Original Article

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Budget Impact of the Thalassemia Management under the National Health Security Scheme in Thailand

A. Riewpaiboon[1], S. Bunyadharokul[1], U. Chaikledkaew[1] and K. Torcharus[2]*

[1]Division of Social and Administrative Pharmacy, Department of Pharmacy, Faculty of Pharmacy, Mahidol University, Bangkok, Thailand; [2]Division of Hematology, Department of Pediatrics, Phramongkutklao Hospital, Bangkok, Thailand

Abstract

This study was aimed to determine the budget impact due to the proposed thalassemia management program for transfusion-dependent thalassemia children under the National Health Security Office. The budget impact analysis was conducted from the National Health Security Office (NHSO) perspective. The budget covered drugs, blood, medical devices, and medical services. The target population was transfusion-dependent beta-thalassemia children aged up to 15 years. The treatment regimen was modified from the proposal of the Thalassemia Foundation of Thailand, while the pattern of service utilization and unit cost were derived from a cost of illness study. The budget was presented based on 2007 prices. Sensitivity analysis was performed testing the effects of prices of chelating agents. It was found that the direct medical budget for 37,452 patients was 2.5 billion THB (US$ 1 = 34.56 Thai THB). This represented the amount needed for patients receiving high transfusion with single deferrioxamine (DFO) and low transfusion with combined iron chelation package. In addition, the budget of 1.9 billion THB was required for patients receiving high transfusion and low transfusion with combination package. The increased prices of iron chelators affected 29% to 63% of the total budget. The total budget for conventional treatment (high transfusion + low transfusion) was 1.5 billion THB. In conclusion, from existing conventional practice to the thalassemia management program, the budget increased from 27% to 68%. Consequently, the total expenditure ballooned from 1.9 to 2.5 billion THB per year. Moreover, the prices of iron chelating agents had a significant effect on the budget.

Key words: Thalassemia, disease management, budget impact analysis, national health security, Thailand

INTRODUCTION

It has been estimated that there are 18–24 million thalassemia carriers in Thailand[1]. In particular, around 10% of the population or approximately 630,000 are thalassemia patients. Furthermore, 12,125 babies with thalassemia are born every year. The Ministry of Public Health is gravely concerned given the number of affected people. In response to this public health issue, an intervention program dubbed as the "National Thalassemia Plan 2007-2011" was instituted[2]. Currently, various government agencies provide health insurance programs which include the following: the civil servant medical benefit scheme (CSMBS) for government employees, the social security scheme (SSS) for private employees, and the universal health coverage (UC) scheme for farmers as well as for those who do not have any other health insurance coverage. The UC is managed by the National

***Corresponding author:** Faculty of Pharmacy, Mahidol University, 447 Sri-Ayudhya Road, Bangkok 10400, Thailand. Email: pyarp@mahidol.ac.th

Health Security Office (NHSO). In view of the fact that three-fourths of the Thai population is covered by the UC, this scheme is undoubtedly the most important health insurance program. The UC's budget is generally allocated based on the capitation payment method. For patients with high-cost care, this is reimbursed under the disease management program by employing the principle of fee-for-service method[3].

Beta-thalassemia is a chronic illness that regularly requires blood transfusion and iron chelation therapy. Consequently, thalassemia treatment procedures incur high costs. However, the reimbursement is included in the capitation payment. Patients tend to receive limited care from hospitals based on such reimbursement method. Hence, the disease management program with a corresponding fee-for-service financing method is proposed to cover patients with thalassemia. Thereafter, budget information is required for planning and management of the NHSO. Against this backdrop, this study was therefore designed to determine the budget impact of thalassemia management under the NHSO.

MATERIALS AND METHODS

Study design

This study conducted a budget impact analysis (BIA) which estimated the budget impact based on the Principles of Good Practice for Budget Impact Analysis by the International Society for Pharmocoeconomics and Outcomes Research (ISPOR)[4] and the Polish Guidelines for conducting BIA – Financial Analysis[5] (Figure 1). It employed a prevalence-based approach. Furthermore, this study conducted the analysis based from the viewpoint of the National Health Security Office (NHSO) which is the budget administrator of the UC scheme. Consequently, only direct medical costs were taken into account. The study assumed that the cost of thalassemia management can be reimbursed based on the fee-for-service method to encourage the delivery of standard treatment for thalassemia patients. The reimbursement covered drugs, blood, medical devices, medical services, and complications. Other patient's expenditures such as infusion pump, transportation, and opportunity cost were not covered. Moreover, the time horizon was the fiscal year 2007.

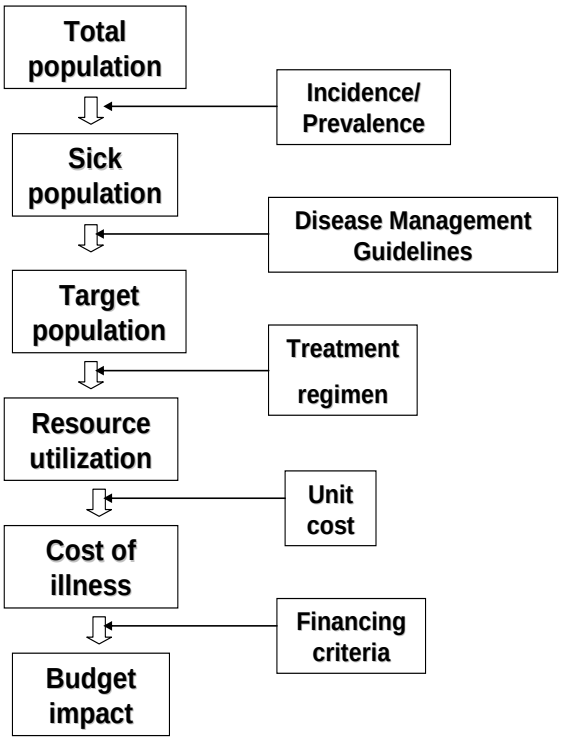

Figure 1. Budget impact analysis model

Target population

The target population was transfusion-dependent beta-thalassemia children aged up to 15 years. The number of beta-thalassemia children was estimated from the prevalence and incidence of thalassemia diseases in Thailand[6-11]. Based on epidemiological estimation, there were 50,265 patients. Thereafter, this was adjusted by the proportion of UC population (74.51%), thus, the number of thalassemia children under the UC scheme was 37,452 cases. This was further classified into homozygous β-thalassemia (1,542 cases) and β-thalassemia/Hb E (35,910 cases).

Scenarios to be compared (treatment regimens)

Two thalassemia treatment scenarios were investigated, namely, conventional treatment and disease management program. Until 2006, thalassemia treatment obtained its budget from UC capitation. This resulted in budget constraints for hospitals or thalassemia patients/parents. For example, physicians considered that patients should receive blood transfusion concurrently with desferrioxamine or deferoxamine (DFO) 20–60 mg/kg/day for 5–7 days a week. Furthermore, serum ferritin should be monitored every 6 months to prevent iron overload. However, thalassemia patients could not always comply because they had no money for infusion pump or transportation payment. Thus, the medication was changed to low blood transfusion which is a suboptimal treatment. There was no deferiprone (L1) used in the conventional treatment. Therefore, the current or conventional thalassemia treatment was somehow suboptimal.

The proposed thalassemia management program was modified from the proposal of the Thalassemia Foundation of Thailand (TFT)[12] to cover the proposed blood and iron chelating agents (Figure 2), and all other required services. It sought to provide fee-for-service reimbursement under the NHSO's disease management program. The proposed treatment regimen involved continuous treatment for erythropoiesis suppression and prevention of organ damage, for example, of the spleen, heart, and liver. Patients who receive high transfusion (>12 times/year) will be treated with single DFO (Package A1: DFO 40 mg/kg/day for 5 days a week) or combination package (Package A2: DFO 40 mg/kg/day for 2 days/week with deferiprone (L1) 70 mg/kg/day every day). In contrast, patients who receive low transfusion (6-12 times/year) will be treated with only the combination package (Package B: DFO 40 mg/kg/dose concurrent with treatment and L1 70 mg/kg/day every day). The patients are annually subjected to laboratory tests to check for hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) for a single time, and ferritin level for 2 times. The TFT estimated the direct medical costs covering blood components, iron chelating agents, and laboratory tests. The proposed cost estimation in the case of high transfusion was 144,510 THB/case/year in patients receiving single DFO (package A1) and 81,110 THB/case/year in patients receiving combination package with local L1 (package A2). In the case of low transfusion, it needed 24,530 THB/case/year in patients receiving combination package with local L1 (package B).

Cost analysis

Baseline data on resource utilization and unit cost were drawn from the study of Riewpaiboon et al[13]. In the fiscal year 2006, this study determined the treatment costs of thalassemia children aged 2–18 years in two teaching hospitals in Bangkok and one public regional hospital. The costs of medical services were calculated by employing CSMBS reimbursement rates[14]. Iron chelating agent prices were obtained from the average prices provided by the drug-medical supply information center of the Ministry of Public Health[15]. The consumer price index (CPI)[16] was used to adjust to the 2007 value. Table 1 presents the unit costs of drugs and medical services.

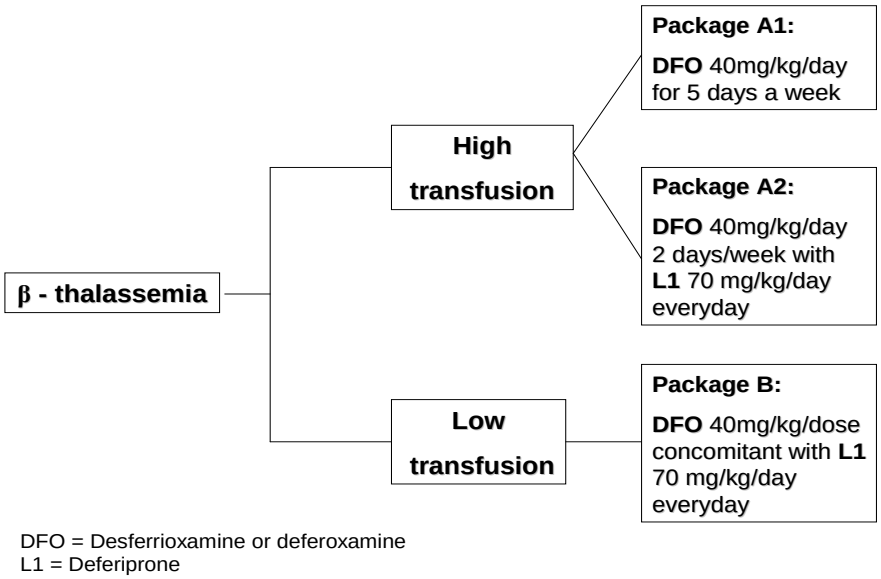

Figure 2. Thalasemia management model

Table 1. Unit cost of drugs and medical services (THB at 2007 prices)

Services	*Unit cost (THB)*
Iron Chelating agents	
Deferoxamine(DFO) 500 mg/ vial	181.9
Deferiprone (L1) 250 mg/capsule	10
Blood components	
Leukocyte poor Packed Red Cell (LPRC)	552.58
Laboratory investigation	
Ferritin	311.46
Hepatitis C virus (HCV)	301.41
Hepatitis B virus (HBV)	180.85
Human immunodeficiency virus (HIV)	140.66
Routine services	
Blood transfusion	150.7
Out patient visit	50.23
Hospitalization day	301.41

Sensitivity Analysis

Iron chelating drugs accounted for a major bulk of the treatment cost. Therefore, drug prices were included in the sensitivity analysis. Based on information from the drug-medical supply information center of the Ministry of Public Health[15], the price of DFO increased by 1.5%, thus bringing it to 184.63 THB/ 500 mg vial. Similarly, imported L1 was supposed to be used instead of locally produced L1. The price increased to around 30 THB/ 250 mg capsule**.**

RESULTS

From the study of Riewpaiboon et al.(201 patients)[13], the β-thal/Hb E patients were transfused with high transfusion (>12 times/ year) for 42.20% and low transfusion (6-12 times/ year) for 57.80%. Among these patients, 71 cases with DFO use were selected. There were β-thal/Hb E 58 cases (81.69%) and homozygous β-thal 13 cases (18.31%). The average age was 9 years old. The number of male and female cases was almost similar. There were 32 (45.07%) cases of β-thalassemia patients who underwent high transfusion and 39 cases (54.93%) for low transfusions. They had splenectomy in 26 cases (36.62%). Moreover, there were no complications in 61 cases (85.92%), as detailed in Table 2. Table 3 shows the service utilization. The patients had at least one physician visit per month (13.32 times/year), and 8 cases (11.27%) were hospitalized. The average frequency of blood transfusion was approximately once a month (12.31 times/ year). Likewise, there were 3 packages of iron chelation therapy that relied on the proposal of the TFT. For the first package (A1), the first single DFO (40 mg/kg/day for 5 days a week), the average DFO 500 mg vial usage was 497 vials a year. For the second (package A2), the combination package for high transfusion (DFO 40 mg/kg/day for 2 days a week concurrently with L1 70 mg/kg/day every day), the average DFO usage was 199 vials a year, and the L1 usage was 1,221 capsules a year. For the third (package B), the combination package for low transfusion (DFO 40 mg/ kg/day concurrently with treatment and L1 70 mg/kg/day every day), the average DFO usage was 24 vials a year, and the L1 usage was 1,221 capsules a year. Table 4 demonstrates the annual average direct medical cost. The cost of conventional treatment (no L1) was calculated based on existing practice from the study of Riewpaiboon et al[13]. They were 49,859 and 32,565 THB/case/year for high and low blood transfusion, respectively. The cost of treatment under the proposed disease management program was calculated based on the scenarios of the proposed blood transfusion and the use of chelating drugs plus other medical services based on existing practice (Table 3). The cost of β-thalassemia management for patients receiving high transfusion with single DFO was 111,210 THB/case/year (package A1); for patients receiving high transfusion and combined with local L1, 72,289 THB/ case/year (package A2); and for patients receiving low transfusion and combined with local L1, 34,246 THB/case/year (package B). When imported L1 (30 THB/ 250 mg) and increased price-DFO (184.63 THB/500 mg) were used, the cost was 102,185 THB/case/year in patients who underwent high transfusion (package A2;s.a.) and 67,942 THB/case/year in patients who underwent low transfusion (package B;s.a.).

In terms of budget calculation, the annual average direct medical costs were multiplied with the number of target patients (Table 5). The budget was presented in Thai baht (THB) at 2007 prices. The exchange rate in 2007 was 1US$=34.56THB[17]. There were 37,452 thalassemia children in the fiscal year 2007. The budget accounted for 1,790,832,819 THB in patients receiving high transfusion with single DFO (package A1), 1,164,090,535 THB in patients receiving high transfusion and combined with local L1 (package A2), and 731,128,298 THB in patients receiving low transfusion and combined with local L1 (package B). The total budget for the thalassemia management program was divided into 2 programs. In Program 1, the patients received high transfusion with single DFO and low transfusion with a combination of iron chelators (DFO+L1), while the global

budget was 2,521,961,117 THB (package A1+B). In Program 2, both high and low-transfused patients received a combination of iron chelators (DFO+L1), and the global budget was 1,895,218,833 THB (package A2+B). Table 5 shows the effect of drug prices. When the prices of DFO and L1 increased, these affected package A2 and B. The total budget was 3,241,333,664 THB and 3,096,012,083 THB for Program 1 (package A1+B;s.a.) and Program 2 (package A2;s.a.+B;s.a.), respectively. The budget increased by 29% and 63% for programs 1 and 2, respectively. The total budget for the conventional treatment (high transfusion+low transfusion) was 1,498,135,123 THB. After shifting from the conventional treatment to Program 1 and Program 2 of the disease management program, the budget increased by 68% and 27%, respectively.

Table 2. Characteristics of thalassemia patients

Category	Homozygous β-thal		β-thal/Hb E		Total	
	Number	%	Number	%	Number	%
Number of patients	13	18.31	58	81.69	71	100.0
Age (year); mean (SD)	9 (3.7)		10 (2.9)		9 (3.0)	
Gender (N=71)						
Male	5	7.04	32	45.07	37	52.11
Female	8	11.27	26	36.62	34	47.89
Blood transfusion (N=71)						
Low (6-12 times/year)	5	7.04	34	47.89	39	54.93
High (> 12 times/year)	8	11.27	24	33.80	32	45.07
Splenectomy* (N=71)						
Yes	8	11.27	18	25.35	26	36.62
No	5	7.04	40	56.34	45	63.38
Complications* (N=71)						
Yes	2	2.82	8	11.27	10	14.08
No	11	15.49	50	70.42	61	85.92

Note * prevalence

Table 3. Average service utilization classified by patient characteristics and type of services

Category	Out-patient services; visits	Hospitali-zation		Blood transfusion; times/year	Package A1	Package A2 (High transfusion)		Package B (Low transfusion)	
		No.	%		DFO; vials	DFO; vials	L1; capsules	DFO; vials	L1; capsules
β-thalassemia disease									
Homozygous β-thal (n=13)	14.46	-	-	13.31	464.00	185.62	1,140.08	22.92	1,140.08
β-thal/Hb E (n=58)	13.07	8	11.27	12.09	504.16	201.79	1,238.78	23.31	1,238.78
Type of blood transfusion									
Low (6-12 times/year) (n=39)	11.41	5	7.04	9.87	n/a	n/a	1,294.28	20.15	1,294.28
High (> 12 times/year) (n=32)	15.66	3	4.23	15.28	460.25	184.25	1,131.05	n/a	1,131.05
Complications									
Yes (n=10)	15.20	1	1.41	12.70	516.90	206.60	1,269.94	25.70	1,269.94
No (n=61)	13.02	7	9.86	12.25	493.51	197.56	1,212.64	22.84	1,212.64
Mean(n=71)	13.32			12.31	496.8	198.83	1,220.71	23.24	1,220.71
Median	13			12	489	196	1,201.90	23	1,201.90
Standard deviation	3.48			3.5	128.76	51.51	316.17	7.91	316.17
95%Confidence Interval									
Lower	12.5			11.48	466.33	186.64	1,145.87	21.37	1,145.87
Upper	14.15			13.14	527.28	211.02	1,295.55	25.11	1,295.55

[1] per hospitalized patient per year, [2] per total patients per year
DFO = Desferrioxamine or deferoxamine, L1 = Deferiprone

Table 4. Annual aver age direct medical costs of thalassemia (THB at 2007)

Scenarios	Average costs (THB)						
	Routine[1]	**Investigation**	**Blood**	**Chelators**[2]	**Complication**	**Others**[3]	**Total**
Conventional treatment							
High transfusion	3,298.22	3,500.73	9,100.34	26,966.68	1,907.60	5,085.30	49,858.87
Low transfusion	2,142.06	2,912.58	6,453.23	17,644.30	200.56	3,212.70	32,565.44
Disease management program							
Package A1	3,323.34	4,133.06	13,050.04	83,710.38	1,907.60	5,085.30	111,209.72
Package A2	3,323.34	4,133.06	13,050.04	44,790.03	1,907.60	5,085.30	72,289.37
Package B	2,194.87	3,616.39	8,430.42	16,591.15	200.56	3,212.70	34,246.09
Sensitivity analysis							
Package A2;s.a.	3,323.34	4,133.06	13,050.04	74,686.00	1,907.60	5,085.30	102,185.34
Package B;s.a.	2,194.87	3,616.39	8,430.42	50,286.60	200.56	3,212.70	67,941.54

[1] Routine services at out and in-patient departments, [2] Iron chelating agents: DFO and combination package (DFO + L1)
[3] Others: other drugs and medical supply
s.a. = sensitivity analysis

Table 5. Annual budget of direct medical cost for beta-thalassemia children in Thailand in 2007 (THB)

Scenarios	Budget (THB)						
	Routine[1]	Investigation	Blood	Chelators[2]	Complication	Others[3]	Total
Conventional treatment							
High transfusion	53,111,982	56,373,022	146,544,578	434,249,832	30,718,534	81,889,540	802,887,488
Low transfusion	45,731,391	62,181,493	137,771,660	376,692,552	4,281,789	68,588,749	695,247,635
Disease management program							
Package A1	53,516,417	66,555,503	210,147,439	1,348,005,213	30,718,469	81,889,616	1,790,832,819
Package A2	53,516,417	66,555,503	210,147,439	721,262,930	30,718,469	81,889,616	1,164,090,535
Package B	46,858,826	77,207,210	179,983,135	354,208,590	4,281,805	68,588,732	731,128,298
Sensitivity analysis							
Package A2;s.a.	53,516,417	66,555,503	210,147,439	1,202,683,793	30,718,469	81,889,616	1,645,511,238
Package B;s.a.	46,858,826	77,207,210	179,983,135	1,073,581,137	4,281,805	68,588,732	1,450,500,845

[1] Routine services at out and in-patient departments, [2] Iron chelating agents: DFO and combination package (DFO + L1)
[3] Others: other drugs and medical supply
s.a. = sensitivity analysis

DISCUSSIONS

This study's budget impact analysis covered all medical services including drugs, blood, out-patient services, in-patient services, laboratory investigation, and treatment of complications. We assumed that the complete service reimbursement would improve the quality of the treatment. The comparison that we conducted found a difference with the original proposal of the TFT that dealt with chelating drugs only and some laboratory investigations. The TFT estimated the direct medical costs specific to blood components, iron chelating agents, and laboratory tests. The proposed cost estimation in the case of high transfusion was 144,510 THB/case/year in patients receiving single DFO (package A1) and 81,110 THB/case/year in patients receiving the combination package with local L1 (package A2). In the case of low transfusion, it needed 24,530 THB/case/year for patients receiving the combination package with local L1 (package B). From these estimations, we found both over and under estimation of the TFT in comparison to those of our analyses. From our analyses regarding summation of investigation, blood, and chelators as shown in Table 4 (similar to the proposal of the TFT), the cost of single DFO was 100,893 THB/case/year (package A1) (-30% as compared to the TFT's estimation), when the cost of combined on iron chelation package was 61,973 THB/case/year (-24% comparing to the TFT's estimation) in case of local L1 (package A2). On the other hand, the costs of low transfusion were higher than the proposed costs of the TFT. The cost of the combination package was 28,638 THB/case/year (+17% as compared to the TFT's estimation) in the case of local L1 (package B).

It was found that there was a difference in the forecasted service utilization by the TFT and the real life practice used in our study. Considering the average service utilization in real life (Table 3), patients receiving high transfusion visited as out-patients for 15.66 times a year, and they were hospitalized in three cases. Furthermore, the average blood transfusion was 15.28 times a year. Patients were treated with single DFO; DFO usage was about 461 vials a year. For combined drugs, DFO usage was 185 vials a year, and L1 usage was 1,132 capsules a year. Furthermore, patients receiving low transfusion with the combination package had 11.41 out-patient visits, a year and they were hospitalized in 5 cases. The average blood transfusion was 9.87 times a year. DFO usage was 21 vials a year, and L1 usage was 1,132 capsules a year. The medical resource utilization proposed by the TFT estimated that patients receiving high transfusion will be transfused and visit hospitals as out-patients at least 17 times a year. Patients were treated with single DFO; DFO usage was 650 vials a year. For combined drugs, DFO usage was 260 vials a year, and L1 usage was 1,460 capsules a year. In contrast, patients receiving low transfusion with the combination package will receive transfusion and visit hospitals as outpatients at least 6 times a year. DFO usage was 20 vials a year, and L1 usage was 1,460 capsules a year. In summary, the medical service utilization proposed by the TFT was more than that of real life practice in patients receiving high transfusion, while less than that of real life practice in patients receiving low transfusion.

From the results, the possibility of providing the necessary budget was crucial. Considering the limited country budget, however, the financing of the thalassemia management program in Thailand was questionable. To control the total thalassemia budget, there were two possibilities: limiting the number of patients and limiting the scope of reimbursable medical services. In this study, we focused on the latter option. The cost composition was divided into iron chelating agents, blood, medical devices, medical services, complications, other drugs (excluding iron chelating agents), and routine service costs. The proportion of chelator cost to the total cost in Table 4 for all scenarios was approximately 50 - 75%. Therefore, the cost of iron chelating agents should be the key priority for reimbursement consideration.

The study's findings should be interpreted in light of several limitations. Primarily, epidemiological data on thalassemia in Thailand have not been well established. The number of living patients used in this study was derived from the literature review so this may not accurately reflect actual data. Certainly, the life expectancy of living thalassemia patients might have also increased because of the improved quality of treatment.

Conclusions

From existing conventional practice to the thalassemia management program, the budget increased by 27% to 68%-from 1.9 to 2.5 billion THB per year. Moreover, the prices of iron chelating agents had a significant effect on the budget. Results from the budget impact analysis were different from the proposed estimation by -30% to +17%. This was significant, and therefore, the budget impact analysis is crucial for the country's budget management.

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DECLARATIONS

Conflict of interest

The authors declare that they have no conflicts of interest to disclose.

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