

Communi-Pharm™ Analysis: Impact of Changing Input Parameters on Results

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INTRODUCTION

The use of computer-based simulations to teach decision making was minimal before 1981 but has since grown considerably (1). Simulations now are employed in the areas of pharmacokinetics modeling, clinical problem solving, pharmacy management, and other areas (2, 3). Simulation models permit the modeling of demands under conditions that approximate real life; they are useful tools for assessing alternative use of resources in terms of cost-minimization and cost-benefit analyses.

Simulation models have been used primarily in "what if" operational management analyses (4). They have particular application to systems with random events, such as the delivery of drug services. This has been done by two primary methods, sometimes simultaneously. On the demand side, the types of demand for services (e.g., new, refill, compounded prescriptions, IVs, consultations) or the level (quantity) of that demand may be mixed or adjusted to determine its effect on an existing complement of resources. This approach addresses the question, for example, of how much unused capacity exists within a pharmacy as presently configured or how

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well existing resources could handle a different mix of demands. The second approach focuses on the resource side and involves investigation of the optimal resource mix to meet a specified demand level. Some employ a combination, characterized by what might be called the marketing model. In this case, the student (player) attempts to influence demand by using various tools at his disposal, such as advertising and price. The player may be required to organize the firm's resources to produce the product or service at the demand levels that have been simulated.

Communi-Pharm™ (version 88.8), developed by Arthur Nelson, is a community pharmacy simulation game that replicates community pharmacy practice. In this game, up to seven pharmacies compete against each other for prescription (Rx), over-the-counter (OTC), and third-party market share in hypothetical cities. It has been widely used as a teaching tool, both in the classroom and in countless community pharmacy continuing education seminars throughout the country. Use of the program invariably generates further interest, as well as some frustrations for the participant. The players are often unclear about how and to what extent one's decisions affect observed results, as opposed to the actions of competitors. As in the real world, this question cannot be answered during the normal course of conduct in the game.

PURPOSE

The purpose of this study was to investigate how different input variables in the Communi-Pharm™ pharmacy management simulation affected the results. The intent of this study was to determine:

1. How do changes in promotion affect sales?
2. What is the impact of services, specifically delivery and offering patient records, on sales and net profit?
3. How do high and low markup, in combination with or without services, affect sales and net profit?

METHODS

One city was examined, consisting of seven stores: two medical centers, three neighborhood stores, and two shopping centers. Baseline data are shown in Table 1. The baseline data were extracted from sample data on the Communi-Pharm™ 88.8 program disk. The pharmacies were typical of those used to initiate the game; each was less than optimally managed at the start. A copy of the instructor data used for all simulations is provided in the Appendix.

For each objective, a single pharmacy of each type was examined. The three pharmacies were: Number 1 (medical center), Number 4 (neighborhood store), and Number 5 (shopping center). The pharmacies were examined on an individual basis, and only one parameter in one store type was changed at any one time. The same period was rerun many times over, changing only the parameter of interest.

Promotion

To determine the impact of promotion on sales, two different approaches were used. The first involved changing the total amount of money allocated to the promotion budget. The range of promotion dollars in the budget was from \$0 to \$1,600, and results were recorded at \$200 increments. In each case, 50% of the total promotion budget was distributed to the prescription department.

The second approach involved changing the percentage of the promotion budget that was allocated to the prescription department. In each case, the promotion budget was set at \$1,200, and the percentage allotted to the Rx department was changed from 0% to 100% in increments of 15%.

Services Offered

The only services examined in this study were delivery and patient records. Results were recorded for four combinations: patient records and delivery services offered, delivery only, patient records only, and no services offered.

TABLE 1. Summary Statistics for Pharmacies at Baseline*

| | All Pharmacies | Neighborhood | Shopping Center | Medical Center |
|------------------------------|----------------|--------------|-----------------|----------------|
| Total store sales | \$164,983 | \$188,069 | \$171,822 | \$123,515 |
| Average Rx charge | \$18.72 | \$19.23 | \$17.52 | \$19.17 |
| Total number of Rxs | 5,000 | 5,638 | 3,990 | 5,053 |
| Number 3rd-party Rxs | 1,300 | 2,160 | 1,016 | 294 |
| Average Rx markup | 40% | 41% | 35% | 41% |
| OTC markup | 38% | 33% | 34% | 48% |
| Promotion budget | \$1,357 | \$900 | \$2,650 | \$750 |
| Promotion \$ allocated to Rx | 70% | 60% | 93% | 63% |
| Store hours open | 74 | 75 | 95 | 50 |
| Net profit/total sales | -1% | 2% | -14% | 8% |
| Rx market share | 14% | 13% | 11% | 18% |

*Values represent averages for pharmacies of each designated type.

Markup and Services

In this section, markup alternatives consisted of high Rx and high OTC markup or low Rx and low OTC markup. For Rx drugs, the low, mean, and high markups were 33%, 40%, and 55%, respectively, regardless of pharmacy type. For OTC drugs, the low, mean, and high markups were 28%, 38%, and 42%, respectively. The mean values are those at baseline for all pharmacies.

When services were considered, patient records and delivery were combined. Integrating markup and service options produced four combinations for analysis: high markup (Rx and OTC), services offered; high markup (Rx and OTC), no services offered; low markup (Rx and OTC), services offered; and low markup (Rx and OTC), no services offered. All simulations were based on quarterly time periods.

RESULTS

Promotion

The results of changing the amount of the promotion budget are presented in Table 2. When one examines the impact of promotion on total sales, it is clear that the neighborhood pharmacy is most affected by increasing advertising dollars. The increase in total sales was approximately \$20,000 for the neighborhood pharmacy, as opposed to only \$3,000 and \$4,000 for the shopping center and medical center pharmacies, respectively. When total sales were differentiated into Rx sales and OTC sales, it was clear that the OTC department was more heavily affected than the Rx department. It was also observed that a plateau was eventually reached after which an increase in promotion dollars no longer generated higher total sales. This plateau occurred at \$1,200, the maximum level set in the instructor's file.

The results of the second parameter, altering the percentage of the promotion budget allocated to the Rx department, are shown in Table 3. The results were unexpected in that there were not substantial changes in the Rx sales when more money was allotted to the Rx department. The results do, however, generally agree with the

TABLE 2. Impact of Modifying Promotion Expenses on Sales by Pharmacy Type

| Promotion | <u>NEIGHBORHOOD STORE</u> | | | # of Rx | Rx Mkt. Share % |
|-----------|---------------------------|-----------------|------------|---------|-----------------|
| | <u>Total</u> | <u>Sales Rx</u> | <u>OTC</u> | | |
| \$0 | \$188,573 | \$108,631 | \$79,941 | 6,512 | 18.6 |
| \$200 | \$188,573 | \$108,631 | \$79,941 | 6,512 | 19.6 |
| \$400 | \$188,573 | \$108,631 | \$79,941 | 6,512 | 18.6 |
| \$600 | \$189,616 | \$109,675 | \$79,941 | 6,573 | 18.8 |
| \$800 | \$197,825 | \$109,675 | \$88,151 | 6,573 | 18.8 |
| \$1,000 | \$203,090 | \$110,706 | \$92,384 | 6,633 | 18.9 |
| \$1,200 | \$208,198 | \$111,798 | \$96,400 | 6,696 | 19.1 |
| \$1,400 | \$208,198 | \$111,798 | \$96,400 | 6,696 | 19.1 |
| \$1,600 | \$208,198 | \$111,798 | \$96,400 | 6,696 | 19.1 |

MEDICAL CENTER

| Promotion | <u>Total</u> | <u>Sales Rx</u> | <u>OTC</u> | # of Rx | Rx Mkt. Share % |
|-----------|--------------|-----------------|------------|---------|-----------------|
| \$0 | \$124,366 | \$103,446 | \$20,921 | 5,449 | 15.6 |
| \$200 | \$124,366 | \$103,446 | \$20,921 | 5,449 | 15.6 |
| \$400 | \$127,813 | \$103,446 | \$24,368 | 5,449 | 15.6 |
| \$600 | \$127,813 | \$103,446 | \$24,368 | 5,449 | 15.6 |
| \$800 | \$127,813 | \$103,446 | \$24,903 | 5,449 | 15.6 |
| \$1,000 | \$128,349 | \$103,446 | \$24,903 | 5,449 | 15.6 |
| \$1,200 | \$128,349 | \$103,446 | \$24,903 | 5,449 | 15.6 |
| \$1,400 | \$128,349 | \$103,446 | \$24,903 | 5,449 | 15.6 |
| \$1,600 | \$128,349 | \$103,446 | \$24,903 | 5,449 | 15.6 |

TABLE 2 (continued)

SHOPPING CENTER

| Promotion | Total | Sales Rx | OTC | # of Rx | Rx Mkt. Share % |
|-----------|-----------|-------------|----------|---------|-----------------|
| \$0 | \$128,728 | \$66,988 | \$61,740 | 4,064 | 11.6 |
| \$200 | \$130,925 | \$69,184 | \$61,740 | 4,196 | 11.9 |
| \$400 | \$131,740 | \$70,000 | \$61,740 | 4,246 | 12.1 |
| \$600 | \$131,740 | \$70,000 | \$61,740 | 4,246 | 12.1 |
| \$800 | \$131,740 | \$70,000 | \$61,740 | 4,246 | 12.1 |
| \$1,000 | \$131,740 | \$70,000 | \$61,740 | 4,246 | 12.1 |
| \$1,200 | \$131,740 | \$70,000 | \$61,740 | 4,246 | 12.1 |
| \$1,400 | \$131,740 | \$70,000 | \$61,740 | 4,246 | 12.1 |
| \$1,600 | \$131,740 | \$70,000 | \$61,740 | 4,246 | 12.1 |

outcome of the first approach to examining promotion. What is more surprising is that regardless of the percentage of the promotion budget allotted to the OTC department (0% to 100%), there was no change in the OTC sales. This pattern was consistent across all pharmacy types.

Services

The results shown in Table 4 indicate that offering services has a substantial impact on sales, specifically Rx sales. Both the neighborhood pharmacy and the medical center had an increase in total sales (and Rx sales) in the range of \$18,000 to \$23,000 and increases in net profit of about \$4,000. The shopping center pharmacy did not fare as well, only increasing sales by \$3,700 and net profit by \$250. The change in net profit is shown; however, the values may be misleading, as expense items such as staffing were not adjusted in response to any change in sales. Because the services offered were mainly from the Rx department, OTC sales, as expected, were not affected by the changes in the services offered. When one compares the impact of the services individually, it appears that offering delivery has a slightly higher outcome than offering patient records. This difference, however, is minimal.

Combined Impact of Markup and Services

The results of the combined effect of markup and services are given in Table 5. The impact of moving from low to high markup was a dramatic increase in OTC sales and total sales for the neighborhood and shopping center pharmacies, but not for the medical center pharmacy. This held true regardless of the level of services offered. In the case of the medical center pharmacy, moving from high to low markup actually resulted in a sales decline. Because the number of prescriptions filled remained relatively constant, this pattern reflects the price inelasticity for medical center pharmacies. This table also illustrates the impact of services under conditions of high and low markup. The presence of services had the greatest impact on Rx volume and sales. However, there was little difference in the magnitude of impact depending on whether markup was high or low. Although sales increased substantially with low

TABLE 3. Impact of Modifying the Allocation of Promotion Expenses to the Prescription Department on Sales, by Pharmacy Type

| Promotion % to Rx Dept.* | <u>NEIGHBORHOOD STORE</u> | | | # of Rx | Rx Mkt. Share % |
|-----------------------------|---------------------------|-------------|----------|---------|--------------------|
| | Total | Sales Rx | OTC | | |
| 0% | \$208,198 | \$111,798 | \$96,400 | 6,696 | 19.1 |
| 15% | \$205,032 | \$108,631 | \$96,400 | 6,512 | 18.6 |
| 30% | \$206,065 | \$109,675 | \$96,400 | 6,573 | 18.8 |
| 45% | \$207,106 | \$110,706 | \$96,400 | 6,633 | 18.9 |
| 60% | \$208,198 | \$111,798 | \$96,400 | 6,696 | 19.1 |
| 75% | \$209,454 | \$113,054 | \$96,400 | 6,771 | 19.3 |
| 90% | \$209,454 | \$113,054 | \$96,400 | 6,771 | 19.3 |
| 100% | \$209,454 | \$113,054 | \$96,400 | 6,771 | 19.3 |

MEDICAL CENTER

| Promotion % to Rx Dept.* | <u>Total</u> | <u>Sales</u> <u>Rx</u> | <u>OTC</u> | # of Rx | Rx Mkt. Share % |
|-----------------------------|--------------|---------------------------|------------|---------|--------------------|
| 0% | \$128,349 | \$103,446 | \$24,903 | 5,449 | 15.6 |
| 15% | \$128,349 | \$103,446 | \$24,903 | 5,449 | 15.6 |
| 30% | \$128,349 | \$103,446 | \$24,903 | 5,449 | 15.6 |
| 45% | \$128,349 | \$103,446 | \$24,903 | 5,449 | 15.6 |
| 60% | \$128,349 | \$103,446 | \$24,903 | 5,449 | 15.6 |
| 75% | \$129,567 | \$104,664 | \$24,903 | 5,513 | 15.8 |
| 90% | \$129,567 | \$104,664 | \$24,903 | 5,513 | 15.8 |
| 100% | \$130,026 | \$105,123 | \$24,903 | 5,538 | 15.8 |

TABLE 3 (continued)

SHOPPING CENTER

| Promotion % to Rx Dept.* | <u>Total</u> | Sales <u>Rx</u> | <u>OTC</u> | # of Rx | Rx Mkt. Share % |
|-----------------------------|--------------|--------------------|------------|---------|--------------------|
| 0% | \$131,740 | \$70,000 | \$61,740 | 4,246 | 12.1 |
| 15% | \$128,728 | \$66,988 | \$61,740 | 4,064 | 11.6 |
| 30% | \$131,740 | \$70,000 | \$61,740 | 4,246 | 12.1 |
| 45% | \$131,740 | \$70,000 | \$61,740 | 4,246 | 12.1 |
| 60% | \$131,740 | \$70,000 | \$61,740 | 4,246 | 12.1 |
| 75% | \$131,740 | \$70,000 | \$61,740 | 4,246 | 12.1 |
| 90% | \$131,740 | \$70,000 | \$61,740 | 4,246 | 12.1 |
| 100% | \$131,740 | \$70,000 | \$61,740 | 4,246 | 12.1 |

*Total promotion dollars = \$1,200

markup, net profit plummeted. Net profit decreased by \$26,000, \$7,000, and \$16,000 in the neighborhood store, shopping center, and medical center pharmacies, respectively. The same caveats apply in interpreting impact on net profit.

SUMMARY

Promotion

It is evident that increasing the amount of money spent on advertising is effective only to a certain extent, a plateau being reached at about \$1,200. This is consistent with the intent of the program as reflected in the instructor's guide. Further, in this analysis, the type of pharmacy most affected by promotion was the neighborhood pharmacy, and it was the OTC sales that increased, not the Rx sales. Increasing the percentage of promotion dollars to the Rx department had a minimal effect on Rx sales and no impact on OTC sales. Because this finding does not seem reasonable, these results warrant further investigation.*

Services Offered

As expected, offering both services to the public had a large impact on total sales, the response mainly affecting Rx sales as opposed to OTC sales. This was the case for both the neighborhood pharmacy and the medical center pharmacy but was not so for the shopping center.

Markup and Services

The impact of moving from high to low markup situations was a dramatic increase in total sales, specifically in the neighborhood and shopping center pharmacies. Offering services also increased

*This apparent error was corrected in the 1989 version of the CommuniPharm™ program. The analysis was rerun on a 1989 beta test version of the program. The results showed that altering promotion dollars or allocation did not greatly affect OTC sales in the medical center pharmacy and had uneven results in the shopping center and neighborhood pharmacies.

TABLE 4. Impact of Modifying Services on Sales by Pharmacy Type

DELIVERY = YES

| | Patient Records = Yes | | | Patient Records = No | | |
|-------------|------------------------|---------------------------|--------------------------|------------------------|---------------------------|--------------------------|
| | Neigh. <u>Store</u> | Shopping <u>Center</u> | Medical <u>Center</u> | Neigh. <u>Store</u> | Shopping <u>Center</u> | Medical <u>Center</u> |
| Total sales | \$202,285 | \$134,301 | \$127,873 | \$189,433 | \$133,224 | \$119,470 |
| Rx sales | \$109,675 | \$72,560 | \$103,446 | \$99,506 | \$71,483 | \$96,384 |
| OTC sales | \$92,611 | \$61,740 | \$24,428 | \$89,926 | \$61,740 | \$23,086 |
| # of Rx | 6,573 | 4,399 | 5,449 | 5,997 | 4,335 | 5,076 |
| Net profit | \$13,297 | (\$11,637) | \$11,238 | \$11,268 | (\$11,456) | \$9,224 |

DELIVERY = NO

| | Patient Records = Yes | | | Patient Records = No | | |
|-------------|------------------------|---------------------------|--------------------------|------------------------|---------------------------|--------------------------|
| | Neigh. <u>Store</u> | Shopping <u>Center</u> | Medical <u>Center</u> | Neigh. <u>Store</u> | Shopping <u>Center</u> | Medical <u>Center</u> |
| Total sales | \$189,351 | \$131,740 | \$115,837 | \$178,692 | \$130,651 | \$108,465 |
| Rx sales | \$99,424 | \$70,000 | \$92,752 | \$88,766 | \$68,911 | \$85,379 |
| OTC sales | \$89,926 | \$61,740 | \$23,086 | \$89,926 | \$61,740 | \$23,086 |
| # of Rx | 5,971 | 4,246 | 4,883 | 5,343 | 4,181 | 4,494 |
| Net profit | \$11,575 | (\$11,546) | \$8,404 | \$9,547 | (\$11,389) | \$6,668 |

TABLE 5. Impact of Modifying Both Markup and Services on Sales, by Pharmacy Type

HIGH RX AND OTC MARKUP

| | Services = Yes | | | Services = No | | |
|-------------|---------------------|------------------------|-----------------------|---------------------|------------------------|-----------------------|
| | <u>Neigh. Store</u> | <u>Shopping Center</u> | <u>Medical Center</u> | <u>Neigh. Store</u> | <u>Shopping Center</u> | <u>Medical Center</u> |
| Total sales | \$197,825 | \$121,580 | \$129,120 | \$174,425 | \$117,684 | \$109,743 |
| Rx sales | \$109,675 | \$59,839 | \$102,813 | \$88,766 | \$55,944 | \$84,779 |
| OTC sales | \$88,151 | \$61,740 | \$26,307 | \$85,479 | \$61,740 | \$24,965 |
| # of Rx | 6,573 | 3,592 | 5,415 | 5,343 | 3,361 | 4,462 |
| Net profit | \$20,698 | (\$12,227) | \$10,147 | \$16,346 | (\$12,220) | \$5,662 |

LOW RX AND OTC MARKUP

| | Services = Yes | | | Services = No | | |
|-------------|---------------------|------------------------|-----------------------|---------------------|------------------------|-----------------------|
| | <u>Neigh. Store</u> | <u>Shopping Center</u> | <u>Medical Center</u> | <u>Neigh. Store</u> | <u>Shopping Center</u> | <u>Medical Center</u> |
| Total sales | \$216,083 | \$153,441 | \$126,857 | \$189,786 | \$150,051 | \$109,579 |
| Rx sales | \$110,827 | \$67,804 | \$92,579 | \$92,524 | \$64,415 | \$76,661 |
| OTC sales | \$105,256 | \$85,637 | \$34,278 | \$97,262 | \$85,637 | \$32,918 |
| # of Rx | 7,238 | 4,431 | 5,569 | 6,058 | 4,212 | 4,610 |
| Net profit | (\$5,145) | (\$18,922) | (\$5,818) | (\$3,430) | (\$18,395) | \$7,917 |

the total sales, but the magnitude of the difference, depending on whether markup was high or low, was minimal.

The observed drop in net profit when low markup was implemented was very likely the consequence of holding all other factors within the pharmacy constant. Such a large increase in sales would warrant an increase in Rx and OTC purchases, as well as increased staffing. Without adjustment, overtime wages and other extraordinary costs were incurred, and these factors may have contributed to the net profit decline.

This analysis indicates that, in general, the Communi-Pharm™ simulation game accomplishes its intended purpose of affecting sales in the predicted direction when certain options are exercised. It is recognized that the results reported herein may very well be situation-specific. A different mix of pharmacies in a hypothetical city or pharmacies configured differently may produce results that are different, at least in magnitude. One must also recognize that the results presented herein merely illuminate the dynamics of the simulation and do not necessarily reflect or predict the impact of similar changes in a real world setting. Nevertheless, the relative ease of using Communi-Pharm™ on microcomputer systems makes the conduct of this type of sensitivity analysis particularly tempting to instructor and student alike. Analyses of this type are not only valuable learning experiences but also help to refine an already outstanding program.

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APPENDIX. Communi-Pharm Instructor Data

1. Avg. Rx ingredient cost = 11.30
2. Avg. copay = 2.00
3. Avg. 3rd party fee = 2.25
4. 3rd party Rx of total = .26
5. Max promotion = 1,000
6. Store #1 credit sales = .24
7. Store #2 credit sales = .19
8. Store #3 credit sales = .09
9. Interest rate on current loans = .150
10. Avg. # Rx = 5,000
11. Avg. \$ OTC sales = 78,000
12. Gross margin slippage rate = .0090
13. # periods in year = 4
14. Third-party lag = .27
15. A/R lag = .15
16. Stock transaction rate = 6.90
17. Closing date = 9-30-89
18. Inflation rate = .000
19. Rx inventory level = .50
20. OTC inventory level = .55
21. Passbook savings rate = .055
22. Stock E.O.D. quote = 7.40
23. Money market rate = .081
24. \$ sales clerk/hr. = 45