

Measurement of Insulin Wastage in Five Ontario Hospitals

D. Rosenbloom, J. Scime, O.D. Elviss, B. Mayhew, W.J. Thompson, P. Thornley and M. Wildeman

ABSTRACT

This study was designed to determine the extent of insulin wastage and the extrapolated cost of wastage for Ontario hospitals. The five hospitals in the study were chosen to include differences in patient mix and drug distribution systems. Beginning and ending inventories of all insulin types were taken spanning a six-week period. The quantity of insulin dispensed and wasted during this time period was recorded. Partial vials were measured using a calibrated scale. Wastage was calculated as insulin discarded divided by the amount of insulin used in the time period. Insulin wastage averaged 34.1%. This was equivalent to up to \$8,000 a year for the largest hospital surveyed and translates to an estimated cost of \$360,000 a year in all Ontario hospitals. Therefore, hospitals should estimate their insulin wastage and seek ways to reduce it. The pharmaceutical industry should be encouraged to develop cost-effective insulin delivery systems.

Key words: insulin, wastage

Can J Hosp Pharm 1994;47:5-7

RÉSUMÉ

L'étude avait pour but de déterminer dans quelle mesure on gaspille l'insuline dans les hôpitaux de l'Ontario et d'extrapoler le coût d'un tel gaspillage. Les cinq hôpitaux retenus pour le projet ont été choisis de manière à inclure une certaine diversité dans la clientèle et dans les systèmes de distribution des médicaments. On a dressé l'inventaire de toutes les formes d'insuline au début et à la fin d'une période de six semaines. La quantité d'insuline administrée et perdue au cours de cette période a été consignée. On a mesuré la quantité restant dans les ampoules au moyen d'une échelle étalonnée. Le volume gaspillé correspondait à la quantité d'insuline jetée, divisée par la quantité utilisée au cours de la période à l'étude. En moyenne, on gaspille 34,1 p. 100 d'insuline, soit l'équivalent de jusqu'à 8 000\$ par année pour les hôpitaux le plus importants examinés. En Ontario seulement, un tel gaspillage coûte approximativement 360 000 \$ par année. Les hôpitaux devraient déterminer quelle quantité d'insuline ils gaspillent et essayer de remédier au problème. Il faudrait aussi encourager l'industrie pharmaceutique à mettre au point des systèmes efficaces d'administration de l'insuline.

Mots clés: gaspillage, insuline

INTRODUCTION

Regardless of the drug distribution system utilized by a hospital, insulin is often dispensed as a multi-dose vial. In the chronic hospital setting, it is common to label a vial with an individual patient's name in anticipation of a hospital stay long enough for the vial contents to be fully used. In

the acute care setting, a shorter length of stay and the more frequently changing medical condition mean more frequent changes in dose and even insulin type than in the more stable chronic care setting. Hence, the allocation of one vial per insulin-requiring patient could generate considerable wastage. Hospitals often adopt a

one month expiry date on multi-dose vials following their initial use in order to minimize contamination¹⁻⁹.

There is little literature regarding the amount of insulin wastage in an institutional setting. The purpose of the present study; therefore, was to calculate the wastage of insulin across a spectrum of

D. Rosenbloom, Pharm. D., is the Director of Pharmaceutical Services, Chedoke-McMaster Hospitals and Associate Professor of Medicine, McMaster University, Hamilton, Ontario.

J. Scime, M.A., M.B.A., is a Consultant, JAS Business Consulting.

O. Dale Elviss, B.S.P., is the Co-ordinator of Materiel Management, Department of Pharmaceutical Services, Victoria General Hospital, London, Ontario.

B. Mayhew, B.Sc. Pharm., is the Director, Department of Pharmaceutical Services, Norfolk General Hospital, Simcoe, Ontario.

W. Jeffrey Thompson, B.Sc. Pharm, M.B.A., was the Director, Department of Pharmaceutical Services, West Haldimand General Hospital and is now Assistant Director of Pharmacy, Henderson Hospital, Hamilton, Ontario.

P. Thornley, B.Sc. Pharm, is the Director, Department of Pharmaceutical Services, Hotel Dieu Hospital, St. Catharines, Ontario.

M. Wildeman, B.S.P., M.S., was the Manager of Pharmacy, St. Peter's Hospital, Hamilton, Ontario, and is now the Co-ordinator of the Pharmacy Assistant Program at Mohawk College, Hamilton, Ontario.

This study was supported by a grant-in-aid from Connaught Novo Nordisk Inc.

Address Correspondence to: David Rosenbloom, Pharm.D., Director of Pharmaceutical Services, Chedoke-McMaster Hospitals, Box 2000, Station A, Hamilton, Ontario L8N 3Z5.

hospitals and drug distribution systems. We believe that these findings can be extrapolated to provide an estimate of the dollar value of insulin wastage in Ontario.

METHODS

Description of Hospitals

Five hospitals participated in this study. St. Peter's Hospital in Hamilton, Ontario is a 284-bed chronic geriatric facility with a wardstock drug distribution system. Five wards were surveyed representing 50% of the beds. The remaining wards were not surveyed because insulin was not used for these patients.

The West Haldimand General Hospital in Hagersville, Ontario has 21 chronic care beds and 50 acute care beds. This hospital used a wardstock drug distribution system. The three wards used in this study represented 100% of the beds.

Norfolk General Hospital in Simcoe, Ontario has 50 chronic care beds and 187 acute care beds. It used a "mosaic" drug distribution system. The eight wards used in this study represented 100% of the beds in the hospital.

Hotel Dieu Hospital in St. Catharines, Ontario has 235 acute care beds and it used a unit-dose drug distribution system. The ten wards used for the survey included 100% of the beds.

Victoria General Hospital in London, Ontario has 107 chronic care beds and 563 acute care beds. The hospital used a unit-dose drug distribution system. The study wards included 16 rehabilitative (chronic) beds and 282 acute care beds and these beds were considered to be representative of the hospital as a whole. The remaining beds were not surveyed because they were located on another campus and were less accessible.

These five hospitals spent varying amounts on insulin annually. For purposes of this study, annual usage was defined as the fiscal 1990/91 expenditure on insulin. St. Peter's annual expenditure was \$1600, West Haldimand's \$1200, Norfolk General's \$3166, Hotel Dieu's \$8337, and Victoria's \$26,604.

Measurement of Insulin Wastage and Calculations

The study took place over a six-week period on specific wards of each hospital. A beginning inventory was taken that documented the source of the insulin (eg. human, beef/pork) and the activity profile (i.e., regular, NPH etc.). Measurement of partial vials was accomplished using a calibrated ruler. Additional vials dispensed from the pharmacies during this study period were recorded. An ending inventory was taken at the conclusion of the six-week period. Expiry dates were checked either weekly or monthly by the pharmacy staff depending on the procedures and practices at each hospital.

"Usage" was defined as the beginning inventory on each ward, plus the vials dispensed to that ward, less the ending inventory on that ward. "Wastage" was defined as the insulin that was discarded due to either expiry, patient discharge, insufficient for dose, spoilage, or other.

The percentage wastage was calculated as wastage in mL divided by usage in mL times 100. The dollar value for annual wastage was calculated using the percent wastage multiplied by the 1990/91 annual expenditures.

RESULTS

The annual insulin expenditures and the wastage rates for the individual hospitals are presented in Figure 1.

A total of 1662.5 mL of insulin was used by the selected wards of the five hospitals in the six-week period (Table I). Of this usage, 566.5 mL was wasted. As expected, chronic wards wasted less insulin (15.9%), whereas acute wards wasted more (35.6%). Of the wastage, 73.9% was due to expiry, 11.6% was due to patient discharge (a form of expiry), 11.6% was due to spoilage, and the reasons were not recorded for 3.3%.

An interesting aspect was that the amount of insulin in the discarded vials was equal to or greater than 5.0 mL in 85% of the cases. The wasted vials contained on average 7.2 mL of insulin (median 8.0 mL). There were only small differences observed in the amounts of insulin left in the vials when broken down by the source of insulin and the activity profile.

DISCUSSION

The main objective of the study was to determine the overall wastage rather than the tracking of individual vials. Hence, nurses might have opened two vials when only one was required at a time. The tracking of each vial was not possible; however, due to the daily monitoring effort that would have been required at each site.

In attempting to calculate the financial impact of the wastage of insulin in the Ontario hospital system, the sales figure of all brands of insulin (including Lilly products) to Canadian hospitals of \$3,166,000 was used (communication from Connaught Novo Nordisk Inc.). Since Ontario hospitals serve roughly one-third of the Canadian population, it was assumed that they spend approximately \$1,055,333 annually on insulin. With a wastage rate of 34.1%, the annual cost of the wastage would be almost \$360,000. This is a substantial number; how-

Table I: Insulin Wastage Analysis by Hospital and Ward Type

HOSPITAL	WARD TYPE	USAGE (ML)	WASTAGE (ML)	% WASTAGE	WASTAGE TYPE	#OF VIALS
ST. PETER (Total)	Chronic	93.0	10.0	10.8	Expired	4
WEST HALDIMAND	Surgical	44.0	30.0	68.2	Expired	5
	Chronic	19.9	10.9	52.6	Expired	1
	Other	26.0	25.0	92.2	Expired	3
TOTAL		89.0	65.0	73.03		9
NORFOLK	Surgical	109.0	17.5	16.1	Expired	3
	Surgical		46.0	42.2	Discharge	7
	Surgical		9.0	8.3	Spoilage	1
	Medical	30.0	17.0	56.7	Expired	2
	Medical		10.0	33.3	Discharge	1
	Chronic	14.0	0.0	0.0		0
	Other	115.5	35.5	30.7	Expired	4
TOTAL		268.5	135.0	50.3		18
HOTEL DIEU	Surgical	278.0	56.0	20.1	Expired	8
	Surgical		17.0	6.1	Spoilage	2
	Surgical		8.5	3.1	Other	1
	Medical	120.5	12.5	10.4	Expired	2
	Other	424.5	94.0	22.1	Expired	12
	Other		37.5	8.8	Spoilage	6
	Other		10.0	2.4	Other	2
TOTAL		823.0	235.5	28.6		33
VICTORIA	Surgical	199.5				
	Medical	169.5				
	Other	20.0				
	?		111.0	28.5	Expired	14
	?		10.0	2.6	Discharge	1
TOTAL		389.0	121.0	31.1		15
GRAND TOTAL		1662.5	566.5	34.1		79
WARD TYPE TOTALS						
Chronic		126.0	20.0	15.9		5
Acute		1536.5	546.5	35.6		74

Definitions: Usage is defined as the Beginning Inventory plus Insulin Dispensed minus the Ending Inventory.

"?" refers to the lack of information regarding the ward origin.

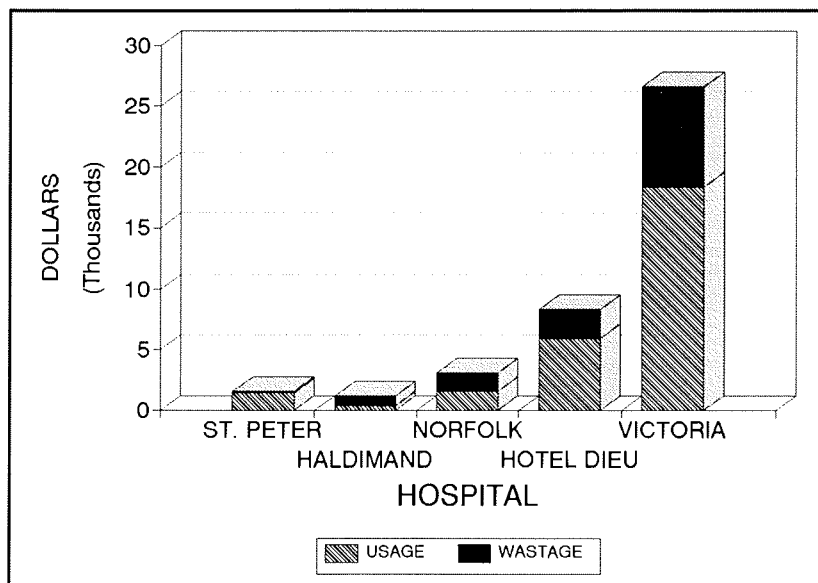


Figure 1: Annual 1990/91 Usage and Estimated Annual Wastage.

ever, spread over the hundreds of hospitals in Ontario, the impact is reduced. The annual wastage in the hospitals surveyed (Figure 1) was estimated to range from a figure of \$172 (St. Peter's) to \$8274 (Victoria). Therefore, although wastage may be less than \$1000 per annum for a smaller hospital, it can accumulate to thousands of dollars and become significant for larger hospitals.

In addition to recommending that hospitals estimate their insulin wastage and seek ways to reduce it, we also encourage the pharmaceutical industry to investigate and develop more efficient insulin delivery systems. One reasonable avenue to investigate is for manufacturers to produce a wider variety of package sizes (i.e., 5mL or even smaller vials). ☒

REFERENCES

1. Bawden J.C., Jacobson JA, Jackson JC, et al. Sterility and use patterns of multiple-dose vials. *Am J Hosp Pharm* 1982; 39: 294-7.
2. Anon. Panel discussion: Recent advances in the technology of injectable products. *Am J Hosp Pharm* 1983; 40: 1940-4.
3. Heller WM. Time limits on the use of opened multiple-dose vials. *Am J Hosp Pharm* 1980; 37: 1610.
4. Corley CE, Manos JP, Thomas JD. Multiple-dose vials: A source of contamination? *J SC Med Assoc* 1968; 64: 461-4.
5. Bothe J. Studies show contamination in multiple-dose vials. *J Am Assoc Reg N* 1973; 17: 111-4.
6. Sheth NK, Post GT, Wisniewski TR, et al. Multiple-dose vials versus single dose vials: A study in sterility and cost effectiveness. *J Clin Microbiol* 1983; 17: 377-9.
7. Longfield R, Longfield J, Smith LP, et al. Multi-dose medication vial sterility: An in-use study and review of the literature. *Infect Control* 1984; 5: 165-9.
8. De Silva M, et al. Multi-dose medication vials, study of sterility, use patterns and cost effectiveness. *Am J Infect Control* 1986; 3: 135-8.
9. Anon. Contamination of multi-dose vials due to repeat usage of syringes for aspiration — Nova Scotia. *Can Dis Weekly Report* 1988; 14: 193-5.