



SHORT COMMUNICATION

Insulin vials vs. insulin cartridges: Further cost considerations

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Received 27 June 2012; accepted 13 July 2012
Available online 26 August 2012

KEYWORDS

Insulin;
Vial;
Cartridge;
Wastage;
Cost

Abstract *Scope:* Many studies have provided evidence that favor the use of insulin pens over traditional insulin vials due to lower overall costs. The cost of insulin in the Royal Medical Services in Jordan is subject to other considerations due to the favorable tender prices and the process of dispensing of insulin within the Royal Medical Services.

Objective: To highlight further cost considerations associated with the wastage in the use of insulin vials and cartridges in the Jordanian Royal Medical Services.

Methods: Two random samples were selected from prescriptions dispensed for diabetic patients using insulin in January 2012 from the outpatient pharmacy in Al-Hussein Hospital, King Hussein Medical Center, Amman, Jordan. First sample was selected from prescriptions of patients using vials; second sample was selected from prescriptions of patients using pens and cartridges. Average costs for insulin and wastage were calculated per patient from the Royal Medical Services perspective.

Results: The average direct cost per patient using vials was JD 5.197 and for those using cartridges was JD 22.135. The average wasted quantity per patient in the first sample was more than ten times that of the second sample. The cost of the average wasted quantity per patient in the first sample (1.022 JD) was more than the double that in the second sample (0.441 JD).

Conclusion: Although, the direct cost of insulin per patient by using vials was lower than cartridges, there was a substantial reduction in the cost of wastage by using the cartridges in the Jordanian Royal Medical Services outpatients.

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1. Introduction

Diabetes is difficult to control and treatment involves several approaches which are associated with different costs. In the Royal Medical Services (RMS), after diagnosis of the disease and by excluding the regular visits to the clinics, the core costs incurred by the RMS in diabetes treatment can be confined to the cost of medications dispensed to patients and hospitalization due to diabetes complications.

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Peer review under responsibility of King Saud University.



Many patients need insulin in the regimen of diabetes treatment. For outpatients, insulin can be administered by two main approaches: traditional vials and cartridges. In the RMS, both approaches are available; however, it is believed that adopting one of these approaches could be more cost-effective from the RMS perspective. Both types of insulin packages contain 100 IU/ml of biphasic insulin aspart. The vial contains 10 ml (1000 IU), while the cartridge used to refill the pen contains 3 ml (300 IU). Although, it is assumed that both approaches produce the same pharmacological outcomes, the ease of use and patient adherence have been compared widely in the literature (Baser et al., 2010; Bohannon, 1999; Rakel, 2009).

The comparison between these approaches strongly favors the use of cartridges due to many reasons, for example, pens provide more accurate dosing, less pain due to smaller needle gauge, increased social acceptability and better quality of life (Bohannon, 1999); moreover, patient adherence was improved by using pens without significant increase in the cost (Baser et al., 2010).

A study conducted in Mayo Clinic found that converting patients to insulin pens provided an overall cost savings (Ward and Aton, 2011). Another study, in the USA, found that overall annual health care costs were significantly decreased by starting or converting patients to insulin pens (Meece, 2008). The same study found a reduction in the costs associated with insulin complications due to the same reason.

In addition, many studies provided strong evidence regarding the increase in the health related quality of life (HRQoL) of the patients and the decrease in the overall costs for the health organizations as a result of using the insulin pens (Meece, 2008; Rakel, 2009; Ward and Aton, 2011).

In the RMS, the cost considerations may be different. This is attributed to two reasons, the favorable tender prices and the process of provision of insulin for diabetic patients. The RMS purchases insulin via tenders from which it obtains favorable prices. On the other hand, Dispensing insulin depends on monthly quantities dispensed according to the need of the patients. In some cases, the dispensed quantity exceeds the required quantity due packaging reason. For example, a patient using (65) IU of insulin daily is consuming (1950) IU monthly; there is no package that dispenses exactly (1950) IU of insulin. Consequently, from the RMS perspective, there is wastage in the dispensed insulin from both approaches. This wastage increases the costs incurred by the RMS.

Under budget constraints, it is widely accepted that the RMS cannot pay for every new medical technology which becomes available unless it provides better outcomes for both the RMS and the patients with reasonable costs. Accordingly, there is an increasing need to apply a clear procedure to select between the alternatives. This is done by evaluating and comparing costs and outcomes of the alternatives to support the decision of selection.

This study is an attempt to highlight further cost considerations associated with wastage in the use of insulin vials and insulin cartridges in the RMS and other publically funded health organizations in Jordan. The researchers are carrying out a further study, in parallel, to measure the health related outcomes of both package types in order to make the comparison more clear and transparent.

2. Materials and methods

The direct cost of both types of insulin was elicited from the last RMS tender price. To measure the cost of the wastage of the dispensed insulin, two random samples were selected from prescriptions of diabetic patients in the outpatient pharmacy at Al-Hussein Hospital (HH) in King Hussein Medical Centre (KHMC) in Amman, Jordan. Al-Hussein Hospital is considered the largest hospital in the RMS. This study was approved by the ethics committee in the RMS.

The first sample consisted of 516 prescriptions for patients on traditional vials; the second sample was 40 prescriptions for patients on cartridges. The samples were selected from the prescriptions dispensed in January 2012. The daily needed dose and the dispensed quantity were elicited directly from the prescriptions. The monthly needed dose for each patient was calculated by multiplying the daily needed dose necessary for 30 days.

The monthly needed quantity (IU) for each patient was then subtracted from the dispensed quantity (IU) to calculate the wastage (excess in prescription) from the RMS perspective. The total needed quantity was calculated by adding all the actual need for each patient as prescribed by the physician on the prescription. The total dispensed quantity was calculated by adding all the dispensed quantities for each patient. By subtracting the total needed quantity from the total dispensed quantity the total wastage was calculated for each sample. The next step was to divide the total wastage by the number of prescriptions in the sample to get the average wastage per patient for each sample. The wastage per patient in JD (1 USD = 0.71 JD) was calculated by multiplying the price of the unit of insulin by the average wastage per patient.

3. Results

The tender prices of the traditional vial and the cartridge used at the time of study are shown in Table 1. It can be noticed that the price of the insulin unit of the cartridge was more than four times the price of the insulin unit of the traditional vial.

The average dispensed quantities and their costs in both samples are shown in Table 2.

Table 3 shows the total needed and dispensed quantities of insulin per month for all the patients in both samples. As shown in the table, the average wastage for the second sample (48 IU/patient) was much smaller, about ten times, than the average wastage for the first sample (483.45 IU/patient).

Only 13 out of 516 patients in the first sample dispensed the exact quantity of insulin as they actually need, i.e., there was no wastage in the dispensed quantities. On the other hand, the number was 26 out of 40 patients in the second sample.

4. Discussion

Although the price of the insulin unit in the vial is more than four times cheaper than the unit in the cartridge, the cost of the average wastage in JD per patient in the second sample (JD 0.441) was less than the half that in the first sample (JD 1.022). This is because the average wasted quantity in the first sample was about ten times greater than the average wasted

Table 1 The RMS tender prices of the vial and the cartridge.

	Price (JD per bottle)	Price (JD per IU)
Insulin vial 100 IU/ml, 10 ml	2.113	0.002113
Insulin cartridge 100 IU/ml, 3 ml	2.754	0.00918

Table 2 The cost of insulin for average patient.

	First sample (vials)	Second sample (cartridges)
Average dispensed quantity (IU)	2459.30	2411.25
Cost of insulin for average patient (JD/patient)	5.197	22.135

Table 3 Total monthly needed and dispensed for both samples.

	First sample (vials) <i>N</i> = 516	Second sample (cartridges) <i>N</i> = 40
The total needed quantity (IU)/month	1019540	94530
The total dispensed quantity (IU)/month	1269000	96450
Total monthly wastage (IU)	249460	1920
Average wastage (IU/patient)	483.45	48
Cost of average wastage (JD/patient)	1.022	0.441

quantity in the second sample. However, it should be mentioned that the insulin quantity purchased in vial packages is more than ten times of that in cartridge packages.

The smaller quantity of wastage in the second sample can be explained by smaller size of the bottle of the cartridge (Table 2). This is because the needed quantity for each patient is more easily obtained by means of the smaller size of the cartridge than the larger size of the vial. Another indication of the decrease of wastage by using the cartridges is that 65% of the patients in the second sample were dispensed the exact quantity as they need, while in the first sample the percentage was only 2.47%.

In fact, the highest wasted quantity in the first sample reached up to 950 IU in some cases (for a patient needs 35 IU daily, 1050 IU monthly and who was dispensed 2000 IU); however, it did not actually exceed 150 IU in any case in the second sample.

The researchers modeled a hypothetical situation where all patients in the first sample were converted to use the cartridges. In this situation, the researchers calculated the number of cartridges that covers the actual monthly need for each patient in the first sample. The wastage under this hypothetical situation was then calculated using the same technique mentioned previously; Table 4 shows the end results of the conversion of the patients in the first sample from vials to cartridges.

Table 4 The hypothetical situation.

	First sample (vials), actual results	First sample under the hypothetical situation
The total needed quantity (IU)/month	1019540	1019540
The total dispensed/calculated quantity (IU)/month	1269000	1045800
Average dispensed quantity (IU)	2459.30	2026.7442
Cost of insulin for average patient (JD/patient)	5.197	18.606
Total monthly wastage (IU)	249460	26260
Average wastage (IU/patient)	483.45	50.89
Cost of average wastage (JD/patient)	1.022	0.467

The average wastage and its cost were reduced significantly under the hypothetical situation. The reduction in the cost per patient was more than the double as shown in Table 4. It should be mentioned clearly that the cost of the pen was excluded from the calculations since it is offered on a free of charge basis to the RMS from the awarded company.

5. Conclusion

Although, the direct cost per patient on vials was lower than cartridges, there was a substantial reduction in the cost of wastage by using the cartridges in the RMS out patients. The higher cost of wastage by using the vials increases the overall costs from the RMS perspective.

The results of this study apparently support the worldwide trends toward favoring the use of insulin cartridges and pens by highlighting another factor of hidden costs associated with the use of insulin vials. However, the conclusion is provided to be considered by the decision makers in the RMS and other publically funded health organizations.

Acknowledgment

Authors would like to thank Maj. Rabia J. Al Jabrah, MSc in clinical pharmacy, for her assistance in data collection.

References

Baser, O., Bouchar, J., DeLuzio, T., Henk, H., Aagren, M., 2010. Assessment of adherence and healthcare costs of insulin device (FlexPen®) versus conventional vial/syringe. *Adv. Ther.* 27 (2), 94–104.

Bohannon, N., 1999. Insulin delivery using pen devices: simple-to-use tools may help young and old alike. *Postgrad. Med.* 106 (5), 57–68.

Meece, J., 2008. Effect of insulin pen devices on the management of diabetes mellitus. *Am. J. Health Syst. Pharm.* 65, 1076–1082.

Rakel, R., 2009. Improving patient acceptance and adherence in diabetes management: a focus on insulin therapy. *Adv. Ther.* 26 (9), 838–846.

Ward, L., Aton, S., 2011. Impact of an interchange program to support use of insulin pens. *Am. J. Health Syst. Pharm.* 68, 1349–1352.