Time Savings Associated With Dispensing Unit-of-Use Packages

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Objectives: To determine how much time can be saved with the use of unit-of-use packaging in a community pharmacy, the distribution of work between the pharmacist and the pharmacy technician when unit-of-use packaging is used, and the number of errors that occur when either unit-of-use or bulk packaging is used in dispensing prescriptions. *Design:* A simulation comparing count-and-pour dispensing with unit-of-use package dispensing. *Setting:* An independent community pharmacy. *Participants:* Two teams, each composed of one pharmacist and one pharmacy technician. *Intervention:* Each team prepared 50 typical prescription orders, once using unit-of-use packaging and once by transferring medication from a bulk container. *Main Outcome Measures:* Time needed to dispense 50 prescriptions, dispensing activities performed by technicians and pharmacists, and number of dispensing errors. *Results:* The time saved with unit-of-use packaging compared with count-and-pour dispensing was 46.5 minutes per 100 prescriptions, which represents an average time savings of more than 27 seconds per prescrition. In the bulk package dispensing simulation, the pharmacists assisted in retrieving and counting medication for 26% of the prescriptions. This percentage dropped to 4% when unit-of-use packaging was used because the technicians dispensed prescriptions at a rate that occupied the pharmacist with verifying the prescription orders and dispensed products. Each team committed two counting errors when executing the bulk package trial and no errors when using unit-of-use packaging. *Conclusion:* Unit-of-use packaging can reduce the time needed for and increase the efficiency of pharmacists' dispensing activities. Unit-of-use packaging may also reduce the number of counting errors.

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Pharmacists' workload is a matter of increasing concern for the pharmacy profession and the public. Numerous groups have evaluated pharmacy workload issues, including the American Pharmaceutical Association (APhA), the National Association of Boards of Pharmacy (NABP), the National Association of Chain Drug Stores (NACDS), and the National Community Pharmacists Association (NCPA).[1–4] The growing concern over a pharmacy manpower shortage has attracted the attention of the U.S. Congress. In December 2000 the Health Resources and Services Administration (HRSA) delivered a report requested by Congress documenting the problem.[5] All of the assessments conclude that a manpower shortage exists in pharmacy and that it will not be a short-term problem. One way to alleviate the manpower shortage is to manage the workload more effectively.

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Industry statistics reveal that the number of outpatient prescriptions processed in the United States increased from 2 billion in 1992 to more than 3 billion in 1999; this number is projected to exceed 4 billion by 2005.[4] Yet the population of pharmacists remains relatively constant.[1,3,4] This imbalance warrants giving serious consideration to changes in practice that could improve the efficiency of prescription order processing.

Recently, the NABP Task Force on Pharmacy Manpower Shortage recommended standardized unit-of-use packaging as an option for decreasing work at the point of dispensing.[1] A unit-of-use package contains prescription medication in a quantity "designed and intended to be dispensed directly to a patient without modification except for the addition of a prescription label by a dispensing pharmacist."[6] Blister packs, compliance packs, course-of-therapy packs, and vials containing 1 month's supply of medication are examples of unit-of-use packaging. In contrast to a unit dose package that contains enough medication for one dose, unit-of-use packaging contains multiple doses sufficient for a typical course of therapy.[7] Adoption of unit-of-use packaging could reduce pharmacy workload by eliminating at least three time-consuming tasks from the dispensing process: measuring and counting dosage units, selecting and retrieving dispensing vials, and returning stock bottles to the storage shelves.

This alternative to counting and pouring from bulk packages has been considered from time to time for more than 50 years.[6] The last time that the adoption of unit-of-use packaging was given serious consideration as a standard in the United States was in 1992, when the United States Pharmacopoeial Convention sponsored a national conference on packaging. At that conference, there was general agreement that unit-of-use packaging was technically feasible and offered a number of advantages over stock bottles. Although a time savings was among the benefits cited, none of the presenters offered any specific data about the amount of time that could be saved or any evidence that unit-of-use could reduce the time pharmacists spend on dispensing relative to other activities.[6] The adoption of unit-of-use packaging in the United States has advanced little in the interim.

Objectives

The primary objective of this study was to measure the time that could be saved with unit-of-use packaging in a typical community pharmacy setting. The second objective was to note the distribution of work between the pharmacist and technician when unit-of-use packaging is used in place of bulk packaging. The third objective was to compare the number of errors that occur when using the two different package types.

Methods

We conducted a simulation study to capture a credible estimate of the time that could be saved by using unit-of-use packaging in a typical community pharmacy. As a first step, members of the research team observed the dispensing process in several pharmacies. These preliminary observations were made at local pharmacies representative of chain, independent, grocery store, and clinic practice. The results of these initial observations showed that the number of prescriptions requiring transfer from one package to another varied from site to site. However, the proportion of capsules, tablets, and liquids being transferred from bulk containers to prescription vials and bottles—76%, 20%, and 4%, respectively—was remarkably consistent. These proportions were adopted for the mix of dosage forms used in the simulation study.

For the simulation, we selected a set of 50 prescription products (see Table 1) from among those ranked by *Drug Topics* as the top 200 drugs by prescription in 1999.[8,9] The selection included an equal number of brand-name and generic drug products and a variety of manufacturers, so that during the simulation the participants would traverse all the areas where prescription products were stored in the pharmacy. We excluded topical medications and drugs that are almost always dispensed in unit-of-use packages, such as inhaled and injectable drugs, because the purpose of the simulation was to compare dispensing using bulk packaging with dispensing using unit-of-use packaging.

The dispensing simulation was conducted in an independent pharmacy in a large city in northern Florida with the cooperation of the pharmacy owner and staff. It took place on a Saturday afternoon in July 2000 after the pharmacy had closed for the day. All participants in the simulation were familiar with the pharmacy as well as its equipment, layout, and inventory, and they had worked with one another before. The four participants were assigned to two teams consisting of one pharmacist and one technician. The observer read instructions to each team, directing them to prepare the prescriptions in the order they were presented while taking the typical time and care needed for prescription processing. The pharmacists were asked to perform the same checking procedures that they routinely apply to any prescription.

The prescription orders were computer printed and presented to the dispensing teams along with a prescription label. The labels had been prepared in advance because this step is common to dispensing both bulk and unit-of-use prescriptions. Using preprinted labels permitted us to measure the time intervals of interest without disrupting the computer record-keeping system at the pharmacy. Each preprinted label included the pharmacy's name and phone number, the patient's name, the drug and strength, the quantity prescribed, the directions for use, and the physician's name.

We used 20-dram prescription vials with childproof caps to simulate unit-of-use packaging. Each vial had a label (1 inch by 2 5/8 inches) with the drug name, strength, package size, lot number, and expiration date. There was enough room at the bottom of the vial for a prescription label to be placed below the "manufacturer's" label with no overlap.

Bulk packaging for the simulation consisted of empty stock bottles collected from a local pharmacy. Appropriately sized and shaped candies were substituted for active medications and loaded into the bulk bottles. This approach required the teams to select the proper package from among the bottles in the existing inventory while eliminating the need to handle and discard expensive products or assume the risk of returning medications to their original containers. The simulated stock bottles were given labels measuring 2 inches by 4 inches with the drug name and strength, the bulk package size, the lot number, and expiration date. Both the unit-of-use and bulk packages were placed in the appropriate location along with the regular pharmacy stock.

Team 1 first prepared the set of 50 prescriptions using the bulk packages and then filled the set of 50 prescriptions using the unit-of-use packages. Team 2 performed the same tasks in the reverse order; that is, they dispensed the 50 prescriptions using unit-of-use packages first, followed by the 50 prescriptions using bulk packaging. The prescription set was presented in a different order each time to offset any learning effects on total dispensing time.

The observer started timing when a team member picked up the first prescription in the set. The time when each prescription was deposited into the "completed" bin was recorded on the data collection sheet along with the name of the team member who retrieved and counted the medication. Timing was stopped after the last prescription in the set was finished and the stock bottles

Table 1. Prescription Orders Used in the Simulation[a]

1. Orphenadrine citrate 100 mg #50	26. Estratest #30
2. Potassium chloride 20 mEq #30	27. Verapamil SR 240 mg #30
3. Celebrex 100 mg #60	28. Relafen 750 mg #75
4. Propoxyphene-N-100/APAP 650 mg #40	29. BuSpar 15 mg #45
5. Cephalexin 500 mg #40	30. Quinine sulfate 324 mg #30
6. Ranitidine 150 mg #60	31. Xanax 1 mg #45
7. Ambien 10 mg #45	32. Ortho-Novum 7/7/7 #28
8. Mevacor 10 mg #30	33. Naproxen 500 mg #75
9. Enteric-coated aspirin 325 mg #100	34. Allegra 60 mg #60
10. Benzonatate 200 mg #45	35. Skelaxin 400 mg #100
11. Guaifenesin 600 mg #40	36. Hyoscyamine 0.125 mg #90
12. Ultram 50 mg #120	37. Hydrochlorothiazide 25 mg #100
13. Albuterol oral liquid 240 mL	38. Zoloft 50 mg #45
14. Yohimbine 5.4 mg #45	39. Levaquin 100 mg #14
15. Premarin 0.625 mg #25	40. Ketoprofen 200 mg #45
16. Triazolam 10 mg #20	41. Sumycin 500 mg #100
17. Glucophage 500 mg #60	42. Vioxx 25 mg #30
18. Spironolactone 25 mg #30	43. Metoprolol 50 mg #30
19. Diphenoxylate with atropine #24	44. Tussionex suspension 240 mL
20. Imdur 20 mg #30	45. Wellbutrin SR 150 mg #60
21. Butalbital/APAP/caffeine #50	46. Colchicine 0.6 mg #30
22. Lanoxin 0.25 mg #100	47. Lorazepam 1 mg #10
23. Trimethoprim/sulfasoxazole DS #24	48. Prilosec 20 mg #30
24. Norvasc 10 mg #30	49. Claritin 10 mg #30
25. Warfarin 1 mg #12	50. Neurontin 100 mg #90

[a]Prescriptions were presented in a different order for each simulation trial.
Source: References 8, 9.

were returned to the pharmacy shelves. The entire simulation was recorded with a video camera that imprinted the elapsed time, and the videotape was used to verify the direct observation record.

The times required for bulk and unit-of-use dispensing were computed for both teams. All of the prescriptions were examined to verify that they contained the proper content and correct quantity.

Results

The times recorded for preparing the set of 50 prescription orders with unit-of-use packages were 19.5 minutes for team 1 and 20.5 minutes for team 2. These results account for the times needed to read the label, walk to the shelf, retrieve the package, return to the counter, label the package, have it checked by the pharmacist, cover the label with tape, place the vial in a bag, and put the bag in a bin designated for completed prescriptions.

Using bulk packaging, team 1 needed 45 minutes to prepare the same set of 50 prescription orders, whereas team 2 completed the identical task in 41.5 minutes. The timed activities for this part of the simulation included the steps required for dispensing using unit-of-use packages, plus the time needed to open the container, pour the contents onto the counting tray, count the correct number of dosage units, return any excess to the stock bottle, locate an appropriately sized dispensing vial, pour the “medicine” into the prescription vial, and replace the bulk container to the proper shelf.

The total time the two teams needed to prepare 100 prescriptions using unit-of-use packaging was 40 minutes. These same two teams needed 86.5 minutes to dispense those 100 prescriptions when they were required to count or measure the various tablets, capsules, and liquids that were ordered. The time saved was 46.5 minutes, an average of more than 27 seconds per prescription. This represents a reduction of more than one-half of the total prescription assembly time.

When bulk packaging was used in the simulation, the pharmacist member of team 1 retrieved the stock bottle and counted the medication for 14 of the 50 prescriptions in the set and performed the final check for all 50 finished prescriptions. Likewise, the pharmacist from team 2 retrieved and counted the medication for 12 of the 50 prescriptions and checked all the finished products when bulk packaging was used. However, the pharmacists were primarily occupied with checking the prescriptions when the team prepared them using unit-of-use packaging. The pharmacist assigned to team 1 retrieved the unit-of-use package from the storage area for only 1 of the 50 prescription orders; the pharmacist in team 2 retrieved the package from the storage area for 3 of the 50 orders. Overall, the pharmacists were involved in the actual prescription assembly process for 26% of the orders dispensed from bulk stock and 4% of the prescriptions using unit-of-use packaging. When dispensing in unit-of-use packaging, the technicians assembled most of the prescriptions. The pharmacists conducted the final check for accuracy of every prescription in both arms of the study.

There were no errors in which the wrong product was used to fill any prescription order during the simulation. However, four counting errors were found when the bulk-packaged prescriptions were examined—two errors by each team. Team 1 prepared one prescription with 5 fewer dosage units than ordered and filled a second with 5 units more than the order specified. Team 2 dispensed 10 extra dosage units in one instance and included 1 extra unit in a second.

Discussion

A search of the pharmacy literature yielded one article reporting detailed information about the time required for preparing unit-of-use sized prescription packages from bulk packaging. Campbell et al.[10] recorded the time required for prepackaging prescription drugs as part of their effort to assess the cost-effectiveness of prepackaging activities in outpatient pharmacies operated by Kaiser Permanente. They separately measured the average manual packaging time for tablets, capsules, and liquids. Using their figures, we estimated that unit-of-use packaging would eliminate approximately 45 minutes of time for every 100 products transferred in a set of prescriptions, given the mix of tablets, capsules, and liquids selected for testing in our simulation.

We found that unit-of-use packaging cut the amount of time required for prescription assembly by a total of 46.5 minutes for every 100 prescriptions prepared with unit-of-use packaging. This represents an average time savings of mose than 27 seconds per prescription. Heaton et al.[11] estimated that unit-of-use containers would generate a savings of 50 seconds per prescription. Their estimate was derived from videotapes of the dispensing process recorded in a busy chain pharmacy during normal business hours. The videotape was used to document the time needed to perform steps that could be eliminated with a unit-of-use package for a random sample of prescriptions captured on tape; that is, the researchers measured the time needed to open the bulk container, count and place tablets in a prescription vial, and then cap and label the vial. They added time to their results to account for the reduction in travel time between storage areas as an opportunity for further efficiencies. In comparison with the results reported by Heaton et al.,[11] it appears that our simulation represents a conservative estimate of the time savings possible with unit-of-use packaging.

However, the relative time savings may be more important than a precise estimate of the number of minutes that can be saved per prescription or per day. The overall time that could be saved in any given pharmacy will depend on the prescription volume and the proportion of prescriptions that require the drug product to be transferred from the manufacturer's package to a container for the patient. Another factor that may affect total time is the use of automated counting devices. Irrespective of these differences across pharmacy practice sites, the results of this study support the conclusion that unit-of-use packages save a significant amount of time.

Furthermore, our results suggest that technicians can handle a greater share of the prescription assembly tasks with a unit-of-use system, while pharmacists may shift their efforts during the time gained to activities other than manual order processing. According to an NACDS–Arthur Andersen study on pharmacist productivity, the average pharmacist spends only 31% of his or her time on cognitive activities, such as reviewing and interpreting the prescription order, assessing patients' drug therapy, resolving clinical conflicts, contacting physicians, and counseling patients about their prescriptions. Based on these results, the study consultants concluded that "a significant opportunity exists to transfer pharmacist time to ancillary personnel."[3] Our results confirm this conclusion. Unit-of-use packaging is one approach that may permit pharmacists to transfer certain work activities to ancillary personnel.

Pharmacists often identify cost considerations as the primary obstacle to adopting unit-of-use packaging. In national surveys of pharmacists conducted by NCPA in 2000[12] and by APhA in 1985,[13] the most frequently cited obstacle to unit-of-use was the assumption that drug products purchased in smaller package sizes are much more expensive per dosage unit than those supplied in bulk packages. We tested this assertion in the study pharmacy by consulting the wholesale price schedule for the prescription products used in the simulation. When we calculated the actual acquisition cost (AAC) of bulk packages and compared it with the AAC for an equivalent quantity of the same products purchased in smaller package sizes, the net price difference was $6.31. In our case, this increase in cost would be offset by eliminating the need for a separate prescription vial as well as by the time saved.

Other reports have suggested that unit-of-use packaging can actually reduce total inventory cost. By requiring fewer units in stock at any given time, adoption of unit-of-use packaging increases inventory turnover and cash flow.[6,11] The extent to which unit-of-use packaging would require additional space and reconfiguration of existing storage space is open to debate.[11]

The results of our study also suggest that unit-of-use packaging could eliminate counting errors. Overages and shortages have implications for customer relations, inventory management, and therapeutic outcomes. An inadvertent shortage of dosage units in an expensive prescription may make a patient distrustful of his or her pharmacist. Units dispensed in excess of the intended quantity adversely affect profits, and perhaps, lead to overuse of the medication. In addition to ensuring accurate quantities, unit-of-use packaging increases patient safety by maintaining product integrity, allowing for a bar-coded label to be attached from the point of manufacture through delivery to the patient, and by giving the patient access to the manufacturer's expiration date and lot number in the event of a product recall.

Most developed nations use unit-of-use packaging for pharmaceutical products, including Canada, Australia, New Zealand, and most countries in Europe and South America.[7] Undoubtedly, the widespread adoption of unit-of-use packaging in the United States would require substantial changes in manufacturing and storage throughout the channel of distribution. It might also require a change in prescribing practices and, possibly, changes in the regulations governing pharmacy. Furthermore, the adoption of unit-of-use could not occur without the consensus and cooperation of pharmaceutical manufacturers, medicine, pharmacy, nursing, government agencies, and consumer groups.[6]

In 1992 APhA adopted a policy opposing the exclusive use of unit-of-use packaging, and the National Wholesale Druggists Association (now the Healthcare Distribution Management Association) took the position that the demands of the competitive marketplace would be the best way to establish whether unit-of-use packaging is useful and cost-effective.[7]

Limitations

It is possible that the precision of the estimated time savings was limited by interruptions. Although the simulation took place after normal business hours, unexpected distractions occurred, including the noise of telephone messages being recorded on the answering machine and the appearance of a patient who needed an emergency prescription. Time was also lost in locating a misplaced stock bottle and replenishing office supplies. Although timing was suspended when there was an interruption, these distractions could have interrupted the workflow and affected the precision of our time estimates. Nevertheless, both teams experienced a similar number of interruptions, and their times were comparable.

Two factors support the reliability and validity of the time estimates. First, the times for the two teams were similar in both parts of the simulation. When using bulk packaging, the two teams finished within 3 minutes and 32 seconds of one another. In the unit-of-use packaging simulation, the times differed by 58 seconds. The total time difference for entire exercise was 2 minutes and 30 seconds. Second, the total time savings of 46.5 minutes was consistent with the predicted time savings of 45 minutes that was based on data reported by Campbell et al.[10]

Conclusion

The pharmacy manpower shortages that exist today are predicted to worsen in the near future as prescription volume increases and new opportunities for patient-oriented pharmacy practice emerge. Unit-of-use packaging is one way to help pharmacists reduce the time they devote to dispensing. The time saved could permit pharmacists to oversee the processing of an increased volume of prescriptions and to provide cognitive services such as drug therapy management. Adoption of unit-of-use packaging may also help to clarify the complementary roles of pharmacists and pharmacy technicians. Unit-of-use packaging may offer additional benefits in terms of reducing dispensing errors.

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