

Evaluation of Elastomeric and Electronic Medication Pumps at an Outpatient Cancer Center

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ABSTRACT

Objectives: The objective of this study was to evaluate ambulatory electronic pumps versus non-electronic elastomeric infusion devices for continuous infusion chemotherapy in an outpatient cancer center relative to four factors: efficiency, customer loyalty, economic outcomes and safety.

Results: Cost comparison between an electronic pump and 2 different elastomeric devices (Baxter infusors and Grifols Dosi-fuser) showed a \$15,225.00 annual savings with the elastomeric devices due to decreased equipment costs. The maximum savings were seen with the Dosi-fuser. The evaluation revealed a more efficient workflow and significant reduction in time and resources by utilizing the elastomeric pumps, resulting in an additional annual cost savings of \$29,572.50. Patients preferred the elastomeric device to the electronic pump for the following reasons: lighter, more convenient, quieter and more discreet. Pharmacy preferred the elastomeric device due to decreased preparation time, storage space and documentation because they do not require pump tracking, batteries, calibration, or maintenance. Multi-disciplinary oncology staff preferred the elastomeric device due to simplified patient education and decreased after hour calls. The elastomeric pumps also proved to have fewer malfunctions, which require multi-disciplinary intervention and result in suboptimal patient care. Elastomerics provide an increased safety measure by eliminating the potential of programming errors associated with electronic pumps.

Conclusion: The pump evaluation project resulted in the practice change to elastomeric pumps which afforded the cancer program cost savings, more efficient workflow, increased customer loyalty and safety.

BACKGROUND

- Location of cancer treatment has shifted from inpatient hospital administration to ambulatory clinics
- Ambulatory medication delivery systems allow for continuous chemotherapy administration without hospitalization
- Variety of medication pumps available for use
 - Electronic
 - Pump is programmed to deliver the medication at a specified rate
 - CADD, Abbott AIM, Infusystems, AmbIT
 - Elastomeric
 - Medication is delivered by the force of the elastomeric balloon contracting with the rate regulated by a capillary element
 - Baxter infuser, Grifols Dosi-fuser

METHODS

- Ambulatory medication delivery systems were evaluated based on four criteria: efficiency, customer loyalty, economic outcomes and safety
- Efficiency
 - Time analysis of pump preparation
- Customer loyalty
 - Patient survey
- Economic outcomes
 - Cost comparison of electronic medication pumps and elastomeric medication pumps
 - Materials, maintenance, staff time, reimbursement
- Safety
 - Literature review of medication errors relating to ambulatory pumps

RESULTS

Pumps evaluated

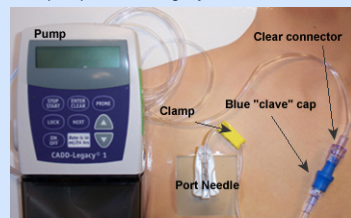
Elastomeric pump- Grifols Dosi-fuser



Elastomeric pump- Baxter Infusor



Electronic pump- CADD Legacy



Efficiency

Electronic medication pump

Technician time = **20 minutes**

- Drawing up solutions
- Injecting solutions into bag
- Removing air bubbles
- Priming tubing

Pharmacist time = **60 minutes**

- Order verification
- Pump calculations
 - 2 pharmacists
- Patient counseling
- Pump calibration
- Pump programming
 - 2 pharmacists
- Pump cleaning

Elastomeric pump

Technician time = **10 minutes**

- Drawing up solutions
- Injecting solution into pump
- Priming tubing

Pharmacist time = **20 minutes**

- Order verification
- Pump calculations
 - 2 pharmacists
- Patient counseling

RESULTS cont.

Economic Outcomes

Costs	Electronic	Elastomeric
(5-FU* 2,400 mg/m ² over 46hours)		
Dextrose 5%	\$0.59	\$0.59
5-FU	\$11.69	\$11.69
Syringes (60mL)	\$2.04	\$2.04
Needles	\$0.18	\$0.18
Empty 250mL bag	\$1.84	N/A
Administration set	\$15.60	N/A
Carrying bag	\$8.93	\$8.93
Gloves	\$0.32	\$0.32
Batteries	\$0.34	N/A
Pump rental**	\$8.50/day= \$17	N/A
Pump cost**	N/A	\$22-\$47 each
Maintenance**	\$0.56/day=\$1.12	N/A
Cleaning materials	\$0.50	N/A
Pharmacist time	1hr = \$50	0.33hr = \$16.67
Technician time	0.33hr = \$3.83	0.16hr = \$1.91
On call pharmacist	\$9,360/year = \$51.29/cycle	N/A
Medicare reimbursement	\$8/day= -\$16	N/A
Total per cycle	\$149.27	\$64.23-\$89.23

* 5-FU= 5-fluorouracil
**Cost varies with individual contracts

Safety

Electronic pumps

- After hours malfunctioning events- 17 per year
 - Requires RPh/MD intervention
 - Results in patient anxiety, inconvenience and loss of trust regarding integrity of the infusion
- Accidental disconnecting of pump from administration set could cause medication to free flow into patient
 - Requires the use of an anti-siphon valve

Elastomeric pumps

- No alert for closed port clamp

ISMP report¹

- Desired medication administration
 - 5-FU 4,000mg/m² continuous infusion over **4 DAYS**
- Actual medication administration
 - 5-FU 4,000mg/m² over **4 HOURS**

Electronic pump

- Potential to program incorrect rate and/or volume
 - Reduce risk by having programming double checked

Elastomeric pump

- Eliminate the need to program rate and volume
- Potential to use wrong elastomeric
 - Example- Use a 2 day pump for a 7 day infusion

RESULTS cont.

Customer Loyalty

Patients (survey results)

- Surveyed 35 patients
- 100% preferred elastomeric pumps over electronic pumps

Electronic medication pump

Pros

- Comfort with the ability for exact programming (volume, rate)

Cons

- Heavy
- Large, more conspicuous
- Noisy
- Increased issues (over the phone trouble shooting)

Elastomeric pump

Pros

- Light
- More discrete
- Quiet
- Fewer issues
- Less to worry about

Cons

- No electronic signaling to alert if pump is functioning properly
- No alert for closed port clamp

Pharmacy Staff

Electronic medication pump

Pros

- One device for all regimens

Cons

- Maintenance
- Joint commission requirements
- Risk for programming errors
- Preparation time
- After hours trouble shooting
 - On call pharmacist

Elastomeric pump

Pros

- Low maintenance
- Easier preparation
- Easier patient education

Cons

- Risk of using wrong infuser
 - 2 day vs 7 day

CONCLUSIONS

- Decreased pharmacy time with elastomeric pumps
 - 30 minutes vs. 80 minutes
 - 1050 pumps/year = 875 hours/year
- Overwhelming patient preference for elastomeric pumps
 - Transition period from electronic pumps to elastomeric pumps was well received by patients
- Pharmacy preferred elastomeric pumps due to decreased maintenance and ease of preparation
- Cost analysis revealed decrease cost with elastomeric pumps despite no Medicare reimbursement
 - Cost savings can be maximized by evaluating available elastomeric pumps and negotiating contract pricing
 - 1050 pumps/year = \$44,797.50/year
- Safety
 - Elastomeric pumps cannot be incorrectly programmed
 - Potential to use wrong elastomeric pump

REFERENCE

- Dobish R, Greenall J and Hyland S. Important findings from an in-depth analysis of a medication incident. <http://www.ismp-canada.org/download/cjhp/cjhp0709.pdf>

DISCLOSURES

George Carro- Nothing to disclose
Jessica Lawton- Nothing to disclose
Abigail Harper- Nothing to disclose