Case Study: Staffing a Call Center

Arizona Children's Hospital has been receiving numerous customer complaints because of its confusing, decentralized appointment and registration process. When customers want to make appointments or register child patients, they must contact the clinic or department they plan to visit. Several problems exist with this current strategy. Parents do not always know the most appropriate clinic or department they must visit to address their children's ailments. They therefore spend a significant amount of time on the phone being transferred from clinic to clinic until they reach the most appropriate clinic for their needs. The hospital also does not publish the phone numbers of all clinics and departments, and parents must therefore invest a large amount of time in detective work to track down the correct phone number. Finally, the various clinics and departments do not communicate with each other. For example, when a doctor schedules a referral with a colleague located in another department or clinic, that department or clinic almost never receives word of the referral. The parent must contact the correct department or clinic and provide the needed referral information.

In efforts to reengineer and improve its appointment and registration process, the children's hospital has decided to centralize the process by establishing one call centered devoted exclusively to appointments and registration. The hospital is currently in the middle of the planning stages for the call center. Harry Sullivan, the hospital manager, plans to operate the call center from 7 A.M. to 9 P.M. during the weekdays.

Several months ago, the hospital hired an ambitious management consulting firm, Unexpected Results International, to forecast the number of calls the call center would receive each hour of the day. Since all appointment and registration-related calls would be received by the call center, the consultants decided that they could forecast the calls at the call center by totaling the number of appointment and registration-related calls received by all clinics and departments. The team members visited all the clinics and departments, where they diligently recorded every call relating to appointments and registration. They then totaled these calls and altered the totals to account for calls missed during data collection. They also altered totals to account for repeat calls that occurred when the same parent called the hospital many times because of the confusion surrounding the decentralized process. Unexpected Results International determined the average number of calls the call center should expect during each hour of a weekday. The following table provides the forecasts.

Work Shift	Average Number of Calls
7 A.M. – 9 A.M.	35 calls per hour
9 A.M. – 11 A.M.	90 calls per hour
11 A.M. – 1 P.M.	65 calls per hour
1 P.M. – 3 P.M.	100 calls per hour
3 P.M. – 5 P.M.	90 calls per hour
5 P.M. – 7 P.M.	25 calls per hour
7 P.M. – 9 P.M.	10 calls per hour

After the consultants submitted these forecasts, Harry became interested in the percentage of calls from Spanish speakers since the hospital services many Spanish patients. Harry knows that he has to hire some operators who speak Spanish to handle these calls. The consultants performed further data collection and determined that on average, 20 percent of the calls were from Spanish speakers.

Given these call forecasts, Harry must now decide how to staff the call center during each 2 hour shift of a weekday. During the forecasting project, Unexpected Results International observed the operators working at the individual clinics and departments and determined the number of calls operators process per hour. The consultants informed Harry that an operator is able to process an average of six calls per hour. Harry also knows that he has both full-time and part-time workers available to staff the call center. A full-time employee works 8 hours per day, but because of paperwork that must also be completed, the employee spends only 4 hours per day on the phone. To balance the schedule, the employee alternates the 2-hour shifts between answering phones and completing paperwork. Full-time employees can start their day either by answering phones or by completing paperwork on their first shift. The full-time employees speak either Spanish or English, but none of them are bilingual. Both Spanish-speaking and English-speaking employees are paid $10 per hour for work before 5 P.M. and $12 per hour for work after 5 P.M. The full-time employees can begin work at the beginning of the 7. A.M. to 9 A.M. shift, 9 A.M. to 11 A.M. shift, 11 A.M. to 1 P.M. shift, or 1 P.M. to 3 P.M. shift. The part-time employees work for 4 hours, only answer calls, and only speak English. They can start work at the beginning of the 3 P.M. to 5 P.M. shift or the 5 P.M. to 7 P.M. shift, and like the full-time employees, they are paid $10 per hour for work before 5 P.M. and $12 per hour for work after 5 P.M.

Harry needs to determine how many full-time employees who speak Spanish, full-time employees who speak English, and part time employees he should hire to begin on each shift. Unexpected Results International advise him that linear programming can be used to do this in such a way as to minimize operations costs while answering all calls. Formulate a linear programming model of this problem.