Costs of School Scoliosis Screening: A Large Population-based Study

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ABSTRACT

Study Design. This was a population-based retrospective study.

Objective. To fully estimate the costs of the Hong Kong scoliosis screening program through a large, population-based study.

Summary of Background Data. School screening for scoliosis has often been criticized for having high costs. In fact, the screening cost that has reported varied widely, from less than 1 to more than 30 US dollars per child screened. This variation is mainly due to the incomplete inclusion of cost items.

Methods. We examined the screening and medical histories of a cohort of 115,190 screened students who were in grade 5 in 1995/96 or 1996/97. The average costs spent on screening, diagnosing, following and treating this cohort of students were calculated.

Results. The total expenses in the screening centers increased steadily from USD 380,930 in 1995/96 to USD 2,417,824 in 2005/06. Based on the 115,190 students who were followed until they were 19 years old or they left school, the costs of screening and diagnosing one student during adolescence were USD 17.94 and USD 2.08, respectively. Of the 1,311 referrals who attended the specialist hospitals for diagnosis, 264 and 39 had been braced and operated on, respectively. The medical care cost averaged USD 34.61 per student screened. The cost of finding one student with a

curvature ≥20° and one treated case were USD 4,475.67 and USD 20,768.29 respectively.

Conclusion. This was the largest study that has evaluated school scoliosis screening on students who were followed during their adolescence and accounted for all relevant costs. The cost per student screened in the scoliosis screening program in Hong Kong was comparable to that in Rochester, which had a similar protocol and was evaluated in a similar manner. The estimated costs can help the policy makers when they allocate healthcare resources.

Key words: Scoliosis screening; Cost; Adolescent idiopathic scoliosis.

Key points

- All studies, except one, in the literature did not adequately estimate the costs of school scoliosis screening, by either not accounting for all relevant costs or by not sufficiently following students.
- Based on a large cohort of students who were followed until skeletal maturity, the costs of screening and induced medical care in the Hong Kong scoliosis screening program were estimated.
- The screening cost of the Hong Kong program, although it included the

additional use of moiré topography, was highly comparable with that of the only other study that followed students up to skeletal maturity.

MINI ABSTRACT

The cost of the scoliosis screening program in Hong Kong was estimated by sufficiently following all screened students and accounting all relevant costs. With the additional use of moiré topography, the cost per student screened was comparable to that of the only study which was evaluated in a similar manner.

INTRODUCTION

School screening for adolescent idiopathic scoliosis (AIS) remains controversial. A main concern was the high screening cost due to unnecessary follow-up of students with insignificant curves.[1, 2] Although the clinical benefits of scoliosis screening may not be directly transferable to monetary terms,[3] screening cost is inevitably an important consideration to policy makers for planning healthcare resources. Many studies have estimated the cost of a scoliosis screening program, but no definite conclusion has been made.[4-12] The cost estimation in these studies varied in many aspects, especially in the cost items that were included. For the Minnesota screening program, USD 0.06 per student screened was spent for mail, workshops, and the salary of a part-time nurse coordinator.[5] For the "Thriasio" screening program in Greece, the cost was 2.04 euro (approximately USD 1.81) per student, but only the costs for the salary and the screeners were accounted for.[4] Some have argued that, in addition to these cost items, the costs for the training of screeners, monitoring, follow-up, diagnostic tests, the treatment of students, and opportunity costs should also be included.[3] With the inclusion of these costs, Thilagaratnam estimated that the screening cost in Singapore was SGD 23.37 (approximately USD 13.61) per student.[10]

On the other hand, most evaluations of routine screening programs were

performed cross-sectionally on students who were screened within a defined time period[5] or did not incorporate follow-up information on students until their skeletal maturity.[10] These evaluations would not provide a realistic cost estimate for school scoliosis screening. The only exception was a Rochester study on 2,197 screened students who were followed until the age of 19 years.[12] It estimated the cost per student screened was USD 34.40 and included costs for screening, diagnosis and medical care. Unfortunately, the sample size was small, and only 16 students who had a curvature $\geq 20^{\circ}$ were identified. A larger scale evaluation would be desirable to ensure a realistic and reliable cost estimate.

In Hong Kong, a school screening program for AIS was initiated in 1995. With over ten years of screening history, we aimed to estimate the costs of school scoliosis screening by investigating all the relevant costs that are spent on the screened students as well as the medical care costs that are induced by the program.

MATERIALS AND METHODS

School Scoliosis Screening Program

Details of the scoliosis screening program in Hong Kong have been reported elsewhere (*Unpublished manuscript.* Luk KDK, Lee CF, Cheung KMC, et al. Clinical effectiveness of school screening for adolescent idiopathic scoliosis: A large

population-based retrospective cohort study, 2008). Briefly, the screening program consists of two voluntary tiers and is part of the Student Health Service (SHS) that has been provided by the Department of Health (DH) since 1995. The first tier screening was conducted in a Student Health Service Centre (SHSC), while the second tier was conducted in a Special Assessment Centre (SAC). There were nine SHSCs in 1995/96, but three SACs and two SHSCs started service in 1996/97, with an additional SHSC in 1998/99. Students in grades 5, 7 and 9 were screened regularly by doctors using the forward bending test (FBT) and the measure of the angle of trunk rotation (ATR).[13, 14] Since 2001/02, students in grade 4 were also screened routinely by nurses if they were aged 10 years or older. Depending upon the results, they could be re-screened more frequently by nurses, referred to a SAC, or referred directly to a specialist hospital. In the SAC, students were observed for clinical signs of scoliosis and assessed by ATR and moiré topography.[15] Students with an ATR $\geq 15°$, ≥ 2 moiré lines, or significant clinical signs would have X-ray taken and were referred to a specialist hospital if a curvature $\geq 20°$ was detected.

Cost Estimation

The cost of the Hong Kong scoliosis screening program was broken down into screening, diagnostic, and medical care costs. Screening costs included those spent on the screening program per se, which were totally borne by the screening centers.

Diagnostic costs were the expenses on X-ray assessments in the SAC or the specialist hospitals. The diagnostic costs in the SAC included all X-ray related expenses, while those in the specialist hospitals included those spent on out-patient visits and the corresponding X-ray assessments of students until they reached a curvature ≥20°. Medical care costs were the expenses on follow-up and treatment in the specialist hospitals for students diagnosed with AIS with a curve ≥20°.

Table 1 details the cost items spent in the screening centers. The corresponding unit costs were obtained from the DH. The costs were divided into staff, material, and training. Staff can be administrative, clinical, and technical. The administrative staff made appointments, referred students, and arranged students when they visited the screening centers. The clinical staff included the doctors and nurses who performed screening or interpreted the screening results. The technical staff operated the moiré and X-ray machines and produced the moiré photos and X-ray films. Since the scoliosis screening was part of a general health assessment, the staff costs for scoliosis screening were obtained by estimating the staff time spent on scoliosis screening on a pro rata basis. Material costs included consumables and the maintenance of the moiré and X-ray machines. Training costs were estimated from the time spent on training clinical staff.

An annual breakdown of the costs was reported. In addition, we considered a

cohort of screened students who were in grade 5 in 1995/96 or 1996/97. Their screening and medical records until they were 19 years old were retrieved and were used to estimate the screening, diagnostic, and medical care costs per student screened and per case finding.

Exchange rate and Inflation rate

Unless otherwise stated, all costs presented were expressed in 2005 US dollars to ease comparisons with other countries. The exchange rate was pegged at USD 1 = HKD 7.75 to 7.85 by the Linked Exchange Rate System since 1983.[16] Therefore, an exchange rate of 7.8 was used.

The Hong Kong Consumer Price Index was 100.4 in 1995 (relative to the base of 100 for the reference period of October 2004 to September 2005), increased to 116.2 in 1998, followed by a decrease to 99.4 in 2004, and raised again to 100.3 in 2005.[17] As there was no systematic trend of inflation during the study period, no adjustment for inflation was made in the estimated costs in Hong Kong.

RESULTS

From 1995/96 to 2005/06, 1,879,591 sessions of FBT/ATR were performed in the SHSC with 1,197,790 (63.7%) conducted by doctors and 685,801 (36.3%) by nurses. The estimated costs of one FBT/ATR session were USD 4.72 by a doctor and

USD 1.90 by a nurse. In 188,666 (10.0%) sessions, students were referred for further screening or management, with an average referral cost of USD 0.92. In this 11-year period, the sum of other administrative, material, and training costs per year ranged from USD 139,636 to USD 186,182.44. As a result, the screening cost in the SHSC increased from USD 380,929.87 to USD 1,145,693.85, which resulted in a total of USD 9,082,211.79 during the entire period.

In the SAC, the estimated cost of one session of ATR and observation of clinical signs by a doctor was USD 7.87, while one session of moiré topography and X-ray examination cost USD 23.42 and USD 35.10, respectively. Note the SAC started its service in 1996/97, since it was only responsible for the second tier screening. From 1996/97 to 2005/06, 149,354 ATR and 128,614 moiré topography sessions were performed, and 30,681 X-ray examinations were taken. They consumed USD 7,446,051.67 in total, which included an increase from USD 348,903.08 to USD 1,272,129.62.

Consequently, the costs borne by the screening centers amounted to USD 16,528,263.46. An annual breakdown is shown in Figure 1(a). The annual cost of FBT/ATR by doctors constituted a substantial portion (45.8% in 1996/97 to 27.6% in 2005/06), while that of moiré topography had an increasing share of the annual total cost (6.9% in 1996/97 to 25.5% in 2005/06). The inflation of annual total cost

was mainly attributed to the increased costs of screening by nurses in the SHSC and moiré topography, which were in turn due to the increased number of students as depicted in Figure 1(b). A sharper inflation in the numbers of students who were screened by nurses can be observed in 2001/02, which resulted in a higher increase in the cost. This was due to the addition of routine screening for grade 4 students aged 10 years or above.

To estimate the total cost spent on the cohort of 115,190 students who were in grade 5 in 1995/96 or 1996/97, the unit costs for a brace and a surgery treatment were first determined. For a brace treatment, an average of USD 2,360.13 per patient would be consumed in each of the first three years, including the costs of out-patient follow-up, X-ray, physiotherapy, consultations from orthotist, social worker and clinical psychologist, and the brace. In each subsequent year, the patient would be followed-up three times at a cost of USD 469.23. For a surgery, the cost varied widely with the costs of surgeon and implant, but the minimum was USD 25,641.03 in the first year for X-ray, implant, surgeon, anesthetic, physiotherapy, consultations from social worker and clinical psychologist, and ward stay. The costs for the second and third years were USD 831.54 and USD 440.77, and that for each subsequent year was USD 312.82 for two follow-up visits. Hence, for a 5-year period, a brace treatment and a surgery treatment would cost USD 8,018.85 and USD 27.538.97,

respectively (Figure 2). If, however, an AIS patient was both braced and operated, the cost would be lower than the total of their individual costs since there would be overlap in resources. The average cost for the treatments and 5-year follow-up after the last treatment was estimated to be USD 32,274.74.

Table 2 summarizes the total cost spent on the cohort. The cost borne by the screening centers was USD 2,296,899.49. A total of 1,512 students were referred to a specialist hospital, but only 1,311 (86.7%) attended. They made 59 visits before the detection of a curvature ≥20°, and 4,209 visits after the diagnosis of a curvature ≥20° but before treatment or until last followed, and 303 cases were eventually treated. The total treatment cost was USD 3,328,332.69, or USD 10,984.60 per student treated. The average cost of screening, diagnosis, and medical care per student screened was USD 54.63. The cost of finding one student with a curvature ≥20° was USD 4,475.67, and the cost for finding one treated student was USD 20,768.29.

There were only six cost evaluation studies of a scoliosis screening program in the literature that have reported enough details to allow for a comparison with the screening program in Hong Kong (Table 3). The screening cost in Hong Kong was relatively higher but highly comparable with that of the screening program in Rochester, which was the only other program that evaluated students who were

followed until they were 19 years old.

DISCUSSIONS

In this study, we have estimated the cost of the school scoliosis screening program in Hong Kong from the institutional perspective. The cost spent by the screening centers increased from USD 380,929.87 in 1995/96, when the program was implemented, to USD 2,417,823.59 in 2005/06. In a large cohort of 115,190 screened students who were followed to the age of 19 years, the average cost of screening one student for the whole adolescent period was USD 17.94. When the diagnostic cost was included, the cost was USD 20.02 per student screened. When the medical care cost was also included, it was USD 54.63 per student screened

The cost per student screened of the Hong Kong program appeared to be higher than that reported in other studies. However, cost estimates from most of these studies are not directly comparable to ours, and some of them had indeed underestimated the costs. First, some studies did not fully account for the salary of the screeners. For instance, in the Minnesota program, only one salaried part-time nurse coordinator was accounted for, but the costs of the school staff who performed the screening were not considered.[5] In the program in Oakland County, only one paid staff was considered in the cost evaluation, but costs for the voluntary screeners

and physical education teachers were omitted.[8] In all cases, human resources were utilized for the screenings, and they should be counted as opportunity costs whether or not they were paid. Second, unlike the Hong Kong program that regularly screened each student three times, some programs screened each student only once and did not follow-up on any students without an initial indication of AIS.[4, 6, 8] This would certainly lower the cost of screening, but this also inevitably increased the chance of missing any late-developing curves. Although the Minnesota program screened each student more than once, its cost was evaluated based on merely one year of cross-sectional data.[5] This only estimated the screening cost per student for the particular year rather than the whole adolescent period. Third, unlike other screening programs that employed part-time nurses or even non-clinical workers as screeners,[4, 5, 8] the screeners in the Hong Kong program were full-time clinical professionals. A recent systematic review of studies on the clinical effectiveness of school scoliosis screening by the authors (Fong DYT, Lee CF, Cheung KMC, et al. A meta-analysis of the clinical effectiveness of school scoliosis screening, 2009. To be appeared in SPINE) revealed that 2 out of 34 studies identified used trained volunteers for screening. In fact, the most expensive part of the screening program was the manpower time cost. Last, many studies did not account for the relevant expenses, especially medical care costs, for students over the period of time until

they reached their skeletal maturity.[6, 10] Since adolescence is a high risk period for developing scoliosis, insufficient coverage of that time would underestimate the costs.

Nevertheless, our estimated cost per student screened in Hong Kong was essentially the same as that in Rochester. The Rochester program was the only one that had costs evaluated by following the complete screening and medical history of students during their adolescent period and had the screening, diagnostic and medical care costs included. It utilized the FBT/ATR as the screening tests, while the Hong Kong program also used moiré topography in the second tier. In Hong Kong, the moiré topography was respectively five and twelve times more expensive than the other two tests, and accounted for 11.69% of the cost spent on the cohort borne by the screening centers. A possible explanation of the fact that the addition of expensive screening test resulted in a similar cost estimate is the screening compliance. Specifically, participation in the Hong Kong program was voluntary, and students may not have attended all the scheduled visits. Due to limitation of data, the compliance in the two programs could not be directly compared. Nevertheless, it is encouraging to observe that the Hong Kong program was better able to predict significant curves. Taking this into consideration, our program appeared to be more cost-efficient.

In Hong Kong, the annual expenses in the screening centers showed a trend towards increasing since the implementation of school scoliosis screening. Although the cost of regular screening by doctors in the SHSC was consistently significant in absolute amount, its proportion actually decreased from 45.8% in 1996/97 to 27.6% in 2005/06. The increasing number of follow-up screenings, including those students who were re-screened by nurses in the SHSC and those by the second tier tests in the SAC, contributed to the higher expenses. According to the screening protocol, students with an initial indication of scoliosis would be re-screened more frequently until they were referred to a specialist hospital or they left school. With only ten years of data so far and the fact that the students would take nine years before they left school, students undergoing re-screening have been generally accumulating, thereby increasing the costs. However, this increasing trend should cease when the initial students begin to graduate. By then, the screening cost is expected to be stabilized.

The ultimate goal of scoliosis screening is to reduce the operation rate by administering conservative treatments, such as bracing. Thilagartnam estimated that, based on the Singapore screening program, even if 65% of the braced students would have required surgery had they not been braced, the cost saved from preventing the need for surgery could offset the costs of screening and follow-up.[10]

In Hong Kong, the cost of a surgery was at least USD 19,520.13 more costly than a brace treatment for the first five years. The difference would be similar in subsequent years (Figure 2), but would be larger if the operated subject developed other health complications. The costs spent on screening, diagnosis, and pre-treatment follow-up in our cohort totaled USD 2,964,458.46, which could be compensated for if just 152 students or more had bracing that eliminated the need for surgery.

In this study, we only considered the costs from the institutional perspective but not the community perspective. However, the community costs that were measurable should be negligible. First, the SHS in Hong Kong was free-of-charge to the students. Second, medical services in the specialist hospitals were subsidized by the government. Patients were only required to pay USD 7.69 for each out-patient visit and USD 8.72 per day for ward stay after an operation. Third, students were generally appointed to the screening centers that were closest to the districts of their homes or schools, and public transportation was highly affordable. Therefore, the transportation cost to the students and parents should be highly bearable. Consequently, the costs would not change much had these community costs been considered. On the other hand, there were other community costs implicitly incurred by the screening program. They included the opportunity costs to

the parents or other family members taking time off from work for bringing their children to a screening center and the psychological cost for a normal child entering the medical world with anxiety about the diagnosis of scoliosis. Unfortunately, these costs cannot be quantified and can hardly be estimated. Therefore, they were not considered in this study.

Hong Kong has a dense population with a culture that may not be shared in other places. However, the way of estimating the cost, for example, the inclusion of the screening, diagnosis and medical care costs, and the consideration of the opportunity cost rather than the salary of the screeners, may be adopted in evaluating the costs of scoliosis screening programs in other places.

School scoliosis screening has been criticized as having high costs due to unnecessary referrals for radiography or follow-up of students who do not require observation or treatment.[1, 2] This study showed that the high costs lie mainly in the manpower for screening and follow-up until the age of 19 years. Fortunately, the Hong Kong screening program has been subsidized by the government. The Hong Kong scoliosis screening program has been previously shown to be more effective than others in identifying students that needed follow-up at a low referral rate. Hence, the screening protocol in Hong Kong appeared to be more clinically effective without an obvious increase in expenses when compared with other existing

screening protocols. However, clinical effectiveness and cost of screening are important, but not the only, considerations for implementing a scoliosis screening program. The effectiveness of bracing in preventing surgery is another concern. Two ongoing randomized controlled trials may likely shed light on the efficacy of bracing.[18, 19] On the other hand, efforts have been made to identify the genetic effect in AIS.[20] Future genetic screening may result in fewer screening visits and fewer X-rays. Moreover, it may also enable the discrimination of progressive curves from non-progressive curves; thereby it clarifies the need and the timing of bracing. Nevertheless, the reported cost estimates in this study are highly relevant to policy makers for the allocation of healthcare resources.

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Figure legends

Figure 1. (a) Costs spent by the screening centers (Student Health Service Centre [SHSC] and Special Assessment Centre [SAC]) (b) Number of students screened from the 1995/96 to 2005/06 academic years

Figure 2. Cumulative costs spent by the specialist centers by treatment type.

Table 1. Estimation of different cost items in the Student Health Service Centres (SHSCs) and the Special Assessment Centres (SACs).

Center	Category	Cost item	Cost estimation
SHSC	Staff cost	Screening by doctors	Time per session (3 min) × Screening staff cost per minute (USD 1.57) × No. of students screened
		Screening by nurses	Time per session (3 min) × Screening staff cost per minute (USD 0.63) × No. of students screened
		Referring students to SAC or clinic	Time for referring one student (3 min) × Administrative staff cost per minute (USD 0.26) × No. of referral cases
		Appointment & Reception	Administrative staff cost per year (USD 22,333.85) × Workload on scoliosis screening (55%) × No. of SHSCs
	Material cost	Referral letters	Cost of one letter (USD 0.13) × No. of referral cases
	Training cost	Training new doctors for screening	Training cost per doctor (USD 283.23) × No. of new doctors per year
		Training new nurses for screening	Training cost per nurse (USD 133.08) × No. of new nurses per year
SAC	Staff cost	Screening of ATR and clinical signs	Time per session (5 min) × Screening staff cost per minute (USD 1.57) × No. of students screened
		Performing moiré topography	Time per session (10 min) × Technical staff cost per minute (USD 0.63) × No. of students screened moiré topography
		Interpreting moiré result	Time per session (10 min) × Screening staff cost per minute (USD 1.57) × No. of students screened moiré topography
		Performing X-ray	Time per session (12 min) × Technical staff cost per minute (USD 0.98) × No. of students X-rayed
		Interpreting X-ray result	Time per session (10 min) × Screening staff cost per minute (USD 1.57) × No. of students X-rayed
		Darkroom technician	Technical staff cost per year (USD 28,986.41) × Workload on scoliosis screening (99%)
		Referring students to clinic	Time for referring one student (3 min) × Administrative staff cost per minute (USD 0.26) × No. of referral cases
		Appointment & Reception	Administrative staff cost per year (USD 43,675.08) × Workload on scoliosis screening (40%) × No. of SACs
	Material cost	Moiré films and processing	Cost of one moiré photo (USD 1.35) × No. of students screened moiré topography
		Maintenance of moiré machine	Maintenance cost per year (USD 44.87) × No. of moiré machines
		X-ray films, chemicals and processing	Cost of one X-ray photo (USD 1.41) × No. of students screened X-ray
		Maintenance of X-ray machine	Maintenance cost per year (USD 15,719.23) × No. of X-ray machines × Usage on scoliosis screening (99%)
		Referral letters	Cost of one letter (USD 0.13) × No. of referral cases
	Training cost	Training new doctors for screening	Training cost per doctor (USD 1,132.93) × No. of new doctors per year
		Training new clinical staff for screening	Training cost per clinical staff (USD 304.19) × No. of new clinical staff per year

Table 2. Estimation of costs spent on the cohort of 115,190 students.

Type of cost	Cost item	Number of visits/students	Total cost spent, in USD (%)	Cost per student screened, in USD
Screening cost	Student Health Service Centre			
	Screening by doctor	179,641 visits	848,004.21 (41.0)	
	Screening by nurse	52,719 visits	100,230.15 (4.8)	
	Other screening costs		403,446.48 (19.5)	
	Special Assessment Centre			
	ATR/Clinical signs	15,359 visits	120,838.20 (5.8)	
	Moiré topography	11,465 visits	268,495.42 (13.0)	
	Other screening costs		325,685.57 (15.8)	
	Subtotal		2,066,700.03 (100)	17.94
Diagnostic cost	Special Assessment Centre			
	X-ray taken	3,158 visits	91,415.12 (38.2)	
	Other diagnostic costs		138,784.32 (58.0)	
	Specialist hospital			
	Out-patient visits	59 visits	9,228.21 (3.9)	
	Subtotal		239,427.65 (100)	2.08
Medical care cost	Specialist hospital			
	Pre-treatment follow-up visits	4,209 visits	658,330.77 (16.5)	
	Brace only	264 students	2,116,975.38 (53.1)	
	Surgery only	10 students	275,389.74 (6.9)	
	Both brace and surgery	29 students	935,967.56 (23.5)	
	Subtotal		3,986,663.45 (100)	34.61

Table 3. Screening costs of the Hong Kong school scoliosis screening program and of other countries reported in the literature.

Type of costs considered	City / Country	Screening Period	Number of students screened	Cost† in USD	
				Total	Per student screened
Screening cost only	Hong Kong, China	1995-2005	115,190	2,066,700	17.94
	Minnesota, US[5]	1979-1980	255,707	39,283	0.15
	Western Attica, Greece[4]	2000-2006	6,470	12,840	1.98
Screening cost + Diagnostic cost	Hong Kong, China	1995-2005	115,190	2,306,128	20.02
	Oakland County, Michigan, US[8]	1978-1990	12,703	130,611	10.28
Screening cost + Diagnostic cost + Medical care cost	Hong Kong, China	1995-2005	115,190	6,292,791	54.63
	Singapore[10]	1999-2001	45,485	642,733	14.13
	Quebec, Canada[6]	1977-1978	29,195	543,378	18.61
	Rochester, Minnesota, US[12]	1984-1994	2,197	119,100	54.21

† All costs were adjusted for inflation[21-25] and converted to US dollars in 2005.[26]

Figure 1 (a)

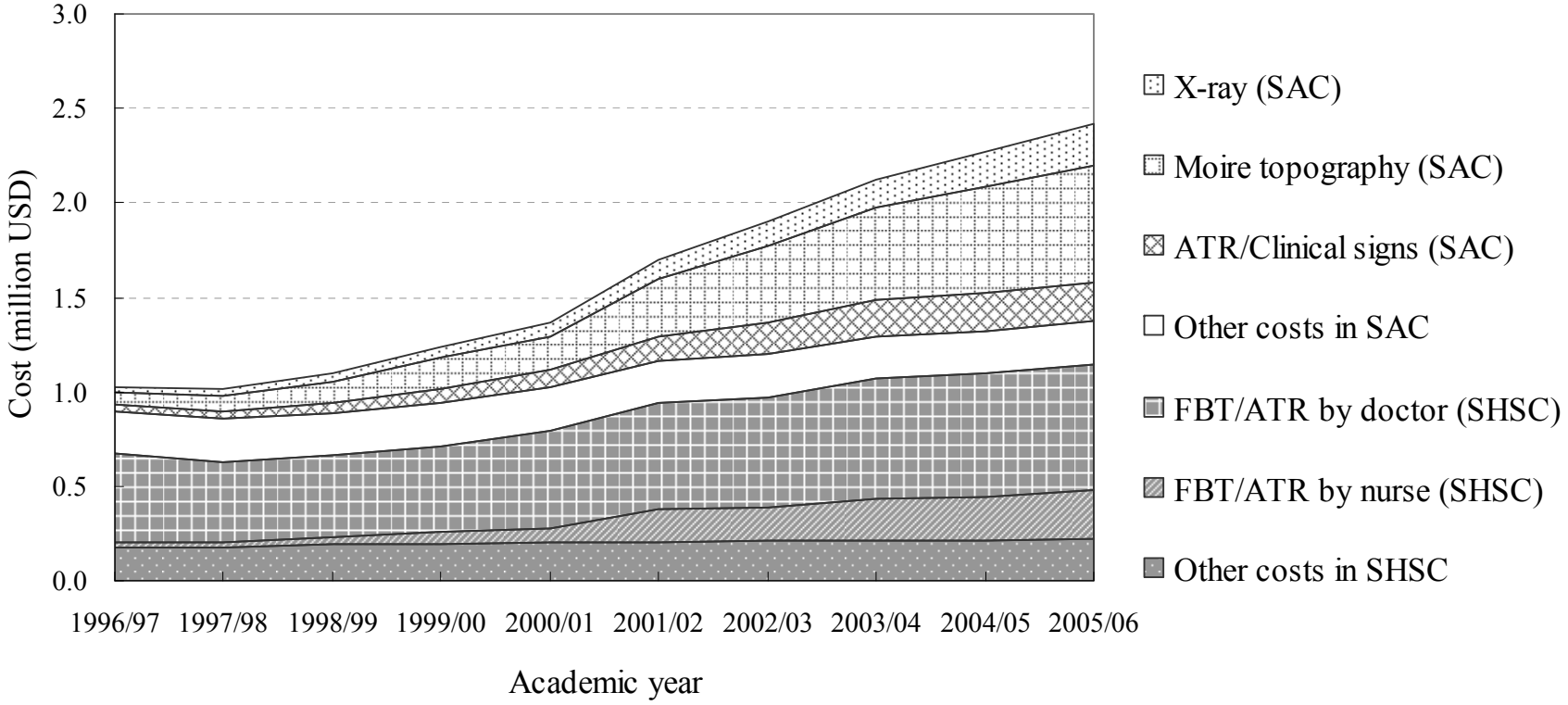

3.0
2.5
2.0
1.5
1.0
0.5
0.0
Cost (million USD)
1996/97
1997/98
1998/99
1999/00
2000/01
2001/02
2002/03
2003/04
2004/05
2005/06
Academic year
X-ray (SAC)
Moire topography (SAC)
ATR/Clinical signs (SAC)
Other costs in SAC
FBT/ATR by doctor (SHSC)
FBT/ATR by nurse (SHSC)
Other costs in SHSC

Figure 1(b)

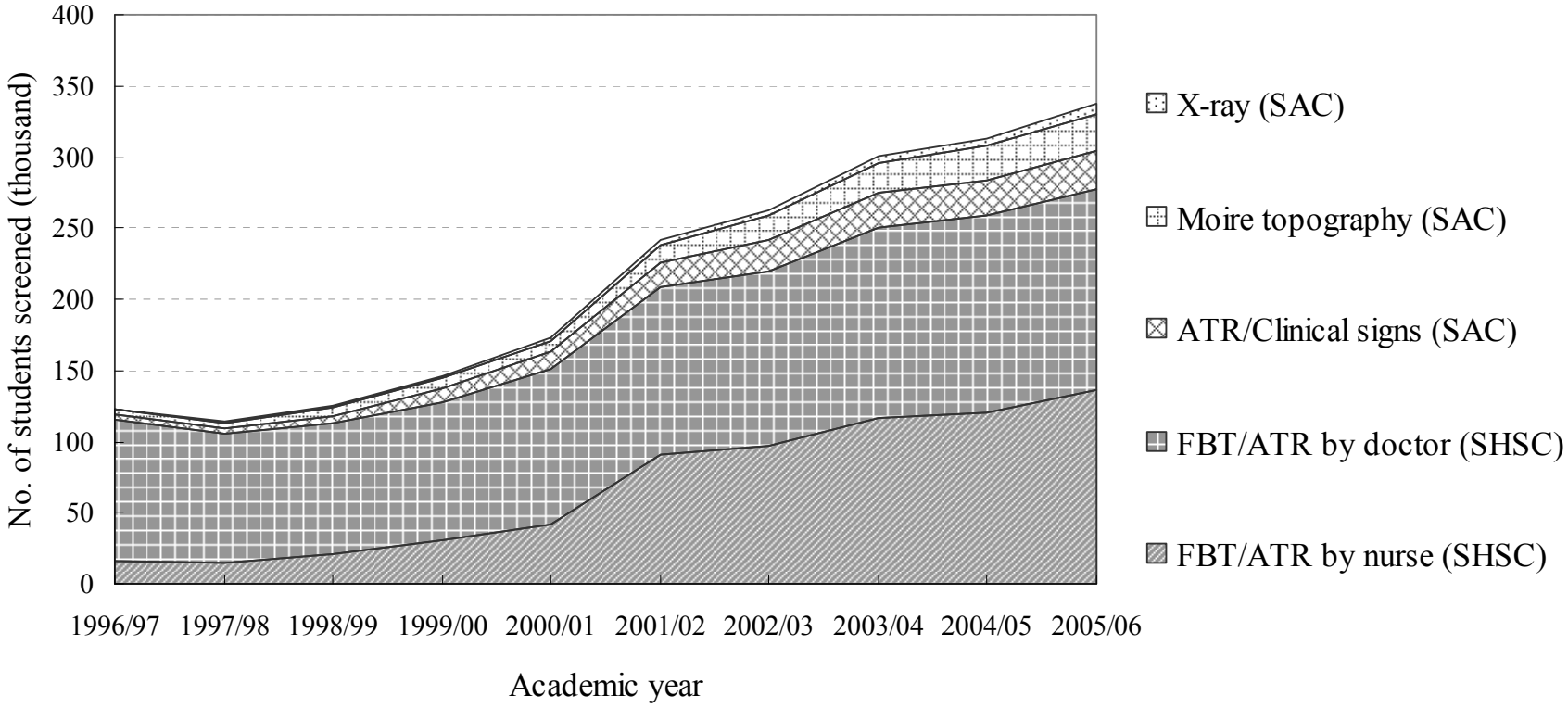
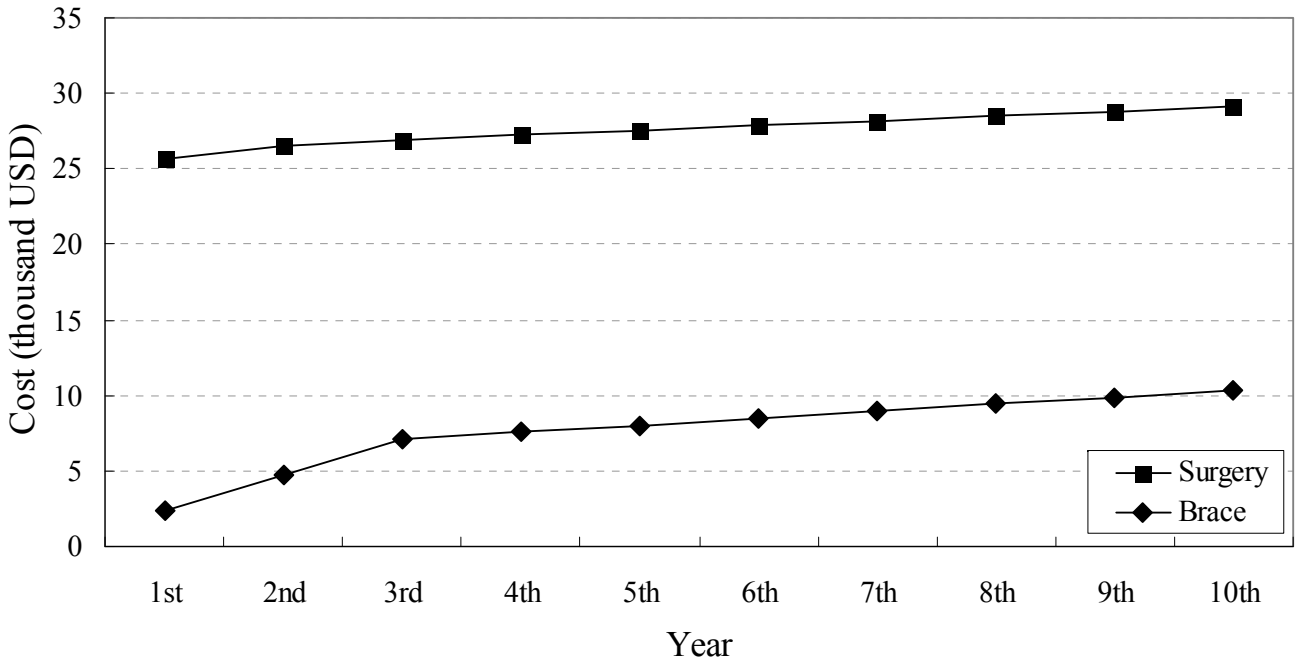

400
350
300
250
200
150
100
50
0
No. of students screened (thousand)
1996/97
1997/98
1998/99
1999/00
2000/01
2001/02
2002/03
2003/04
2004/05
2005/06
Academic year
X-ray (SAC)
Moire topography (SAC)
ATR/Clinical signs (SAC)
FBT/ATR by doctor (SHSC)
FBT/ATR by nurse (SHSC)

Figure 2


35
30
25
20
15
10
5
0
Cost (thousand USD)
1st
2nd
3rd
4th
5th
6th
7th
8th
9th
10th
Year
Surgery
Brace