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Client Flow through the Women, Infants, and Children Public Health Program

Billie Ann Brotman, Mary Bumgarner, and Penelope Prime

The Women, Infants, and Children (WIC) Program, managed by the county boards of health, provides nutrition, limited physical examinations, and food vouchers for pregnant women and for children with nutritional deficiencies. Because federal guidelines for the WIC program leave little maneuvering room to improve the delivery of services, we analyzed the client flow through a WIC clinic in the Atlanta metropolitan area to determine how that flow could be managed more efficiently. The challenge facing the WIC clinic was to increase the efficiency of their operation in an environment characterized by resource constraints, rigid regulations, and dysfunctional client behavior. In a limited physical space, the WIC clinic was expected to provide a number of sequential services to a client population that failed to arrive or arrived late 40 percent–50 percent of the time. The provision of services was further complicated by walk-ins, which were not only common but, according to federal guidelines, also must be accommodated. To analyze the clinic's problem, we used the General Purpose Simulation System for personal computer (GPSS/PC) to simulate client flow through the clinic. Estimates of the average amount of time a client spent in the clinic as well as average waiting times at each station and clerk and nurse utilization rates were generated assuming a variety of staffing levels. For comparison purposes, each version of the model was run with a 20-minute time lag before a late appointment was filled, and then a one-minute lag. The data used for the simulation were collected by clinic personnel during February 1994. It included the number of clerks and nurses available; the waiting time to see clerks and nurses for walk-ins and appointments; the waiting time to get WIC vouchers; the number of appointments met; the number of appointments missed; and the total time in the clinic for walk-ins and appointments.

In all three versions of the model that were estimated, the results of the simulations revealed that reducing the time before a late appointment was filled significantly decreased the time spent in the clinic, on average, for all clients. Furthermore: the time spent waiting for both clerks and nurses decreased, the utilization of the clerks decreased, and the utilization of the nurses increased in two of the three estimations. Key words: *client flow, peak load, WIC*

Confronting the Operational Problem

The Women, Infants, and Children (WIC) Program, a federal program managed by the county boards of health, provides a mandated health service under strict federal guidelines to women and young children. In this article we analyze how a WIC clinic, located in the Atlanta metropolitan area, can serve its clientele more efficiently in an environment of constraints. We focus on achieving shorter waiting times for WIC clients through better management of the flow of clients through the clinic. We apply the peak-load framework from economics to this basic operations-research problem.

The environment

The WIC program provides nutrition counseling, limited physical examinations, and food vouchers for low-income pregnant

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women and for children with nutritional deficiencies who are five years old or less.

WIC represents just one part of the integrated services provided to women and children by the county clinic. Other services include inoculations, medical visits with the nurse, and a variety of social services. Providing more than one health service at the county clinic is advantageous because it reinforces good health practices, provides intervention where necessary, and is convenient for the clients. However, it also complicates the management of service provision and makes it more difficult to improve the delivery of WIC's services.

To participate in the WIC program, a certification of income and health status is required. The first step for a client is to schedule an appointment for certification with a clinic nurse. Once certified, the client is immediately eligible to receive food vouchers and can return to the clinic to pick up her vouchers for up to a year without revisiting a nurse. Vouchers may also be picked up when a client comes to the clinic for nutritional classes, which are required periodically.

From the providers' point of view, several activities directly related to the WIC program are managed simultaneously. They include the scheduling of appointments for certification, meeting previously scheduled certification appointments by the nurses, accommodating unscheduled clients who walk in seeking certification, and distributing food vouchers to eligible clients. (Eligible clients include those certified by the county clinic as well as those who have been certified by Kennestone Hospital and Home Visits, and Child Health.)

In principle, the appointment system is designed to regulate these activities. In prac-

tice, several factors, none of which are within the control of the clinic staff, undermine it. First, since clients come to the clinic for other services as well, they often are delayed for their WIC appointments. Second, of those that make appointments, 40 percent–50 percent of them do not keep them, either because they arrive late or simply do not come. Understanding the obstacles many of their clients face arranging work schedules, transportation to the clinic, and child care, the clinic's management has instituted a policy of waiting 20 minutes for a client to arrive before rescheduling the appointment. Third, walk-ins are common and, according to federal guidelines, must be accommodated. In addition, the clinic has difficulty retaining qualified staff, and its physical space is limited. The end result is that women and children are often in the clinic for hours, are uncomfortable, and are unable to adequately care for their children during this time.

The Peak-Load Problem

The economic problem faced by the clinic is one of demand exceeding capacity, leading to excessive wait times for the clinic's patrons as well as inefficient use of clinic nurses and clerks. The problem arises because the clinic's services are beneficial to the health of expectant mothers and children and are provided without fee to the patient. Without a price mechanism to ration demand, quantity demanded exceeds quantity supplied. This problem is not uncommon. It is encountered often in the public or quasipublic sector, when the price of the good or service does not adequately reflect the benefits of the good or service as perceived by the public.

The economic significance of the problem is one of resource misallocation. In this case, too many resources are employed in the production of WIC services.

In this case, the problem of disequilibrium between demand and supply is exacerbated by the fact that demand for the clinic's services is unpredictable. Clients often do not keep their appointments or arrive at unscheduled times. As a result, appointments may go unfilled or two or more clients may seek the same appointment time.

On the supply side, capacity constraints, coupled with a persistent lack of sufficient numbers of experienced clerks and nurses, hamper the clinic's ability to respond to unexpected demand shifts. Moreover, due to employee turnover experienced by the clinic, few employees become sufficiently skilled to work as part-time clerks during periods of peak demand.

The economic significance of the problem is one of resource misallocation. In this case, too many resources are employed in the production of WIC services. The market solution is to increase the price of the service, thereby matching demand with capacity. But since that option is not available, efficiently managing demand and supply is necessary if the amount of resources used providing WIC services is to be reduced.

Federal guidelines for the WIC program leave little maneuvering room to improve the delivery of services. For example, the clinic cannot refuse to see unscheduled walk-ins; all clients must see a nurse for certification; all

clients must attend nutrition classes; and vouchers must be closely monitored. Based on the data and information provided by the clinic, we determined that the fundamental cause of the queuing problem was the time spent by clients waiting to see clerks and nurses. Our hypothesis is that the flow of traffic through the clinic can be managed more efficiently by changing the current policy of waiting 20 minutes before filling a broken appointment with a "walk-in" to a new policy of filling the appointment immediately.

Method

We began by collecting information on the average daily client volume, the pattern of client flow through various services, the waiting points and times, and services rendered to the clients.

The data were collected by clinic personnel during February 1994. It was recorded in a chart form throughout a day in periodic intervals and included nine items:

1. Number of clerks available
2. Number of nurses available
3. Waiting time to see clerks for walk-ins and appointments
4. Waiting time to see nurses for walk-ins and appointments
5. Total time in the clinic for walk-ins and appointments
6. Waiting time to get vouchers
7. Number of nutrition classes
8. Number of appointments met
9. Number of appointments missed.

The actual flow of traffic through the clinic is depicted in Figure 1.

Clients visit the clinic to keep an appointment with the nurse or attend a nutrition

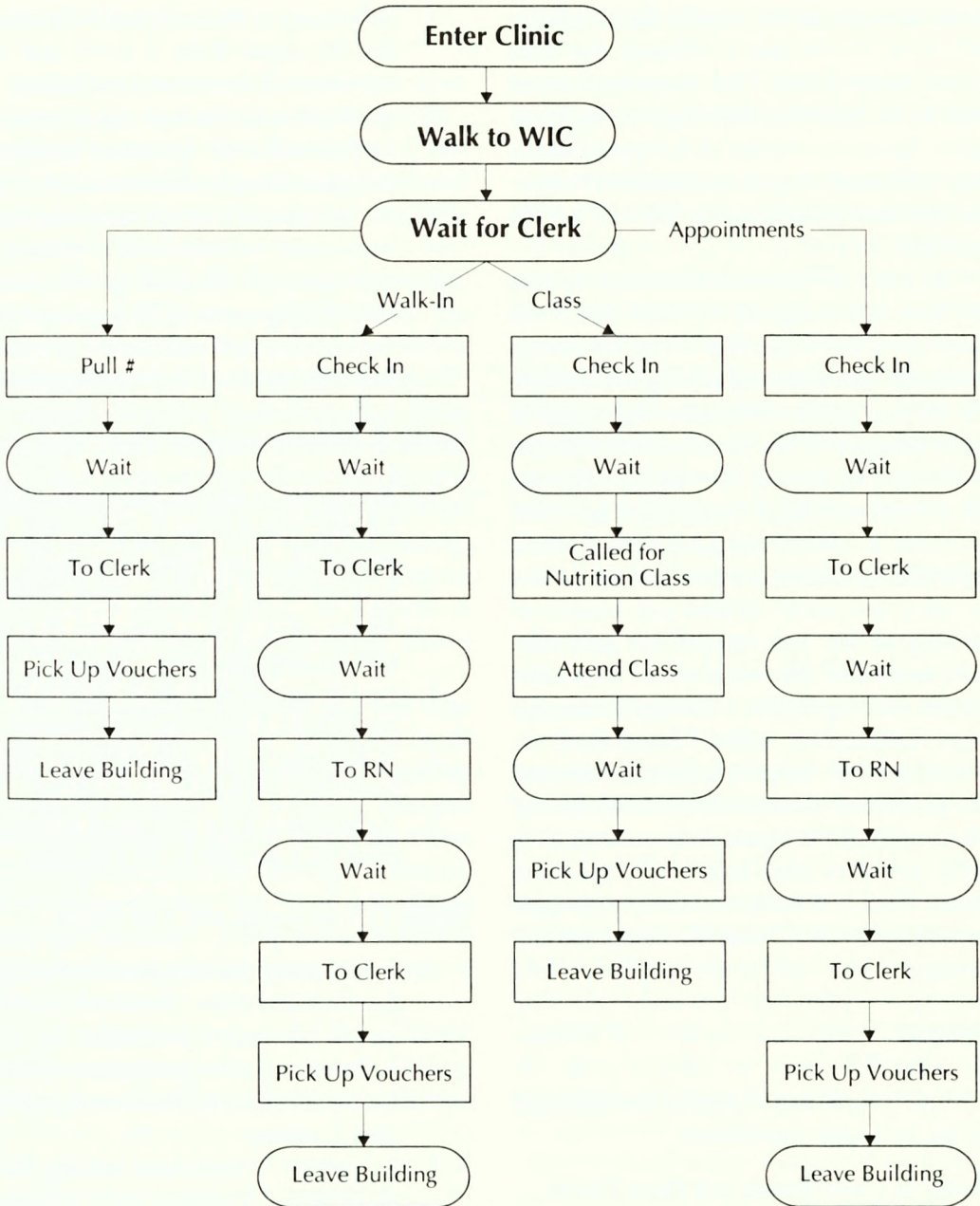


Figure 1. Traffic flow

class, or as an unscheduled walk-in. All clients first see a clerk to arrange for their records to be pulled. They then check in and wait to be called to their class or appointment. At the completion of the appointment, they see a clerk to pick up vouchers. Vouchers are also distributed at the end of the nutrition classes.

The General Purpose Simulation System for personal computer (GPSS/PC) model simulates the average flow of traffic through the clinic. Estimation of traffic flow through the clinic is initiated when the client signs in and continues as the client meets with the clerks and the nurses. The model estimates the average amount of time a client spends in the clinic as well as average waiting times at each station. Clerk and nurse utilization rates are also generated assuming a variety of staffing levels. For comparison purposes, each version of the model is run with a 20-minute time lag before a late appointment is filled, and then run with a 1-minute lag.

Six versions of the model are estimated using different combinations of numbers of clerks and nurses. Model A assumes that the clinic is staffed with three nurses and three clerks, Model B with two clerks and three nurses, and Model C with two clerks and two nurses.

Results

Models A, B, and C present the results of all the computer simulations.

Model A: Three Nurses and Three Clerks

A comparison of the results generated changing a 20-minute wait to a 1-minute wait show that reducing the time before an appointment is filled results in the following:

1. A decrease in the total time in the clinic for the client from 3 hours and 16 minutes to 1 hour and 11 minutes
2. A decrease in the time spent waiting for the clerk from 1 hour and 9 minutes to approximately 3 minutes
3. An increase in time spent waiting for a nurse from 3 minutes to 10 minutes
4. A decrease in the utilization of clerks from 91.6 percent to 53.2 percent
5. An increase in the utilization of nurses from 46.7 percent to 61.2 percent.

Model B: Three Nurses and Two Clerks

1. A decrease in the total time in the clinic for the client from 3 hours and 13 minutes to 1 hour and 27 minutes
2. A decrease in the time spent waiting for the clerk from 1 hour and 19 minutes to approximately 1 minute
3. An increase in time spent waiting for a nurse from 8 minutes to 43 minutes
4. A decrease in the utilization of clerks from 91.6 percent to 46.8 percent
5. An increase in the utilization of nurses from 51.2 percent to 73.3 percent.

Model C: Two Nurses and Two Clerks

1. A decrease in the total time in the clinic for the client from 1 hour and 50 minutes to 1 hour and 9 minutes
2. A decrease in the time spent waiting for the clerk from 19 minutes to less than 1 minute
3. A decrease in time spent waiting for a nurse from 18 minutes to 13 minutes
4. A decrease in the utilization of clerks from 76.6 percent to 30.3 percent
5. A decrease in the utilization of nurses from 64.6 percent to 53.7 percent.



In all three versions of the model that were estimated, the results of the simulations reveal that reducing the time before a late appointment is filled significantly decreases the time spent in the clinic by the client, on average, for all clients. Furthermore, the time spent waiting for both clerks and nurses decreases, the utilization of the clerks decreases, and the utilization of the nurses increases in two of the three estimations.

Greater decreases in waiting time occur when the clinic is staffed with three nurses and either three or two clerks. Smaller decreases occur when only two nurses and two clerks are available. This suggests that the clinic has little to no scheduling flexibility on days when it is understaffed, and a policy of filling late appointments immediately should be particularly beneficial.

The utilization of clerks and the time spent waiting for a clerk decreases in all three models when appointments are filled within one minute, and in every case but one, the utilization rate of nurses increases when appointments are filled immediately. This suggests that the flow of clients through the clinic is improved by filling appointments quickly. Utilization rates of nurses decreases only when the clinic is staffed with three nurses and three clerks. One explanation for this result is that the clinic is overstaffed with this combination

of nurses and clerks. A supporting piece of evidence for this conclusion is that the change in rates of utilization for both nurses and clerks is the smallest when three of each are employed.

Another implication of these results is that if the clinic does not implement the expedited scheduling policy, it makes little difference to time spent in the clinic whether it is staffed with two nurses and two clerks or three nurses and two clerks. Both scenarios result in clients spending approximately three hours and a quarter in the clinic. With the 20-minute wait before rescheduling, the clinic must be staffed with three nurses and three clerks if the time spent in the clinic by the client is to fall below 2 hours.

In sum, our results suggest that following a policy of immediately rescheduling missed appointments reduces the misallocation of resources employed in the clinic and thus permits the clinic to respond to its clients' needs more efficiently. Although this approach cannot duplicate the increase in efficiency that could be realized through the use of a price mechanism, it does improve the overall welfare of the clinic's clients. Filling appointments immediately results in shorter wait times for all clients, so no client is made worse off by the new policy. Moreover, as the patients realize that timeliness is important, more will arrive on time, further increasing the clinic's ability to monitor demand and provide services for its clients.