow variability of $\geq 20\%$.

not recorded for 59% of cases, and asthma severity was assessed for only 2% of cases on the basis of clinical symptoms. No inhaled corticosteroids were prescribed.

Intervention phase

After health worker training, a total of 2068 asthma patients were identified in 2007–2008, of whom 264 were identified in 2007 in Khartoum State, 942 in 2008 in Khartoum State, and 862 in 2008 in Gezira State. Asthma severity of the 2068 patients was intermittent in 185 (9.0%), mild persistent in 231 (11.2%), moderate persistent in 640 (31.0%), severe persistent in 812 (39.3%), and unclassified in 200 (9.7%).

Of the 1683 patients with persistent asthma, 1504 (89.4%) had a history of asthma before the current episode; 1442 (85.7%) had never smoked; 1304 (77.5%) identified asthma trigger factors; 1298 (77.1%) had had one or more emergency room visits in the previous year (28.5% had ≥ 10 emergency room visits); 401 (23.8%) had had ≥ 1 periods of hospitalisation in the previous year; 1577 (93.7%) reported usually having symptoms; 414 (24.6%) had best PEF rate of $\geq 80\%$ of predicted, 596 (35.4%) had best PEF of 60–79% of predicted and 673 (40.0%) had best PEF of $< 60\%$ of predicted; 1199 (71.2%) had PEF rate variability of $\geq 20\%$, 288 (17.1%) had variability of $< 20\%$ and 196 (11.7%) had incomplete information.

Sex ($P = 0.01$), age ($P < 0.001$) and having a history of asthma ($P < 0.001$) were statistically significantly associated with asthma severity, while smoking ($P = 0.097$), passive exposure to tobacco smoke ($P = 0.504$) and exposure to combustion of solid fuels ($P = 0.832$) were not (Table 2). Patients with severe persistent asthma

had had a median (mean) of 4 (16.3) unplanned visits due to an asthma attack in the previous year, patients with moderate persistent asthma had had 3 (9.6), and patients with mild persistent asthma had had 3 (8.7; $P = 0.004$). The proportion of patients with PEF variability $\geq 20\%$ was 76.5% in patients with severe persistent asthma, significantly higher than among patients with moderate persistent (68.3%) and mild persistent (61.0%; $P < 0.001$).

TABLE 3 Multinomial logistic regression assessing factors associated with asthma severity, 2007–2008, Khartoum and Gezira States, Sudan

	Moderate persistent asthma*		Severe persistent asthma*	
	Relative risk ratio	95%CI	Relative risk ratio	95%CI
Sex				
Female	1		1	
Male	1.1	0.8–1.5	1.4	1.0–1.9
Age group, years				
<25	1		1	
25–44	1.9	1.3–2.8	2.1	1.4–3.1
45–64	2.0	1.3–3.2	3.2	2.1–4.9
≥65	1.6	0.9–2.0	2.8	1.6–5.2
Ever asthma				
No	1		1	
Yes	1.3	0.8–2.0	2.4	1.5–3.7

*Mild persistent asthma was the basis for comparison. CI = confidence interval.

TABLE 4 Prescription of inhaled beclometasone by medical assistant for patients with persistent asthma*

	1 puff	2 puffs	4 puffs	6 puffs	8 puffs
Aged <15 years					
Mild	1 [†]	20	1	0	0
Moderate	4	3 [†]	14	3	1
Severe	0	0	3 [†]	0	11
Aged ≥15 years					
Mild	1	189 [†]	7	0	0
Moderate	0	5	560 [†]	24	19
Severe	0	1	8	0	779 [†]

*Recommended dosage: for children, respectively 1, 2 and 4 puffs for mild, moderate and severe persistent; for adults, respectively 2, 4 and 8 puffs for mild, moderate and severe persistent.

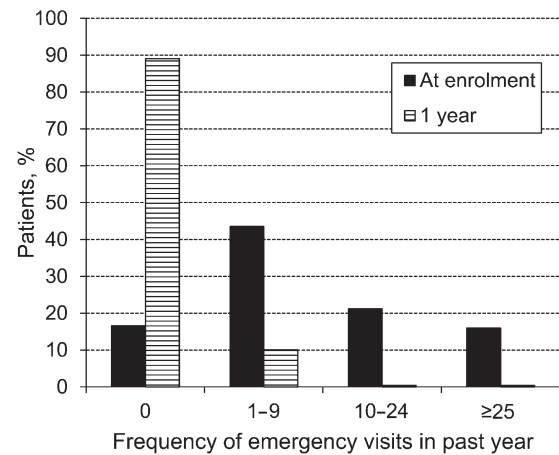
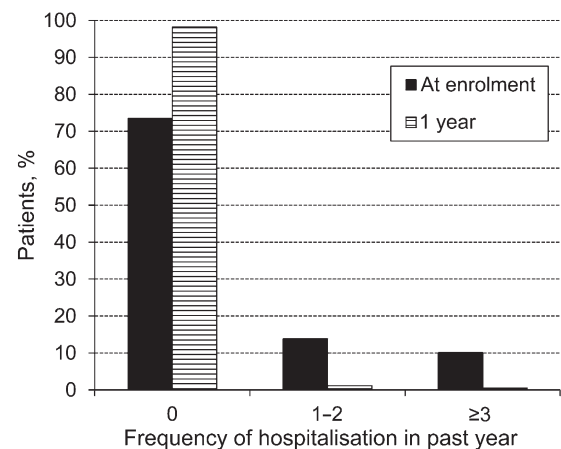
[†]Consistent with recommended dose.

In multinomial logistic regression models, sex, age and history of asthma remained significantly associated with asthma severity (Table 3). The relative risk of severe persistent over mild persistent asthma was 1.37 (95% confidence interval [CI] 1.0–1.9) for males vs. females; 2.1 (95%CI 1.4–3.1) for those aged 25–44 years, 3.2 (95%CI 2.1–4.9) for those aged 45–64 years and 2.8 (95%CI 1.6–5.2) for those aged ≥65 years vs. those aged ≤24 years; and 2.4 (95%CI 1.5–3.7) for those with a history of asthma vs. those without.

Of the 1654 patients, 61 (3.7%) were aged <15 years and 1593 (96.3%) were aged ≥15 years (Table 4). Of the 1593 adults, 1528 (95.9%) received recommended dosages of inhaled corticosteroids, 50 (3.1%) higher than recommended and 15 (0.9%) lower than recommended; of the 61 children, 7 (11.5%) received the recommended dosage, 50 (82.0%) received higher dosages than recommended, and 4 (6.6%) lower than recommended.

Of the 1654 patients with persistent asthma who were treated with inhaled corticosteroids, 1157 (70.0%) had treatment cards available for outcome assessment. Table 5 shows the outcome assessment of the 1157 patients after 1 year of follow-up. Of the 1157 patients, 652 (56.4%) did not attend their annual evaluation, of whom 1 (0.1%) died and 651 (56.3%) were lost to follow-up. Of the 505 patients who attended their annual evaluation, 417 (82.6%) improved, 32 (6.3%) were stable and 56 (11.1%) were worse. Asthma severity was significantly associated with improved status ($P = 0.015$) and worse status ($P = 0.039$), but not with remaining stable ($P = 0.306$) nor being lost to follow-up ($P = 0.098$).

Figure 1 shows the frequency of emergency visits in the previous year assessed at enrolment and at 1 year follow-up among patients with persistent asthma who attended their 1-year follow-

**FIGURE 1** Frequency of emergency visits in past 12 months assessed at enrolment and at 1-year follow-up among patients with persistent asthma who attended the 1-year follow-up visit.**FIGURE 2** Frequency of hospitalisation in past 12 months assessed at enrolment and at 1-year follow-up among patients with persistent asthma who attended the 1-year follow-up visit after enrolment.

up visit. Figure 2 shows the frequency of hospitalisation of patients in the past year: 16.6% had had no emergency visits in the previous 12 months at enrolment; this increased to 89.1% at 1-year follow-up; 73.5% had had no hospitalisation in the previous 12 months at enrolment; this increased to 98.2% at 1-year follow-up.

TABLE 5 Outcome of asthma management among 1157 persistent asthma patients whose treatment cards were available at 1-year follow-up by asthma severity

	Attended annual evaluation					
	Yes (n = 505, 43.6%)			No (n = 652, 56.4%)		
	Improved n (row %)	Stable n (row %)	Worse n (row %)	Lost to follow-up n (row %)	Died n (row %)	Total n (row %)
Mild persistent	45 (27.3)	4 (2.4)	14 (8.5)	102 (61.8)	0	165 (100.0)
Moderate persistent	147 (35.0)	8 (1.9)	21 (5.0)	244 (58.1)	0	420 (100.0)
Severe persistent	225 (39.3)	20 (3.5)	21 (3.7)	305 (53.3)	1 (0.2)	572 (100.0)
Attended annual evaluation	477 (82.6)	32 (6.3)	56 (11.1)			505 (100.0)

DISCUSSION

Asthma management before the project was inadequate, and inhaled corticosteroids were not available and/or not affordable. Management consisted of treatment for asthma attacks, and no long-term management was offered. A substantial number of patients therefore had a high frequency of unplanned visits to the health services.

This pilot project clearly demonstrates that it is possible to train health workers in following international recommendations for standard case management of asthma.¹¹ The number of asthma patients enrolled in Year 1 was relatively small, and increased strikingly in Year 2. Most patients were in the economically productive age group, but usually had asthma symptoms; half of them presented with severe persistent asthma and had a high frequency of unplanned visits that were disruptive to their lives. As a chronic illness, asthma has had a major impact on the life of these individuals as well as their families, and the economic burden of asthma was high, in particular among those whose disease was uncontrolled. Most patients had a past history of asthma; however, about 10% did not, likely indicating under-diagnosis of asthma. Smoking, passive exposure to tobacco smoke and domestic use of solid fuels were not associated with asthma severity. As there were no participants without asthma as a comparison group, we are not able to assess whether smoking, passive exposure to tobacco smoke and domestic use of solid fuels were associated with asthma in Sudan.

During the pilot project, most enrolled patients with persistent asthma received adequate dosages of inhaled corticosteroids; however, a small minority were prescribed inadequate dosages that were not consistent with guidelines, indicating the importance of supervision and in-service training. Maintaining an information system in a complete and timely manner was another challenge. A substantial proportion of asthma treatment cards were not available for outcome assessment; this was mainly due to staff turnover and insufficient human resources. This considerably compromised the comprehensive assessment of the effectiveness of standard case management of asthma in Sudan.

Despite the fact that inhaled corticosteroids were provided to patients with persistent asthma at no cost, more than half of the enrolled patients did not attend their annual evaluation. This was also the finding in Benin¹² and China,¹⁰ where asthma patients had to pay for their inhaled corticosteroids. The patients may have been well and did not see the need to continue their medication on a regular basis, or their asthma was not controlled by inhaled beclometasone. Unfortunately, we are not able to determine the actual reasons for non-attendance of the annual follow-up visit.

Among those who did not attend their annual follow-up visit, for the majority their asthma had improved or was stable and there had been a substantial reduction in the frequency of unplanned visits, indicating improvements in their quality of life

and reduction in the burden of asthma on themselves and their families. The success and experience in delivering TB services inspires the practical endorsement of this approach for asthma services.¹³ The ambition was to develop an interrelated, holistic approach that would help Sudan as a low-income country to reduce health service costs at both individual and health system levels. The model created synergies between existing health services rather than creating a parallel system trying to overcome long-term challenges facing asthma care.^{14,15} Maintaining an uninterrupted supply of quality-assured essential asthma drugs at an affordable price is critical and a means of improving equity in health services.^{15,16}

We conclude that the asthma pilot project was associated with a reduction in unplanned emergency visits as well as hospitalisation,¹⁵ and that it needs to be scaled up as a routine service in Sudan.

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Context : Projet pilote sur l'asthme dans les hôpitaux sélectionnés des Etats de Khartoum et de Gezira, Soudan.

Objectif : Evaluer la prise en charge standard des cas d'asthme en 2007–2008.

Schéma : Adaptation locale des directives, suivie par une analyse des situations, d'une étude avant intervention, d'une formation et d'une mise en œuvre. Le résultat du traitement est évalué une année après le recrutement des patients.

Résultats : L'analyse de la situation a révélé que la béclométasone en

inhalation n'était pas disponible dans le secteur public. On a recruté 2068 patients au cours du projet. La gravité de l'asthme était du type intermittent chez 185 patients (9,0%), persistant et léger chez 231 (11,2%), persistant et moyen chez 640 (31,0%), persistant et grave chez 812 (39,3%) et non classifié chez 200 (9,7%). Sur les 1654 patients atteints d'un asthme persistant qui ont été traités par les corticostéroïdes par inhalation, 1157 (70,0%) disposaient d'une carte de traitement pour évaluation du résultat. Parmi ceux-ci, 652 (56,4%) ne se sont pas présentés à l'évaluation annuelle, chez lesquels un est

décédé (0,1%) et 651 (56,3%) ont été perdus de vue. Parmi les 505 patients qui se sont présentés à l'évaluation annuelle, l'état de 417 (82,6%) était amélioré, celui de 32 (6,3%) est resté stable et celui de 56 (11,1%) aggravé. La fréquence des visites d'urgence et des hospitalisations a diminué de manière substantielle parmi ceux qui se sont présentés pour l'évaluation de suivi après 1 an.

Marco de referencia: Un proyecto piloto sobre asma en hospitales escogidos de los estados de Jartum y Gezira, en Sudán.

Objetivo: Evaluar el manejo corriente de los casos de asma en el 2007 y el 2008.

Método: Se llevó a cabo una adaptación local de las directrices de tratamiento, seguida de un análisis de la situación, un estudio preliminar, la capacitación del personal y la ejecución de la intervención. Se evaluó el desenlace terapéutico un año después de la inscripción de los pacientes al programa.

Resultados: El análisis de la situación puso en evidencia que la beclometasona inhalada no se encontraba al alcance en el sector público. Durante la ejecución del proyecto se inscribieron 2068 pacientes; la gravedad del asma fue intermitente en 185 (9,0%), leve persistente en 231 (11,2%), moderada persistente en 640 (31,0%), grave persistente en 812 (39,3%) y no se clasificó su gravedad en 200 (9,7%).

Conclusion : Les résultats d'une prise en charge standard des cas d'asthme sont encourageants ; toutefois, une proportion élevée des patients ne se sont pas présentés pour la prise en charge à long terme.

De los 1654 pacientes con asma persistente que recibieron tratamiento con corticosteroides inhalados, 1157 contaban con tarjetas de tratamiento para la evaluación del desenlace (70,0%). De estos pacientes, 652 no se presentaron a la evaluación anual (56,4%) y de ellos uno había fallecido (0,1%) y 651 se habían perdido de vista durante el seguimiento (56,3%). De los 505 pacientes que acudieron a la evaluación anual, 417 presentaban mejoría (82,6%), 32 permanecían estables (6,3%) y en 56 pacientes se había degradado su estado clínico (11,1%). La frecuencia de consultas de urgencia y de hospitalizaciones disminuyó considerablemente en los pacientes que se presentaron a la evaluación de seguimiento un año después.

Conclusión: Los resultados del manejo corriente del asma son prometedores; sin embargo, una alta proporción de pacientes no acudió al tratamiento a largo plazo.