

# Cost-Effectiveness and Safety of Reusable Tracheal Suction Tubes

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**Objectives :** To evaluate whether the repetitive use of disposable tracheal suction tubes is cost-effective and safe over the single use.

**Material and Method :** The cost intrinsic to the washing, cleaning, re-sterilization by ethylene oxide gas, and processing was determined and compared to the cost generated by disposable tubes. The reused disposable suction tubes were also determined for their properties in physical characters and probable contamination and damages.

**Results :** The evaluation showed that cost from single-use disposable suction tubes (8.66 baht) was cheaper than expenses generated from processing steps for recycling of disposable tubes (9.92 baht). The use of a disposable tube only once should minimize the risks posed by the use of the potentially unsafe reused disposable tubes both to the patients and health care workers.

**Conclusion :** Recycling of tracheal suction tubes was neither cost-effective nor safe.

**Keywords :** Cost-effectiveness, Safety, Reusable, Tracheal suction tubes

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Many patients admitted in a hospital have conditions that need assisted ventilation, such as patients with neurological deficits. Endotracheal tubes or tracheostomy tubes are needed for these patients in order to assist and control their respiration. The airways of these patients have to be taken care of to prevent airway obstruction and to remove any secretion that may be a source of bacterial colonization by tracheal suction tubes<sup>(1)</sup>. As a result of this practice, these tubes induce bodily reactions and production of more secretion than normal<sup>(2)</sup>. The removal of these secretions has to be performed many times a day, more for patients on respirators. The large number of suction tubes used coupled with limited resources, reusable suction tubes are used routinely in some hospitals to reduce treatment cost. The reusable suction tubes

made of non-translucent natural rubber, which intraluminal materials cannot be seen during use are rarely used and clear polyvinylchloride (PVC) suction tubes are preferred for patient care. Then, it is a common practice to reuse a PVC suction tube, even though it is designed to be of single use. There is no clear evidence showing that this practice is absolutely wrong, and how many times these PVC tubes can be reused. Until now, the cost of disposable suction tubes has been reduced steadily, the practice of reusing a disposable tube may not be appropriate in both safety and underlying cost from washing and re-sterilizing the tubes. The comparative study on the use of disposable and re-used disposable tubes should be useful to evaluate whether recycling the disposables is appropriate. The total direct and indirect costs originated from the use of these two different practices were analyzed. The results obtained from the present study would yield a better recommendation regarding the proper use of these suction tubes.

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## Material and Method

The present study was a comparative, descriptive study to evaluate the direct and indirect costs originated from two different types of tracheal suction tubes in a regional hospital from April to July 2002. One thousand and five hundred of single-use and 6,035 re-used disposable polyvinyl chloride disposable tubes were included in the present study. The labor, material, and capital costs were recorded and analyzed. Labor cost included the salaries of all personnel involved in the process of washing, packaging, sterilizing by ethylene oxide gas, and also waste disposal, i.e. incineration of discarded tubes. Materials included the suction tubes, washing materials, electricity, personal protecting materials, ethylene oxide, chemical indicator tapes and strips, fuel, and packaging materials. Capital costs were machines for washing and gas sterilization.

## Results

The purchase cost of a disposable tube was at 8.56 baht plus the cost for incineration at 0.10 baht making the total cost of 8.66 baht from a single-use disposable tube (40 baht = 1 US dollar). The cost from making the used tube to be sterile for use again was 9.92 baht/piece, which included 4.96 baht for materials needed for the whole processes of cleaning to re-sterilization, 4.1 baht for labor, and 0.86 baht for capital costs.

The re-use tubes have been shown to be more rigid over time as they are cleaned and sterilized by ethylene oxide gas. The softness of disposable tubes was tested by thermo gravimetric analyzer (TGA), and the value of softness was reduced from 13.02 % of new tubes to 7.80 % in tubes that have been used for 14 times. Scanning electron microscopy demonstrated the degradation of the tubes and contaminants left-over in the lumen of the tubes.

## Discussion

Cost saving in health care management is one of the most important issues especially in a resource-limited country such as Thailand<sup>(3)</sup>. The development from reusable medical equipment and devices to disposable ones has brought convenience and promising safety with the apparently increased costs. Any hospital management team has to go through the consideration, when its institute has to accept the use of disposable elements as a result of increasing labor cost and decreasing prices of commercial medical supplies over time. The authors have conducted this comparative and descriptive research to evaluate whether it is time to convert the reusable tracheal suction tubes to

the commercial disposable ones. This evaluation posed some difficulties in that there were many factors involved, such as labor costs in all personnel involved, different costs conferred by many processes, and costs of equipments used with their annual depreciation values, etc. Furthermore, the practices of using recycled medical materials, which actually were disposable, are usually unconventional and there are no clear recommendations developed for these practices. The findings from any research conducted to establish a supposedly better practice have to wait for approval from users. The results obtained from the present study showed that the cost originated from re-use of a disposable suction tube at 9.92 baht ; this was more than the cost of a single use disposable tube (8.66 baht). The cost of the reused suction tube was based on the expenses from washing, cleaning, and re-sterilization, not including the extra 0.10 baht for waste management at the end. If only expense was the indicator for judgment, the use of disposable suction tube would be recommended over the use of recycled suction tubes. Furthermore, there were occasionally reports of the mishaps from the reuse of single-use medical devices of their potential bacterial contamination<sup>(4)</sup>, toxicity from residual antiseptic/germicidal chemicals, retention of foreign materials, and breakage of reused materials<sup>(5-9)</sup>. In addition, the risks of exposure to infectious materials in workers whose jobs were to wash and clean the used suction tubes may be avoided as there were incidences of potential exposures of infectious agents from such practices<sup>(10,11)</sup>. The rigidity of reused suction tubes also increased over time and posed potential traumas by the use of such tubes as evidenced by the reduction of softness from 13.02 % to 7.80 % in repeatedly used tubes. There were some unwanted outcomes from the use of disposable suction tubes including increased plastic wastes and toxic chemicals, such as acid gases from incineration<sup>(12)</sup>. These problems may be alleviated in the future by the use of biodegradable plastics.

## Conclusion

The cost of reuse tracheal suction tubes is higher than that of disposable ones. It may be the time to switch the reusable tracheal suction tubes to the disposable ones, as they were justified in their costs, convenience, and safety. The extension of these findings to other medical devices that were used repeatedly may be welcome.

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## ความคุ้มค่าและความปลอดภัยจากการใช้สายดูดเสมหะซ้ำหลายครั้ง

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**วัตถุประสงค์ :** ศึกษาเปรียบเทียบความคุ้มค่าและความปลอดภัยจากการใช้สายดูดเสมหะซ้ำหลายครั้ง

**วัสดุและวิธีการ :** ต้นทุนของการใช้สายดูดเสมหะซ้ำหลายครั้ง ประกอบด้วยค่าใช้จ่ายในการล้าง การห่อ และทำให้ปราศจากเชื้อด้วยแก๊สเอทิลีนออกไซด์ เปรียบเทียบกับราคาของสายดูดเสมหะใช้ครั้งเดียว ประเมินสายดูดเสมหะใช้ซ้ำหลายครั้ง เกี่ยวกับคุณสมบัติทางกายภาพ, และการปนเปื้อน

**ผลการศึกษา :** ค่าใช้จ่ายสำหรับการใช้สายดูดเสมหะชนิดใช้ครั้งเดียว (8.66 บาท) ถูกกว่าการใช้สายดูดเสมหะชนิดใช้ซ้ำหลายครั้ง (9.92 บาท) สายดูดเสมหะชนิดใช้ซ้ำจะแข็งมากขึ้นและมีการเสื่อมของวัสดุ

**สรุป :** การใช้สายดูดเสมหะซ้ำหลายครั้ง มีค่าใช้จ่ายสูงกว่าและมีความปลอดภัยน้อยกว่าการใช้สายดูดเสมหะชนิดใช้ครั้งเดียว