

Can converting to synthetic surgical gloves lower hospital operating room costs?

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Alta Bates Medical Center offers comprehensive medical services designed to meet the health care needs of the diverse communities of San Francisco's greater East Bay. With recognition as one of the nation's top hospitals for clinical excellence and patient safety, the hospital has decided to convert the operating room to synthetic surgical gloves to reduce the risks related to Type 1 allergic reactions to natural rubber latex. The Alta Bates operating room leadership team wanted to perform a fact-based cost-benefit analysis of this conversion.

Kraton Polymers is the worldwide leading supplier of the polyisoprene raw material utilized by surgical glove manufacturers to produce high quality synthetic surgical gloves. Kraton Polymers' management team was interested to determine the long-term sustainability of its Cariflex[®] polyisoprene raw material offering to healthcare organizations.

Purpose of case study

Type 1 natural rubber latex (NRL) allergic reactions are avoidable in the operating room (OR) environment. Typically surgical gloves are the last products remaining in the operating room that contain natural rubber latex. Higher cost, clinically acceptable synthetic latex surgical gloves are readily available. However, operating room leaders can receive significant resistance from hospital administrators when suggesting a change in clinical practice that increases supply costs, especially when hospitals are struggling to make a profit. Resistance to a surgical glove change may also come from surgeons and OR staff already comfortable with their current glove choice. This case study attempts to understand and quantify the cost impact of converting from NRL surgical gloves to synthetic at Alta Bates Medical Center in Berkeley, California.

Recent findings

Little analytical work has been published on the cost-benefit impact of converting an operating room environment to synthetic latex surgical gloves. Anecdotally hospitals report the Lean management benefits of "NR latex-free" OR's citing: 1) a streamlined admissions process; 2) increased OR efficiencies; and 3) a reduction in glove sourcing, storage (in the OR suite) and inventory costs. Converting to synthetic surgical gloves should significantly reduce or eliminate NRL-related OR teardowns and NRL Type 1 allergic reactions experienced by patients and health care workers (HCWs).

Summary

Retrospective cost profiles were developed for Alta Bates Medical Center pre and post a synthetic surgical glove conversion in 2013. The cost profiles captured key elements that are easily 'trackable' and quantifiable for extremely busy OR and hospital staff. An analysis comparing the costs pre and post the synthetic surgical glove conversion revealed a 25% reduction in overall costs after switching to higher unit priced synthetic surgical gloves. The cost increase in surgical glove supplies was more than offset by the elimination of Type 1 NRL allergic events and NRL-related OR teardowns.

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Introduction

The prevalence of natural rubber latex (NRL) Type 1 allergies among healthcare workers (HCWs) and patients has driven the need for hospitals to use only medical and surgical products which do not contain NRL. NRL Type 1 allergies affect 1% to 2% of the general population¹ and repeated exposure to NRL increases the prevalence to 18-37%.^{2,3,4} Allergists advise NRL sensitive patients to warn health care providers of their NRL sensitivity before undergoing any type of medical procedure.⁵ Hospitals care for NRL sensitive patients by following NRL-allergic protocols and using products that do not contain NRL. The majority of hospitals have switched general medical and surgical supplies to synthetic latex or other alternatives not made with NRL. In the operating room (OR), typically the last products to switch to synthetic latex variants are surgical gloves. Several factors have created this situation.

Many surgeons still associate NRL with a superior fit, feel, comfort, and resealing capability. Among OR staff, synthetic surgical gloves suffer from historically poor quality perceptions.⁶ Synthetic surgical glove performance has improved significantly and now mimics or exceeds the performance of NRL gloves⁷. Recently, one major surgical glove manufacturer referenced a survey claiming 94% of surgeons rated their synthetic glove as good or better than their NRL surgical glove.⁸ Purchasing managers discourage the use of synthetic surgical gloves due to acquisition prices approximately 50% more than NRL.⁹ Finally, hospital administrators focused on financial performance resist initiatives that increase costs without a demonstrable and quantifiable cost benefit,^{10,11} e.g., reducing or eliminating the costs associated with Type 1 NRL allergic events.

According to JS Elder the cost of one simple anaphylactic event for both patient and HCWs can be significant, with severe anaphylactic episodes requiring hospitalization.⁹ The legal exposure to a hospital resulting from an anaphylactic event significantly increases the risk of paying out a large financial settlement, especially if the patient or HCW is permanently disabled or dies.¹² Repeated exposure to NRL can slowly increase a patient or HCWs susceptibility to developing a Type 1 NRL allergy, which could result in an anaphylactic episode.⁴

NRL surgical gloves are known to cause hand irritations for HCWs. Severe hand irritations or contact dermatitis may require time off to heal. With 18-37% of HCWs acquiring a Type 1 NRL allergy from long-term exposure, there's a high likelihood hospitals will incur incremental costs and human resource planning to manage HCWs requiring days off.^{2,4} Costs will be incurred to transfer and retrain sensitized employees; additional costs are also incurred for hiring and training replacements.

Other consequences a hospital could experience due to the presence of NRL products include tearing down an operating room.¹³ If a NRL allergic surgical patient is assigned to an operating room that has been cleaned and prepared for surgery by HCWs wearing NRL gloves, the room must be thoroughly cleaned, disposable surgical products discarded, surgical instruments re-sterilized, and potentially a contaminated implantable device written off.¹⁴ This results in increased OR department operating costs and underutilization of operating rooms causing surgical procedures to be delayed or even cancelled.

Given the opportunity to: 1) lower clinical, financial, and legal risks; 2) reduce HCWs long-term NRL exposure; 3) increase admissions and operating room efficiencies; and 4) improve patient safety,

hospital OR leaders, like those at Alta Bates Medical Center, are taking the final step to convert from using NRL surgical gloves to synthetic. However, there are hurdles to overcome.

The majority of US hospitals are under financial pressure.^{15,16,17} The ostensible financial impact of converting from lower cost NRL gloves to higher cost synthetic gloves could squelch any attempt to suggest a conversion. OR leaders championing a synthetic surgical glove conversion will quickly encounter resistance primarily due to the surgical glove cost increase. A convincing business case using actual internal hospital data is required to receive approval from hospital administrators.

The purpose of this article was to answer the question, “Can converting to synthetic surgical gloves lower hospital operating room costs?” The authors have attempted to answer this question by quantifying and comparing the OR cost profiles at Alta Bates Medical Center before and after a synthetic surgical glove conversion, which took place in 2013. The cost comparison pre/post the conversion provided a view of the financial impact at Alta Bates Medical Center and potentially serves as an empirical model OR leaders can refer to in developing a business case to recommend a synthetic surgical glove conversion in their hospital.

Method for creating a cost model

The method employed consisted of developing a cost profile for Alta Bates Medical Center’s OR department before the synthetic surgical glove conversion. Once the cost profile was established the actual costs pre/post the conversion to synthetic surgical gloves were collected. The financial impact on the cost profile post-conversion to synthetic surgical gloves was analyzed. The financial analysis yielded findings that supported key conclusions.

A cost profile was determined by selecting the financial and clinical parameters that a conversion to synthetic surgical gloves would impact directly. An exhaustive list of financial and clinical drivers was brainstormed and those ultimately selected consisted of drivers deemed to have a clear, direct impact on costs, and are easily ‘trackable’ and quantifiable by hospital OR staff.¹⁸ Ease of tracking and quantifying key data is paramount as most hospital OR settings are fast-paced and staff have little to no time to track metrics which are not easily identifiable and require protracted analytics to determine the financial impact.

Therefore, the following financial and clinical attributes were selected:

- 1) Number of operating rooms and annual surgical procedures;
- 2) Annual surgical glove consumption including percentage of latex and synthetic gloves;
- 3) Number of latex allergic events for both HCWs and patients;
- 4) Number of latex-related OR tear downs.

To quantify the cost profile, Alta Bates Medical Center performed a retrospective study to collect the required information. Several sources were accessed including OR tracking records, surgical glove usage data, employee health records, patient discharge records, risk management, and surgical supplies spending. The information was collected for twelve months prior to the synthetic surgical glove

conversion in January 2013 and for twelve months post conversion.

A search for relevant published articles in healthcare and medical journals was also performed and interviews with OR staff were conducted.

The information gathered from these sources was then input into an analytical model developed to quantify the cost profile 'pre' a conversion to synthetic surgical gloves.

There are other risks and costs that would be significantly reduced or eliminated by a conversion to synthetic surgical gloves: 1) legal expenses related to latex allergic reactions, 2) purchasing fewer stock keeping units (SKUs) and carrying less inventory, 3) Worker's Compensation claims related to Type 1 NRL allergic episodes and 4) the institutional costs incurred to retrain and reassign HCWs affected by a NRL allergy, and hire new staff. These benefits are more difficult to quantify, and have therefore been excluded.

Alta Bates Medical Center OR profile

Alta Bates utilized nine operating rooms, and reported an annualized number of 9,764 surgical cases in the pre-conversion period consuming 139,866 pairs of surgical gloves. In order to generate a fair cost-benefit analysis, the number of surgical cases and surgical gloves consumed were kept constant for the periods pre- and post-conversion, while the number of Type 1 NRL allergic episodes and latex-related OR tear downs reflect reported events.

Table 1: Alta Bates OR Profile	
Attribute	Data
Number of operating rooms	9*
Number of surgical cases (events/year)	9,764
Number of surgical gloves consumed (pairs/year)	139,866

* Average number in use.

Based on the methodology employed the table below provides key annual data for Alta Bates Medical Center's operating room department, pre-conversion.

Table 2: Key pre-conversion annual data

Attribute	Data
Number of latex allergy events:	
HCWs	1
Patients	4
Number of OR teardowns	24
Number of surgical gloves consumed (pairs)	
Latex Powdered	20,396
Latex Powder-free	20,990
Synthetic	98,480

Cost profile for Alta Bates OR: pre-conversion

Based on the information above, the annual costs would equate to \$291,334 as shown in Table 3. The surgical glove costs (\$180,019) were determined by multiplying the annual consumption by the price per pair. Surgical glove prices were provided by Purchasing and reflect the average cost for all styles of natural rubber latex and synthetic surgical gloves.

Table 3: Annualized costs pre-synthetic surgical glove conversion

	Quantity/Events	Cost per event	Total Costs
<i>Surgical Glove Costs*</i>			
Latex Powdered	20,396	\$0.34	\$6,934
Latex Powder-free	20,990	\$0.88	\$18,471
Synthetic	<u>98,480</u>	\$1.57	<u>\$154,614</u>
Total Surgical Gloves	139,866		\$180,019
Latex allergy events-HCWs	1	\$15,111	\$15,111
Latex allergy events-Patients	4	\$15,111	\$60,444
OR teardowns due to latex allergy	24	\$1,490	\$35,760
Total Costs			\$291,334

* Usage based on 9,764 surgical procedures.

Despite synthetic gloves representing 70% of the total prior to conversion, the hospital still reported five Type 1 NRL allergic events and 24 OR teardowns in the 12 months pre-conversion period.

Latex allergy events were assigned the value of \$15,111 based upon the NRL screening project conducted by a multidisciplinary team at the University of Maryland Medical School and published in the Annals of Allergy, Asthma and Immunology in 2002.¹⁹ Given the number of latex allergic events, the hospital incurred costs of \$15,111 and \$60,444 for HCWs and patients, respectively. The range of anaphylactic treatment costs varies from \$5,000 to \$25,000.^{9,19} Severe anaphylactic events would require hospital admittance, treatment and monitoring in the Emergency Department or ICU, and would cost significantly more than \$15,111.^{20,21} To maintain a consistent conservative cost approach, \$15,111 per anaphylactic episode was assigned for both HCWs and patients.

The 24 OR teardowns cost the hospital \$35,760. Each OR teardown event is profiled to cost \$1,490 to: 1) teardown and disinfect the room (\$26/minute x 45 minutes or \$1,170); 2) dispose of surgical consumables (\$300);¹² and 3) re-sterilize or reprocess surgical instruments and reusable items (\$20).^{22,23} Write-off of contaminated implantable devices was not included and could be significant. These are considered conservative OR tear down cost estimates, and costs may vary across the country.

Three items were identified with a direct cost impact but were determined too cumbersome to quantify. First, no provision for legal costs was assumed. However, the risk of legal action would be high, especially if a severe anaphylactic event occurs. The average cost to defend a legal case according to the American Medical Association is \$94,000 and the median jury award is \$439,000.²⁴ After converting to synthetic gloves the legal risks would decline significantly. Second, the costs to manage fewer SKUs and carry less inventory associated with stocking fewer glove styles should provide additional savings. Finally, Worker’s Compensation claims related to Type 1 latex allergy will lower hospital costs with the elimination of Type 1 allergies related to NRL surgical gloves and the elimination of personnel costs associated with hiring, retraining, or reassigning latex-sensitive employees.

Financial impact: post-conversion to synthetic gloves

Table 4 shows the situation post-conversion, based on the same number of surgical cases, and hence the same number of gloves.

Table 4: Key post-conversion annual data*	
Attribute	Data
Number of latex allergy events:	
HCWs	0
Patients	0
Number of OR teardowns	0
Number of surgical gloves consumed (pairs)	
Latex Powdered	0
Latex Powder-free	0
Synthetic	139,866

* Adjusted for equivalent number and profile of pre-conversion surgical procedures.

The actual cost profile post-conversion to synthetic surgical gloves was developed and compared to costs pre-conversion. As seen in Table 5 below, the pre-conversion costs of \$291,334 drops to \$216,792 post-conversion to synthetic surgical gloves.

Table 5: Annualized costs pre and post synthetic surgical glove conversion*			
	Pre-conversion	Post-conversion	Difference (=Pre - Post)
<i>Surgical glove costs</i>			
Latex (Powdered + Powder-free)	\$25,405	\$0	\$25,406
Synthetic	<u>\$154,614</u>	<u>\$216,792</u>	<u>-\$62,179</u>
Total Surgical gloves	\$180,019	\$216,792	-\$36,773
Number of HCW latex allergy events	1	-	1
Cost of HCW latex allergy events	\$15,111	\$0	\$15,111
Number of patient latex allergy events	4	0	4
Cost of patient latex allergy events	\$60,444	\$0	\$60,444
Number of OR teardowns due to latex allergy	24	0	24
Cost of OR teardowns	\$35,760	\$0	\$35,760
Costs not quantified			
Legal	NA	Lower	Lower
Number of glove SKUs	NA	Lower	Lower
Worker's Compensation claims	NA	Lower	Lower
Total Costs	\$291,334	\$216,792	\$74,542

* Based on 9,764 surgical procedures.

Even though the surgical glove costs increased by \$36,773, the overall costs decreased \$74,542. The elimination of costs associated with latex allergies and OR teardowns contributed significant savings exceeding the increase in surgical glove costs.

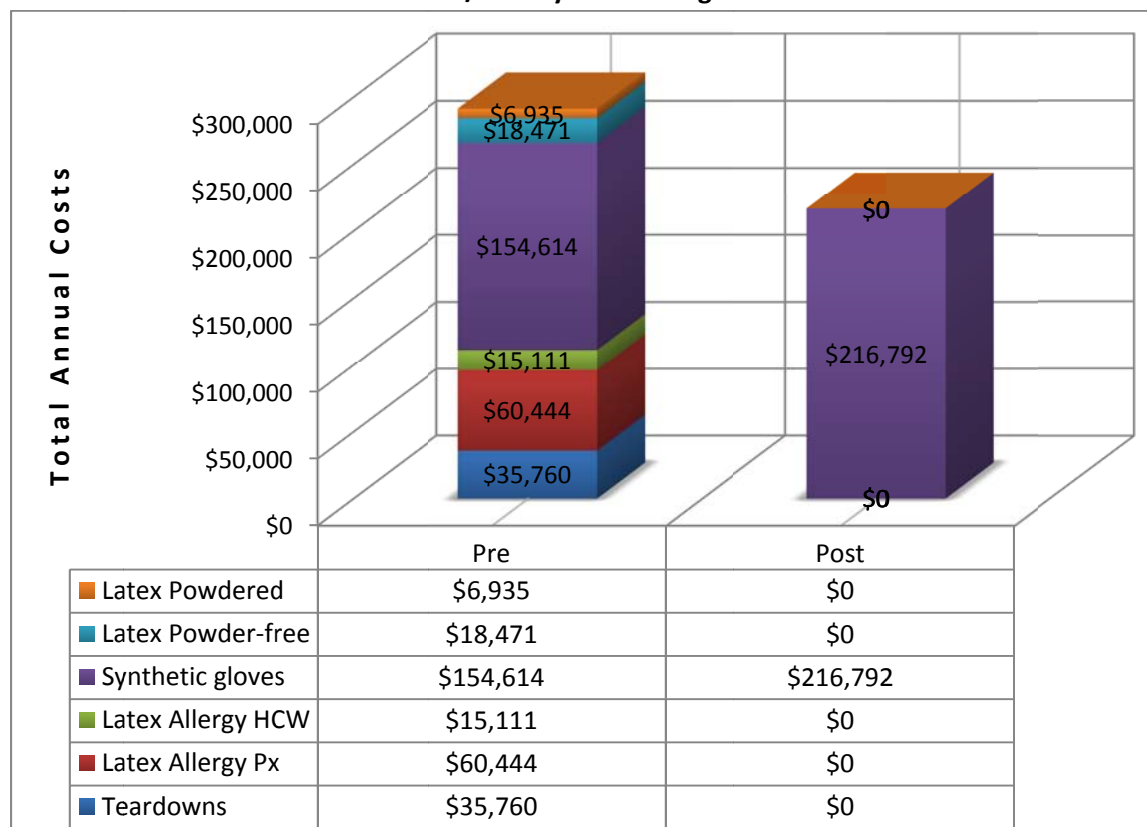
Table 5 depicts how Alta Bates Medical Center's increased surgical glove costs are more than offset by the decreased costs associated with natural rubber latex allergies and OR teardowns. Neutralizing the inherent legal risk undoubtedly connected with these potentially litigious events enhances the business case further.

Anecdotally, Alta Bates OR staff members were impressed by the synthetic surgical glove quality,

equating the fit, feel, and comfort performance with NRL surgical gloves. All of the of the synthetic surgical gloves procured by Alta Bates were manufactured using Kraton’s Cariflex® Polyisoprene Latex raw material. The high level of synthetic surgical glove performance experienced by OR staff members buttressed their commitment to improve safety for patients and HCWs.

Alta Bates Medical Center’s decision to convert their surgical gloves 100% to synthetic has significantly reduced overall costs, eliminated Type 1 NRL allergic events for both patients and HCWs, stopped NRL-related OR tear downs, and improved patient and HCW safety.

Chart 1: Annual Costs: Pre/Post Synthetic Surgical Glove Conversion - Alta Bates



Conclusions

Converting an OR department to synthetic surgical gloves reduces overall operating costs. This case study has proven Alta Bates Medical Center significantly reduced overall OR operating costs by \$74,542 or 25% after converting fully to synthetic surgical gloves.

Converting to synthetic surgical gloves considerably decreases and potentially eliminates the risk of patients and HCWs encountering a Type 1 natural rubber latex allergic reaction related to surgical gloves. Alta Bates Medical Center’s OR department has reported no Type 1 NRL latex allergic events in the 30 months that followed the conversion to synthetic surgical gloves until this study was conducted.

In addition to a significant reduction or elimination of Type 1 NRL latex allergic events, converting to synthetic surgical gloves will end OR latex-related tear downs. Alta Bates Medical Center reported no latex-related OR tear downs following the conversion to synthetic surgical gloves.

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