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# Effect of therapeutic play on pre- and post-operative anxiety and emotional responses in Hong Kong Chinese children: a randomised controlled trial

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## KEY MESSAGES

1. Play is a very important part of children's lives even when they are ill. Awareness of the importance of play in nurses, parents, and health care professionals should be promoted.
2. There is empirical evidence of the effectiveness of therapeutic play intervention in preparing children for surgery.
3. The transferability, feasibility, and cost-effectiveness of therapeutic play intervention in Hong Kong clinical settings are supported.

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## Introduction

Surgery, in particular the preparation procedure for anaesthesia, can be very stressful for children and has a profound effect.<sup>1,2</sup> Excessive anxiety and stress can affect children's physical and mental well-being, hinder their ability to cope with surgery, and inhibit their postoperative recovery. Psychological needs of children are seldom taken into consideration. In a study of paediatric day surgery in Hong Kong Chinese children, the preoperative anxiety level of the children was high, despite having received information on pre- and post-operative care.<sup>1</sup>

Therapeutic play intervention in preparing children for hospitalisation and medical procedures has increased. Nevertheless, studies to assess the implementation potential of therapeutic play intervention, including the transferability, feasibility, and cost-effectiveness, in preparing children for surgery in Hong Kong clinical settings are lacking. This study aimed to examine the effectiveness of therapeutic play intervention in preparing children undergoing elective surgery and assess the implementation potential of such intervention in Hong Kong clinical settings.

## Methods

The study was approved by the hospital ethics committee and conducted from November 2009 to November 2011. Written consent was obtained from the parents. A total of 108 children admitted for elective surgery who were aged 7 to 12 years, able to speak Cantonese and read Chinese, and

accompanied by their parents (either mother or father) on the preoperative assessment day and day of surgery were randomised to the experimental (n=51) or control (n=57) groups. However, five children in the experimental group failed to attend the intervention and four children were lost to follow-up. Children who had undergone surgery previously, or had identified cognitive and learning problems were excluded.

Children in the control group received routine preoperative information preparation, including preoperative fasting time, physical health care and preparation, personal hygiene, postoperative wound care, possible postoperative complications and their management, and methods of controlling postoperative pain. Children in the experimental group received usual care plus therapeutic play intervention, which was implemented in a small group with a maximum of 5 children. The intervention was standardised and lasted for 1 hour (Table 1).

The anxiety level of all children and parents was assessed using the Chinese version of the State Anxiety Scale for Children and Adults at three time points: preoperation (before intervention), preoperation (after intervention), and postoperation. Children's emotional responses during the procedure of anaesthesia were documented using the Children's Emotional Manifestation Scale. Before discharge home, the Postoperative Parents' Satisfaction Questionnaire was used to measure the patient's perception of the adequacy, relevancy, and understanding of the preoperative information.

TABLE I. Therapeutic play intervention protocol

Time	Activities
00:00	1. In the operating theatre: research nurses meet the children and their parents and explain the procedures that will be performed: identification and verifying the information, checking the bracelet, and checking the consent form. 2. The environment and equipment are introduced, including the operating table, anaesthetic and monitoring machines, and operating lamp.
00:10	1. In the operating theatre: doll demonstration on obtaining vital signs for the child: (1) apply electrocardiographic electrodes on the doll's upper chest and lower trunk, (2) place a pulse oximeter on the doll's finger, (3) attach a blood pressure cuff to the doll's arm, and (4) apply a stethoscope to the doll's chest and explain how the doctors and nurses will use it to listen to the child's heart and lungs. 2. Doll demonstration on receiving oxygen and anaesthesia gas therapy: (1) explain the purposes of the oxygen mask and anaesthesia gas, (2) apply the anaesthetic mask on the doll, and (3) give the children the mask and ask them to try it on. 3. Doll demonstration on intravenous therapy: (1) explain the purposes of setting up an infusion line, (2) show the soft catheter and demonstrate how this soft catheter will be put in to the doll's forearm, and (3) reinforce to the children that such a procedure will only be performed after they are asleep.
00:25	In the operating theatre: encourage each child to return demonstrate the procedures on the doll with supervision and guidance.
00:50	In the recovery room: tell the children that they will stay for around 30 minutes and their parents will stay with them when they regain consciousness from anaesthesia, and explain to the children that some procedures will be performed: measurement of blood pressure, pulse rate, electrocardiograph, and oxygen saturation, and receipt of oxygen therapy.
00:55	Question and answer session: clarify any misconceptions and queries, and reassure the children that they will be asleep during the whole surgical procedure and will only wake up after the surgery.
01:00	End of the therapeutic play intervention.

Additionally, a semi-structured interview was conducted for selected children, parents, and nurses working in the operating theatre.

Intention-to-treat analysis was used, with missing data substituted by the last observation carried forward method. The homogeneity of the experimental and control groups in terms of demographic, clinical, and baseline data were assessed using inferential statistics (independent *t*-test and chi-square test). Mixed between-within subject analysis of variance (ANOVA) was used to determine which intervention was more effective in reducing the state anxiety of children and their parents. Independent *t*-test was used to determine any difference in the mean scores of children's emotional responses during anaesthesia induction, and parents' satisfaction between the experimental and control groups. Additionally, content analysis was used to draw conclusions by creating categories of data from verbatim or unstructured data.

## Results

The experimental and control groups were similar with respect to the age and sex of the children, parents' educational attainments, type of surgery performed, and the baseline state anxiety levels of parents and children (Table 2).

### Effects of intervention on children

Mixed between-within subject ANOVA indicated a significant main effect for intervention. Children in the experimental group reported lower state anxiety scores than children in the control group (Table 3).

Using the guidelines proposed by Cohen,<sup>3</sup> the partial eta squared of 0.06 indicated that the effect size for the intervention was moderate. An independent *t*-test showed a significant difference in mean Children's Emotional Manifestation Scale scores between the two groups ( $t [106] = -5.03, P < 0.001$ ). Children who received the therapeutic play intervention exhibited fewer emotions at induction of anaesthesia. The partial eta squared of 0.19 indicated that the effect size for the intervention was large.

### Effects of intervention on parents

Mixed between-within subject ANOVA indicated no significant difference in parents' anxiety scores between the two groups. The partial eta squared of 0.03 indicated that the effect size for the intervention was small. An independent *t*-test showed a significant difference in mean satisfaction score for parents in the two groups ( $t [106] = 3.04, P = 0.003$ ). Parents of children receiving therapeutic play intervention reported more satisfaction. The partial eta squared of 0.08 indicated that the effect size for the intervention was moderate.

### Process evaluation

Semi-structured interviews indicated that the therapeutic play intervention was feasible and acceptable to both health care providers and participants.

## Discussion

This study demonstrated the effectiveness of therapeutic play intervention in preparing children

TABLE 2. Baseline characteristics of the experimental and control groups

Variable	No. (%) of participants		P value*
	Experimental group (n=51)	Control group (n=57)	
Age (years)			0.81
7	6 (11.8)	7 (12.3)	
8	9 (17.6)	11 (19.3)	
9	10 (19.6)	11 (19.3)	
10	11 (21.6)	12 (21.1)	
11	10 (19.6)	11 (19.3)	
12	5 (9.8)	5 (8.8)	
Sex			0.69
Male	33 (64.7)	40 (70.2)	
Female	18 (35.3)	17 (29.8)	
Type of surgery performed			0.89
Circumcision	17 (33.3)	17 (29.8)	
Herniorrhaphy	8 (15.7)	6 (10.5)	
Eye operation	7 (13.7)	8 (14.0)	
Ear, nose, and throat operation	7 (13.7)	16 (28.1)	
Dental operation	5 (9.8)	8 (14.0)	
Orthopaedic operation	7 (13.7)	2 (3.5)	
Parents' education attainment			0.27
Primary school or below	4 (7.8)	12 (21.1)	
Lower secondary school	15 (29.4)	16 (28.1)	
Upper secondary school	22 (43.1)	21 (36.8)	
University or above	10 (19.6)	8 (14.0)	
Mean±SD State Anxiety Score of children	16.67±3.42	16.33±3.24	0.60
Mean±SD State Anxiety Score of parents	36.67±7.51	36.21±6.88	0.74

\* t test for continuous variable and Chi-square test for nominal and categorical variables

TABLE 3. Split-plot analysis of variance on State Anxiety Scores of children and parents across three time points (n=108)

Variable	State Anxiety Scores of children				State Anxiety Scores of parents			
	F value	P value	Eta squared	Observed power	F value	P value	Eta squared	Observed power
Main effect for time	307.79	0.00	0.85	1.00	370.61	0.00	0.88	1.00
Interaction effect	78.56	0.00	0.59	1.00	31.75	0.00	0.38	1.00
Main effect for intervention	6.08	0.02	0.06	0.82	2.59	0.11	0.03	0.61

for surgery. Return demonstration of the procedures on the doll enabled the children to practise the procedure of anaesthesia induction in an active rather than passive manner. This enabled the children to act out unpleasant experiences and minimise their negative emotional response, as lack of control is one of the major sources of stress for children undergoing surgery.<sup>4</sup> Therapeutic play intervention enhanced the children's sense of control through visiting the operating room so as to increase their familiarity

with the environment. Through demonstration and return demonstration of the procedures of preparing for anaesthesia, the children became desensitised to these potential stressful situations and acquired a greater sense of control. Even though parents did not directly participate in the therapeutic play activities, they could also benefit from watching the activities as the explanations given to children would, in turn, make them feel more comfortable and well-informed.

The most important step in carrying out evidence-based nursing practice is to assess the potential implementation of an evidence-based innovation in clinical settings, including the transferability, feasibility, and cost-effectiveness of the innovation. Therapeutic play intervention can be transferable to all children regardless of different cultural backgrounds or settings. Play is instinctive, voluntary, and spontaneous; just like birds fly and fish swim.<sup>5</sup> Therefore, play is a very important part of children's lives even when they are ill. Therapeutic play intervention was feasible, as it was implemented on either Saturday afternoon, Sunday, or a public holiday in which no elective surgery was performed in the hospital, and it caused only minor disturbance to the operating theatre. Therapeutic play intervention was acceptable by children, parents, and health care professionals. Most children enjoyed the therapeutic play and found such activities full of fun and interesting. Besides, most parents commented that it was worthwhile and helpful to attend the therapeutic play intervention even though they had to spend extra time in the hospital. Additionally, most of the nurses agreed that therapeutic play is feasible to be implemented in the operating theatre provided that there is adequate support from the hospital organisation. Therapeutic play intervention is cost-effective, as its content is already very familiar

to nurses. It took only an hour of a staff nurse's time to provide fairly comprehensive preoperative psycho-educational care to a group of children and their parents. It is economically feasible for the health care system to consider it as a routine nursing preparation of children for surgery.

## Acknowledgements

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# Effect of compression bandaging on wound healing and psychosocial outcomes in older people with venous ulcers: a randomised controlled trial

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## KEY MESSAGE

Compression bandaging achieved a higher proportion of complete ulcer healing, reduced ulcer size, and improved psychosocial outcomes in venous ulcer patients. The four-layer bandaging and short-stretch bandaging systems achieved a similar effect on both ulcer healing and other psychosocial outcome measures.

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Venous ulcer is the most serious clinical consequence of chronic venous insufficiency. It is also known as varicose ulcer or stasis ulcer. Venous blood refluxes to the superficial venous system, resulting in abnormal elevation of venous pressure within the vein and eventually damages the skin. Venous ulcer affects approximately 1% to 2% of the total population in western countries,<sup>1</sup> and tends to increase with age.<sup>2,3</sup> It increases nurses' workloads and health costs and affects patients' physiological and psychosocial wellbeing. Compression bandaging is the mainstream treatment for venous ulcer, but it is not widely known and practiced by nurses in Hong Kong. The proportion of complete ulcer healing increases with compression bandaging, compared with no compression. Nonetheless, the effectiveness of the four-layer compression bandaging (4LB) versus the short-stretch compression bandaging (SSB) has not been determined. The effect of compression bandaging on the pain severity and pain interference, health-related quality of life (HRQOL), and functional status affects patients' participation in venous ulcer care and treatment choice. This study aimed to compare the 4LB, SSB, and usual care in terms of the time to complete ulcer healing, ulcer size, ulcer-related pain, functional status, and HRQOL in community-dwelling elderly patients with chronic venous ulcers.

A total of 321 patients aged  $\geq 60$  years who presented with a single unilateral venous ulcer with partial- or full-thickness skin integrity, in which the wound bed was free from necrotic tissue were randomised to receive SSB, 4LB, or usual care (without compression bandaging). Outcomes at 12

and 24 weeks were assessed.

Respectively for patients treated with SSB, 4LB, and usual care, 73.0%, 72.6%, and 30.8% achieved ulcer healing at week 12 ( $P < 0.001$ , log-rank test), whereas 85.8%, 86.3%, and 33.5% achieved ulcer healing at week 24 ( $P < 0.001$ , log-rank test). The median times for ulcer healing in the SSB and 4LB groups were 7.0 (standard error [SE], 0.61) weeks and 8.0 (SE, 0.38) weeks, respectively, which were shorter than  $> 24$  weeks in the usual care group ( $P < 0.001$ , log-rank test). However, no significant difference was noted between the SSB and 4LB groups ( $P = 0.578$ , log-rank test).

Respectively for patients treated with SSB, 4LB, and usual care, the mean ulcer size was 7.56 (SD, 10.43) cm<sup>2</sup>, 7.54 (SD, 9.95) cm<sup>2</sup>, and 9.23 (SD, 12.50) cm<sup>2</sup> at baseline ( $P = 0.493$ , analysis of variance), and reduced to 3.00 (SD, 8.40) cm<sup>2</sup>, 3.48 (SD, 8.54) cm<sup>2</sup>, and 7.54 (SD, 12.45) cm<sup>2</sup> at week 12, and further reduced to 2.85 (SD, 8.18) cm<sup>2</sup>, 3.39 (SD, 8.64) cm<sup>2</sup>, and 6.90 (SD, 10.62) cm<sup>2</sup> at week 24. Greater reductions were noted in patients treated with the SSB or 4LB. The reduction in ulcer size from baseline to week 12 was significant in all three groups ( $P \leq 0.001$ ), whereas the reduction in ulcer size from week 12 to week 24 was significant in the SSB group only ( $P = 0.047$ ), but not in the 4LB group ( $P = 0.67$ ) and the usual care group ( $P = 0.16$ ).

For the psychosocial outcomes, changes in ulcer-related pain, functional status, generic and disease-specific HRQOL were compared among the three groups in a 24-week period. Age, ulcer duration, and ulcer size were controlled in the analysis. The rates of reduction in pain severity and interference,

and improvement in disease-specific HRQOL in the SSB and 4LB groups were greater than those in the usual care group.

Compression bandaging achieved significantly better healing and psychosocial outcomes than no compression. The choice of treatment for venous ulcer may depend on several factors such as clinical effectiveness, patient preference, and patient concordance.<sup>4</sup> Venous ulcer care is not merely about reduction of ulcer size, but also about reduction of pain and its interference in daily living, maintenance of HRQOL, and functional status. A holistic approach of biopsychosocial care is suggested for community-dwelling older patients with venous ulcer.

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# Pressurised irrigation versus swabbing for wound cleansing: a multicentre, prospective, randomised controlled trial

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## KEY MESSAGES

1. Pressurised irrigation is more cost-effective than swabbing for wound cleansing by shortening the wound healing time.
2. Patients experience less pain during wound cleansing by pressurised irrigation than swabbing.
3. Patients have more satisfaction on the comfort after wound cleansing with pressurised irrigation than swabbing.
4. The total direct medical cost of pressurised irrigation is lower than that of swabbing.

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## Introduction

Pressurised irrigation for wound cleansing is advocated, as it can loosen debris, remove excess exudates, and reduce bacterial colonisation without traumatising the wound bed and hence impeding the healing process.<sup>1</sup> The use of the DeVilbiss Syringe (DeVilbiss Healthcare LLC, Somerset [PA], USA) connected to the Gomco Vacuum/Pressure Pump Model 309 (Allied Healthcare products, Inc., St Louis [MO], USA) can generate a steady stream at 4 to 15 psi, which is safe and effective pressure for wound cleansing.<sup>2</sup>

## Methods

A multicentre, prospective, randomised controlled trial was conducted in four out-patient clinics in the New Territories East Cluster of the Hospital Authority from April 2008 to August 2010. A total of 256 patients were randomised to receive pressurised irrigation (n=122) or swabbing (n=134) for wound cleansing. Patients were excluded if they had unbroken skin, full-thickness skin loss, damage to muscle, bone, and/or any supporting structures, wounds with a sinus, wounds to be healed by primary intention, wounds that were prescribed to be cleansed by pressurised irrigation, more than one wound, a very poor life expectancy, or a clinical condition that might interfere with wound healing.

Wounds were assessed at enrolment and upon healing (or after 6 weeks if the wounds had not healed). Primary outcome measures included time to wound-healing, change of wound size, and

proportion of wounds healed completely within 6 weeks. Secondary outcome measures included infection rate during follow-up, patient perceived wound symptoms, patient satisfaction with the cleansing method, health-related quality of life (HRQOL), and cost. The intention-to-treat principle was used. The two groups were compared using the log rank test, Pearson Chi-square test, Fisher's exact test, Mann-Whitney *U* test, or independent *t*-test as appropriate.

Cost-effectiveness analysis of wound healing was performed for those who completed the treatment. The total direct medical cost of wound dressing per patient was estimated by arithmetic mean. Mean time to complete wound healing estimated by the approach of Efron was used as the effectiveness measure. Biased-corrected and accelerated bootstrapping with 5000 replications was used to estimate the 95% confidence intervals (CIs) of the mean difference in the medical cost and time to complete wound healing between the pressurised irrigation and swabbing.

## Results

Of the 256 patients, 39 (15.2%) were withdrawn: 15 in each group were lost to follow-up, and one in the pressurised irrigation group and eight in the swabbing group were due to adverse events. The two groups were similar in terms of baseline characteristics (Table 1).

Respectively in the pressurised irrigation and swabbing groups, 82.0% and 78.4% of wounds healed

within 6 weeks (Table 2), and the median times to complete wound healing were 9.0 (95% CI, 7.4-10.6) days and 12.0 (95% CI, 10.2-13.8) days ( $P=0.007$ , log rank test), whereas the mean times to complete wound healing were 11.4 and 14.5 days, with a saving of 3.1 (95% CI, 0.3-5.9) days.

The two groups did not differ significantly in terms of five wound symptoms (wound pain, fluid leaking from wound cleansing, bleeding, smell, and itchiness), except for pain during wound cleansing ( $P=0.020$ ). The two groups also did not differ significantly in terms of the level the patient's life being interfered with by the six wound symptoms (Table 3).

Patients in the pressurised irrigation group had higher satisfaction scores after wound cleansing in terms of cleanliness ( $P=0.161$ ), comfort ( $P=0.002$ ), and overall satisfaction ( $P<0.001$ ) [Table 4].

The two groups did not differ significantly in terms of HRQOL according to the Short Form-12 subscale scores of physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health (Table 5).

Respectively in the pressurised irrigation and swabbing groups, the mean total direct medical costs per patient were HK\$244±283 and HK\$354±882, with a saving of HK\$110 (95% CI, HK\$ -33 to 308) [Table 6].

In the cost-effectiveness plane displaying the distribution of incremental costs and effects of the bootstrapped results of 5000 replications, 90% of the bootstrapped cost-effectiveness pairs were located in the south-east quadrant, indicating that pressurised irrigation was dominantly more effective and less expensive than swabbing for wound cleansing (Fig).

## Discussion

Pressurised irrigation for wound cleansing enabled shorter wound healing time, less pain during wound cleansing, and more patient satisfaction. Benefits of pressurised irrigation have been reported to be promoting wound healing and patient comfort,<sup>3</sup> and shortcomings of swabbing involve the deleterious effects on tissue owing to the extra pressure applied on to the wound affecting the healing of wounds.<sup>3,4</sup>

Although the nurses performing the dressing change were aware of the cleansing method used, the bias in outcome assessment was minimised by having a second assessor. When wounds showed signs of infection as determined by Cutting's criteria,<sup>5</sup> patients were referred to a physician blinded to the method of wound cleansing and study purpose.

The glass bottle and stainless steel nozzle of the pressurised irrigation device were reusable. Although samples of saline were not tested to determine whether there was contamination, the

TABLE 1. Demographics of patients

Variable	No. (%) of patients	
	Pressurised irrigation (n=122)	Swabbing (n=134)
<b>Sex</b>		
Male	76 (62.3)	99 (73.9)
Female	46 (37.7)	35 (26.1)
Mean±SD age (years)	47.9±18.2	47.1±17.1
<b>Education level</b>		
Primary school or below	48 (39.3)	50 (37.3)
Secondary school	64 (52.5)	70 (52.2)
Tertiary school or above	10 (8.2)	14 (10.4)
<b>Employment</b>		
Employed full-time	58 (47.5)	58 (43.3)
Retired	26 (21.3)	36 (26.9)
Other	38 (31.1)	40 (29.9)
Mean±SD body mass index (kg/m <sup>2</sup> )	23.7±3.7	23.8±4.2
Known chronic disease	32 (26.2)	43 (32.1)
<b>Smoking</b>		
Current smoker	24 (19.7)	19 (14.2)
Ex-smoker	18 (14.8)	21 (15.7)
Median (interquartile range) initial wound size (cm <sup>2</sup> )	1.7 (0.6-6.6)	2.0 (0.8-9.5)
Median (interquartile range) time from wound onset to treatment (days)	5 (3-9)	6 (3-14)
Mean±SD overall wound status score	27.4±3.6	28.1±3.8
<b>Wound type</b>		
Trauma	41 (33.6)	36 (26.9)
Burn/scald	20 (16.4)	25 (18.7)
Surgical	23 (18.9)	21 (15.7)
Leg ulcer	2 (1.6)	10 (7.5)
Dog bite	4 (3.3)	6 (4.5)
Other	32 (26.2)	36 (26.9)
<b>Wound site</b>		
Upper extremity	54 (44.3)	52 (38.8)
Lower extremity	57 (46.7)	61 (45.5)
Trunk	8 (6.6)	16 (11.9)
Head/neck	3 (2.5)	5 (3.7)
<b>Wound characteristics</b>		
Delayed healing due to bacteria	0 (0)	1 (0.7)
Wound with risk of infection	2 (1.6)	2 (1.5)
Discolouration of granulation tissue	0 (0)	1 (0.7)
Foul odour	0 (0)	0 (0)
<b>Infection in wound and antimicrobial treatment</b>		
Yes	24 (19.7)	37 (27.6)
No	98 (80.3)	97 (72.4)

TABLE 2. Wound healing outcomes on an intention-to-treat basis

Variable	Pressurised irrigation (n=122)	Swabbing (n=134)	P value
% of wounds healed completely	82.0	78.4	0.470 (Chi-square test)
Median (interquartile range) time to complete wound healing (days)*	9.0 (7.4-10.6)	12.0 (10.2-13.8)	0.007 (log rank test)
Median (interquartile range) reduction of wound area (cm <sup>2</sup> )	1.3 (0.3-6.3)	1.4 (0.3-6.9)	0.701 (Mann-Whitney U test)
Median (interquartile range) % of wound area reduction	100 (100-100)	100 (100-100)	0.225
Infection rate during follow-up (%)	3.3	5.2	0.443 (Chi-square test)

\* Estimated median (95% CI) time to complete wound healing by the Kaplan-Meier method

TABLE 3. Patient perceived wound symptoms and levels of life interference by wound symptoms

Variable	% of patients		P value
	Pressurised irrigation (n=122)	Swabbing (n=134)	
Wound symptom			
Pain over wound			
No/mild	81.1	80.6	0.911 (Chi-square test)
Moderate/severe/very severe	18.9	19.4	
Pain during wound cleansing			
No/mild	93.4	84.2	0.020 (Chi-square test)
Moderate/severe/very severe	6.6	15.8	
Fluid leaking from wound cleansing			
No/mild	86.1	85.1	0.822 (Chi-square test)
Moderate/severe/very severe	13.9	14.9	
Wound bleeding			
No/mild	97.5	96.3	0.725 (Fisher's exact test)
Moderate/severe/very severe	2.5	3.7	
Wound smell			
No/mild	99.2	99.3	0.999 (Fisher's exact test)
Moderate/severe/very severe	0.8	0.7	
Itchiness over wound or surrounding skin			
No/mild	73.8	79.9	0.249 (Chi-square test)
Moderate/severe/very severe	26.2	20.1	
Life interfered by wound symptom			
Pain over wound			
Not at all/a little bit	78.7	82.8	0.400 (Chi-square test)
Somewhat/quite a lot/very much	21.3	17.2	
Pain during wound cleansing			
Not at all/a little bit	95.1	91.0	0.201 (Chi-square test)
Somewhat/quite a lot/very much	4.9	9.0	
Fluid leaking from wound cleansing			
Not at all/a little bit	95.1	95.5	0.868 (Chi-square test)
Somewhat/quite a lot/very much	4.9	4.5	
Wound bleeding			
Not at all/a little bit	97.5	98.5	0.671 (Fisher's exact test)
Somewhat/quite a lot/very much	2.5	1.5	
Wound smell			
Not at all/a little bit	99.2	100.0	0.477 (Fisher's exact test)
Somewhat/quite a lot/very much	0.8	0.0	
Itchiness over wound or surrounding skin			
Not at all/a little bit	91.8	93.3	0.652 (Chi-square test)
Somewhat/quite a lot/very much	8.2	6.7	

TABLE 4. Patient satisfaction

Patient satisfaction*	Median (interquartile range)		P value (Mann-Whitney U test)
	Pressurised irrigation (n=106)	Swabbing (n=111)	
Cleanliness after wound cleansing	6 (5-6)	5 (5-6)	0.161
Comfort after wound cleansing	6 (5-6)	5 (5-6)	0.002
Overall wound cleansing method	6 (5-6)	5 (5-5)	<0.001

\* Rated by 6-point Likert scale from 1 (very unsatisfactory) to 6 (very satisfactory)

TABLE 5. Patient health-related quality of life

Short Form-12 subscale scores	Mean±SD		P value (independent samples t-test)
	Pressurised irrigation (n=106)	Swabbing (n=111)	
Physical functioning	65.1±28.6	67.3±25.2	0.539
Role physical	23.6±42.1	22.1±40.8	0.788
Bodily pain	59.2±28.3	57.2±30.4	0.619
General health	47.8±26.9	50.0±28.0	0.553
Vitality	69.4±28.6	70.3±28.0	0.828
Social functioning	71.9±36.3	74.5±34.0	0.584
Role emotional	62.7±42.6	64.9±40.8	0.707
Mental health	71.9±23.7	72.8±25.1	0.785

TABLE 6. Comparison of costs between pressurised irrigation and swabbing\*

Cost (HK\$)	Pressurised irrigation group (n=106)	Swabbing group (n=111)	Mean difference (95% CI)
Cost for sterile dressing set (with forceps) [1]	21.8±24.7	27.2±28.9	
Cost for sterile gauze (2)	0.53±0.94	0.30±1.17	
Cost for sterile cotton wool ball (3)	0.00±0.04	0.22±1.00	
Cost for normal saline (4)	1.10±1.09	0.99±1.16	
<b>Basic cost for wound cleansing materials (1+2+3+4)</b>	<b>23.4±25.6</b>	<b>28.7±30.6</b>	
Cost for dressing fixation materials (5)	37.4±150.8	126.2±716.8	
Cost for supplementary dressing materials (6)	53.5±158.1	153.0±764.7	
Nursing time spent in dressing (minutes)	57.5±60.1	59.4±73.7	
Cost for nurse labour* (7)	166.7±174.4	172.1±213.7	
<b>Total cost: materials + labour (1+2+3+4+5+6+7)</b>	<b>243.7±283.2</b>	<b>353.8±882.0</b>	<b>110.1 (-32.8-308.3)†</b>
Mean (SE) time to complete wound healing‡ (days)	11.4 (1.0)	14.5 (1.1)	3.1 (0.3-5.9)†

\* Nursing time spent in dressing times HK\$2.9 (HK\$2.9=nurse cost in 1 minute for an average salary of HK\$30 604 per month)

† 95% CI were estimated using bootstrap method

‡ Estimated by the approach of Efron

infection rates for the two cleansing methods did not differ significantly.

Of the nine adverse events, eight were from the swabbing group and its infection rate may have been underestimated. Most wounds were trauma wounds, burns/scalds, and surgical wounds; this may have been due to the demographics of the population.

Costs for chronic wounds are considerably

higher than those for all acute wounds. This may create variability of central tendency in the cost analysis. The dressing packs used for swabbing generate unnecessary waste from the disposal of unused items such as swabs, gauze, and wrappings. The waste disposal landfill is expensive. These financial and environmental liabilities of waste disposal make reducing non-hazardous waste

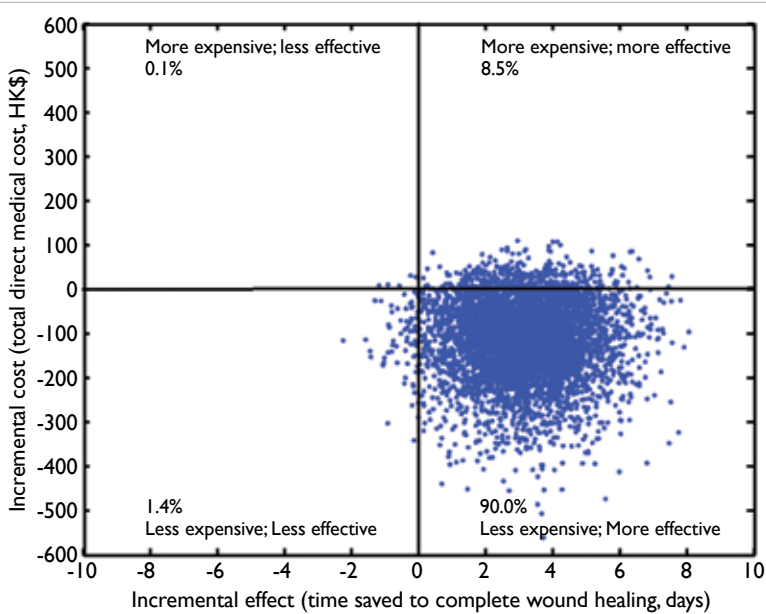


FIG. Cost-effectiveness plane showing 90% of the bootstrapped cost-effectiveness pairs in the south-east quadrant, indicating that pressurised irrigation is dominantly more effective and less expensive than swabbing

imperative. Dressing changes can be performed with clean, reusable instruments such as the self-modified pressurised irrigation device.

**Conclusions**

Compared with swabbing, pressurised irrigation is more cost-effective for wound cleansing in terms of shorter time of wound healing, less pain during wound cleansing, higher patient satisfaction, and lower total direct medical cost.

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