FACTORS INFLUENCING TRAYLINE ACCURACY AT LONG-TERM CARE FACILITIES THAT USE TRAY MENUS AND DISPOSABLE TRAY CARDS

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I am submitting herewith a thesis written by Cecilia J. Zhao entitled "Factors influencing trayline accuracy at long-term care facilities that use tray menus and disposable tray cards". I have examined this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science with a major in Institutional Administration and minor in Nutrition.

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ABSTRACT

Factors influencing trayline accuracy at long-term care facilities
that use tray menus and disposable tray cards

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The purpose of this study was to determine if there is a difference in number and type of trayline errors between long-term care (LTC) facilities that use individualized tray menus and those using disposable tray cards. Tray errors (i.e., omission, substitution, addition, and wrong condiments) were observed at each of six facilities during one weekday lunch trayline. The dietary manager/supervisor was also interviewed regarding trayline operation and demographic information about trayline employees. There was no significant difference in total number of tray errors between facilities using tray menus and those using disposable tray cards. However, facilities using disposable tray cards had a significantly higher number of substitution errors than facilities using individualized tray menus ($P<0.05$). Omission errors were found to be higher for facilities using individualized tray menus. A correlation test did not give evidence of a strong association between number of errors and other demographic factors such as employees' education level, speed of trayline, number of trayline employees, and average length of employees' trayline experience.

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CHAPTER 1

INTRODUCTION

Long-term care (LTC) foodservice operators have long been concerned about the quality of nutritional care provided to the residents. However, with recent budget cuts and downsizing in the healthcare industry, maximizing resident satisfaction and nutrient intake has become a challenge. With technological advancement, many large acute care facilities have implemented computers in their dietary departments to improve the efficiency and productivity of their operations. Automation of dietary function includes menu printing, recipe and cost analysis, production, inventory management and more. However, the level of computer utilization is much lower in the smaller size LTC facilities than the larger size foodservice operations. This may be due to limited funding available to purchase computer software and hardware and foodservice directors/managers lacking computer skills. Priorities are more directed toward purchasing of production related equipment in LTC (1).

However, with decreased reimbursement, labor shortage, and need for cost containment, LTC foodservice directors and administrators have been forced to re-evaluate the benefits of computer applications in the foodservice department. Many studies have shown that use of computers reduces labor and food waste and increases productivity and customer satisfaction (2-5). Computer applications have advanced from the use of the punch card system to the use of electronic tabbing units and cathode-ray

tube display to the use of auto cassette dispensing systems and optical scanners to the automated console; all have brought about improvement in productivity and labor reduction in trayline operations (6-9). However, such innovative equipment may require a huge capital investment, and thus may not be feasible for smaller size operations that have limited resources.

Another area that benefits from the use of computers is the automation of the diet office. With the traditional manual system, countless time was spent on the tray card management or menu sorting, tallying, modifying, and duplicating processes. In addition, trayline staff may have difficulty reading handwritten menus (1). Thus, the manual process may lead to an increase in trayline errors. On the other hand, with a computerized diet office, individualized tray menus that correspond to each resident's diet prescription and preferences can be generated prior to each meal. This capability not only improves the legibility of the menus for trayline staff, but also enhances the image of the dietary department by presenting residents with attractive personalized menus to accompany each meal tray. At the same time, labor hours are reduced and the accuracy of the trayline may be improved (1, 10).

With major emphasis on the quality of nutritional care, serving accurate meal trays that meet specific diet prescriptions for residents is critical. The accuracy of resident trays depends on dietary employees' ability to read and correctly interpret the information on patient menu slips. Since inaccurate meal trays can put resident nutritional health in jeopardy and lead to resident dissatisfaction, a study in trayline accuracy can be an important measure to ensure that quality service is provided to

residents. With the recent increase in use of word processing computer software programs, LTC facilities have started to computerize their tray card system, which prints residents' names, diet orders, room numbers, likes, dislike, and allergies on the menu slips for each meal. This system replaced the traditional messy handwritten tray cards, but is still considered inefficient as employees often have to make a tremendous number of decisions as to what should be served on each tray on the trayline. Thus accuracy and speed of the tray assembly process can be hindered or delayed. On the other hand, some LTC facilities have started using the diet office application software designed specifically for LTC foodservice operation. With computer-generated individualized tray menus, only the selected menu items corresponding with the specified diet and the resident's name, room number, and diet order are printed on the menu slips. Therefore readability and simplicity of the menu slips are greatly enhanced and trayline accuracy is improved (10).

Other factors can potentially influence trayline accuracy including speed of trayline, number of menu items and modifications offered, format of the tray ticket/menu slip, and amount of supervision/training available to the trayline employees. All these factors should be taken into consideration when designing any type of study to evaluate trayline accuracy. Aside from the factors that affect trayline accuracy, the type of mistakes made on each tray, as well as which modified diet has the most errors will be helpful information for foodservice operators. Previous studies found that the most frequent errors on the trayline were omission, substitution, and addition, and that the highest errors occurred in the diabetic/calorie-restricted diets (11).

All this information can be very beneficial to foodservice administrators as a way to assess trayline accuracy and identify problem areas. The information can assist them in designing an individualized training program to solve the specific needs and problems associated with their trayline operations. The study may also show the advantages of using the computerized menu system in the improvement of trayline accuracy and could thus be used for cost-benefit analysis to justify the purchase of computer software and hardware needed to produce individualized menu slips.

The purpose of this research is to compare trayline accuracy of LTC facilities that use computer-generated individualized tray menus and those that use disposable tray cards.

The specific objectives of this research are:

1) To determine if the number of trayline employees and the speed of trayline are associated with trayline accuracy.
2) To determine if employees' work status, education, trayline experience, and English language skills are associated with trayline accuracy.
3) To determine if trayline employees make fewer errors with the individualized tray menus than with the disposable tray cards.
4) To determine which type of errors (i.e. omission, addition, substitution, wrong condiment) is most likely to occur on the trayline with the individualized tray menus and the disposable tray cards.
5) To determine if there is a difference in error rate by diet type between the individualized tray menus and disposable tray cards.

Null hypotheses are as follows:

1. There will not be a significant difference in trayline error between facilities that use the individualized tray menus and those that use disposable tray cards.
2. There will not be a significant difference in error rate by diet type between facilities with individualized tray menus and those that use disposable tray cards.

Following is a list of terms that are being used throughout the study:

Individualized tray menus - A tray ticket printed with individual's name, room number, diet order, food/beverage preferences (likes/dislikes/allergies) and specific menu items corresponding to the diet preference and diet order.

Disposable tray cards - A tray ticket printed with individual's name, room number, diet order, and food/beverage preferences (likes/dislikes/allergies).

Tray error rate - (Total number of errors/ Total number of trays) x 100%

Error of omission - Omitting a designated food item on the tray.

Error of substitution - Substituting another food item for a designated food item on the tray.

Error of addition - Adding extra food items that are not indicated on the tray menu or tray card.

Error of wrong condiments - Substituting inappropriate condiments (salt, sugar, etc.) or omitting indicated condiments on the tray.

CHAPTER 2

REVIEW OF LITERATURE

Due to the recent challenge of downsizing and budget cuts at healthcare facilities, foodservice managers are being forced to take initiatives to improve the efficiency and productivity of their operations. Computer use has been documented as a widely adapted tool for creating a more organized and cost effective department. According to a recent survey, over 42% of hospitals were found to use some type of computer software (12). Computer uses in institution's settings range from diet office management to clinical applications to production and inventory management; all have been shown to reduce labor, food waste, food cost, and at the same time to improve customer satisfaction and accuracy of the foodservice operation (2-4). While the use of computers has blossomed in the large size acute care setting, the implementation of computers in the smaller size hospitals and long-term care facilities (LTC) appears to be proceeding more slowly. There are several reasons for the slow infiltration of computers into the smaller size healthcare facilities including LTC facilities (13, 14). First of all, is the lack of administrative interest and support, as the dietary department is often considered a non-revenue generating department and can continue to function without the benefits of computerization. Second, is the limited funding available for the purchasing of hardware and software as a result of preexisting budgets not prepared with computer start-up costs in mind. Lastly, many management positions are held by those lacking computer skills.

Seventy-two percent of the dietetic practioners in a survey expressed the need to have continuing education on computers as a management tool (15).

Computerization of Diet Office and Tray Assembly Line

Despite various factors delaying the implementation of computers in the healthcare industry, the labor shortage and the increasing of hourly wages are making administrators and/or foodservice directors reconsider the role of computerization in dietary departments. The automation of diet office and tray assembly processes may help to reduce cost and achieve better patient/resident satisfaction.

Automation of diet offices brings numerous benefits to the dietary department. With the traditional manual system, countless hours are spent in modifying patients' menu selections, writing patients' names and room numbers on each menu, and on tray-card management. In addition, there is a high cost associated with producing the preprinted menu. However, with a computerized diet office, the computer generates the individualized daily menu that meets each individual's diet prescription and preferences and also includes the name, room number and diet type. Not only does the individualized printed menu eliminate and reduce the clerical tasks of duplicating and sorting menus and writing names and room numbers on menus every day, it also enhances the image of the dietary operation by presenting attractive and personalized menus to the patients/residents. Another advantage of the individualized printed menu is the improved accuracy and legibility which makes it easier to read on the trayline, thus improving trayline staff performance by reducing trayline time and increasing tray accuracy (13,16).

Another area where a computer-based system is beneficial is the tray-assembly process. Four types of computerized tray assembly systems were found in the literature. An automated tray assembly system described by Galiano and Koncel (6, 17) has helped to streamline the trayline production. The system includes an automated tray loader, an information system of signal lights at each station, and an automated checking station. Each patient meal selection is transferred to a punch card, which then passes through the card reader at the beginning of the line. The produced electrical impulses are then transmitted to a control unit at the end of the line, where the information is stored in a memory bank. The memory bank relays signals back to the food stations. As the patient's tray approaches each station, the employee loads appropriate food items and portion sizes onto the tray according to the flash signal lights displayed on the information system. Finally, as the tray arrives at the checker's station on trayline, the employee verifies that the food on the tray corresponds to the menu indicated by the signal lights flashing on the station's control panel.

Another similar computerized tray assembly system used to improve accuracy and productivity is described by foodservice director, Alan McLaren (7), at the Indianapolis Community Hospital. In this system, the diet technician uses a light pencil to touch the menu items marked by the patients on the electronic tabbing units. Data are then stored in the computer and used during meal assembly. As the trays are released in predetermined sequence and approach each serving station, a plastic box that contains light-emitting diodes (LED's) displays a combination of lights representing the required

food items for each tray. At the end of the assembly line, the checker's station has a cathode-Ray Tube (CRT) and a small printer. The CRT displays the patient's information and food items selected, while the checker verifies the completeness and accuracy of the tray, and the printer prints out a hard copy of this information for it to be placed on the tray.

The third type of automated system that helps to maximize the efficiency of the trayline assembly is the cassette system used primarily in a cook-freeze production system (8). The individual servings of food items are portioned, frozen and loaded into dispensing cassettes. At service time, the patients' menu and dishes, printed in both "human-readable" language and "machine-readable" code, are automatically and manually (i.e. if they are specialized items) placed onto the tray at each station. At the end of the tray assembly line, an overhead optical scanner checks the trays to ensure that each tray corresponds with programmed menus.

Lastly, a similar cook-freeze automated system is used at West Jersey Hospital in New Jersey (9). In their system, the precooked frozen food is placed in tempering refrigerators; the thawed food is ordered electronically from a console that is equipped with 24 numbered buttons that correspond to 24 magazines where the food is stored. The operator pushes the buttons corresponding to the patient's selections and sends the tray off to the second employee, who places the order portions on the tray. This system has been shown to reduce labor by 80% and increase productivity to 7.5 man-minutes per meal (9). In conclusion, these automated systems help to eliminate or reduce the need for

each trayline employee to read menus, thus increasing speed and accuracy of the trayline and reducing communication problems for non-English employees. However, such innovative equipment requires extensive capital investment and technical operational training, thus might not be feasible for wide scale use.

Analysis of Tray Errors

Since the majority of healthcare foodservice operators today use traditional type tray assembly procedures, the manual performance of dietary personnel in preparing the correct diet tray for each patient can have a profound impact on the quality of nutritional care provided to the patients. Past experience indicates that errors made on patient trays cause disruption of meal service, patient dissatisfaction, and increased food and labor costs to replace missing food items or remove incorrect items. Previous research has found that 15% to 35% of diet trays served to hospital patients contained some type of error (18, 19). Types of errors were analyzed and categorized in terms of portion size, omission, substitution, addition, criticality, and diet types. Errors in the portion size were defined as larger or smaller than recommended or indicated on the diet, such as an increased portion of meat on a diabetic diet; increased beverage serving on a fluid restricted diet; and an extra pat of margarine on a low cholesterol diet. Hay et al. (11) found that errors in portion size were infrequent since most of the food items on the trayline were pre-dished, prepackaged, or dished with portion control utensils. The most frequent errors on the trayline were omission, substitution, and addition. Errors of omission are defined as food items that are omitted from a specific diet, such as a salad

left out from a diabetic controlled diet, while errors of addition are the adding of extra food items on the tray that are not indicated for the specific diet. Errors of substitution are described as substituting a designated food item for another food item, such as putting a whole milk rather than low fat milk on the low cholesterol tray. Hay et al. (11) found that 22.4% and 14.1% of the trays have food items omitted and added respectively during their pre-training audit. Both Klein et al. (20) and Dowling et al. (19) also showed similar results, 9% and 7.8% respectively, in which the error of omission was the most frequent error that occurred during the tray-auditing period. In addition to the types of errors being analyzed for trayline accuracy, the severity of the errors made on trays has also been assessed. An error of severity is classified as error that is contradictory to the diet order, such as including a sugar packet on a diabetic diet. Dowling et al. (19) showed that 2.9% and 2.5% of the trays had errors that were contradictory to the diet order during the weekdays and weekend respectively. The critical error rate was nearly the same during the weekdays and weekend. In contrast, in the Glover et al. study (21), the critical errors were found to be 6.33% during the weekdays and 11.33% during the weekend/holiday periods. The critical error rate in their study was much higher for the weekend/holidays than weekdays. The error rate relating to the complexity of diet type has also been analyzed. Hay et al. (11) found that the highest errors occurred in the diabetic/calorie-restricted diets. This could be due to the lack of medical knowledge about diabetic diets and the tendency to place contra-indicated food items on the trays.

Factors Influence Trayline Accuracy

Although tray-error type analysis is essential in identifying specific trayline inaccuracies, understanding the factors that can influence trayline accuracy is also equally important to the foodservice operator. Studies have shown that trayline accuracy and efficiency are affected by the speed of the trayline, number of menu items and modifications offered, and format of the tray ticket/menu slip (22). The speed of the trayline is determined by the rate at which trays are placed on the line, the availability of needed food items on the trayline, the evenness of the workload at each station, and the speed of the conveyor belt. Disruption in any of these areas could potentially affect the flow of the trayline and subsequently cause tray errors. Wise et al. found that unequal work distribution between work stations, lack of a specified runner to replenish needed food items, and inappropriate speed of the conveyor belt were some of the causes which led to the delays in trayline assembly systems (16).

There has not been any evidence that the number of menu items and modifications offered affect the speed and accuracy of the trayline. However, foodservice operators have been concerned that having too many items on the menu or a large number of modified diets can slow the process of reading and delay decision making on trayline. To solve this problem, many foodservice operators are either cutting down the number of choices given on the menus or implementing non-select menus for all patients. However, with technological advancement, some facilities are able to use a computer software program to generate an individualized menu slip, which only includes

the selected menu items on the slip, thus helping to reduce the time of decision making by trayline employees reading the menu slips.

Studies have also suggested that the readability and complexity of the tray ticket can affect the accuracy of trayline assembly. Studies done by McGary and Donaldson (23) have identified menu slip readability as a common problem for trayline workers. Traditionally, menu slips have been preprinted on colored paper, listing all possible menu items for a meal. Patients marked the menu items they wanted to be served. In an earlier study done by Frankhauser (24) an effort to improve the readability of the preprinted menu was attempted by color stripping the menu items and standardizing the position of menu items. The purpose was to utilize the concept of visual perception to define the focal area and cluster the information into a sequence of chunks, thereby facilitating the worker's visual scanning during assembly (25, 26). With this new menu format, the mean number of assembly work group errors per tray decreased significantly when compared to the old menu format. With the recent increase in use of computers, hospital foodservice departments are able to use computer-generated menu slips to improve the readability of the menu. In a similar menu format study, Myers et al. researched the effect of five menu slip formats on the accuracy of food tray assembly and workers' preferences for menu slip formats (10). Results from the study indicated that the highest error rate was found with preprinted formats, while errors were significantly lower with individualized formats that identified menu selections in bold print and type of diet in either large type or colored ink. The results suggested that tray accuracy might be improved if

individualized menu slips that distinguish menu items from each tray line station with different font styles and size are used. Even though the computerized menu format improves the clarity and legibility of the menu, its accuracy can be affected by the correctness of the menu data input. A survey study done by Smith has shown 24 out of 43 hospitals that have computerized diet office did not have a system in place for monitoring accuracy of menu data input. Of the 19 respondents who monitored accuracy of menu data input, the majority monitored the menu data input daily with a stated accuracy level of 96% to 99% (27). The study has reflected that monitoring the menu data input can play a critical role in computerized systems, which can subsequently lead to reduction of trayline errors.

Other studies indicated that the amount of supervision available to the trayline employee also influences trayline accuracy. Dowling et al. (19) found that one of the major factors contributing to the highest error rate during the evening dinner meal is the majority of trayline employees being part-time. This indicates that part-time employees probably had fewer opportunities for training or were paid less attention by management, thus resulting in poorer performance on the trayline when compared to the full-time employees. When an in-service program was developed for these employees, the error rate following the training showed a noticeable decrease in trayline errors for the evening meal. Results agree with a study done by Hay et al. (11) which found that the training program had the most positive effects on part-time employees with tray errors decreasing 25% during the evening meal. The available number of supervisors on duty to provide

necessary guidance to kitchen employees is also critical. Glover et al. (21) found that the error rate was inversely correlated with the total number of foodservice supervisors and the number of food production supervisors and registered dietitians present during the meal. Their study indicates that the fewer the number of supervisors on duty, the more likely a higher error rate and the more the number of supervisors, the lower the error rate. This suggests that having minimal supervisor and professional staff may lead to concurrent reduction of feedback to the employees. The study also found that the error rate tended to be higher during the weekends and holidays rather than during the week (11, 21). The higher error rate on weekends and holidays is probably related to fewer supervisory staff on duty and less training provided to the part time employees who work during weekends and holidays.

Benefits of Tray Accuracy Study

The tray accuracy studies are useful diagnostic tools for evaluating the quality of performance of trayline employees and identifying the training needs of these individuals, as well as providing constructive feedback for quality improvement projects. As discussed in the previous study, employee training programs appeared to have a positive impact on reduction of the total number of errors on the trayline with the improvement of part time employees being most significant (11). Another type of action used to improve trayline accuracy is the use of a public posting feedback mechanism which posts the number of errors occurring at each meal by trayline position (20). Then weekly meetings are held to discuss specific actions which could be initiated to correct the causes of errors.

Results from this study also showed the total percentage of tray errors decreased significantly during the public-posting phases. This study suggested the feedback mechanism played a dominant role in the improvement performance of the trayline employees. A study done by Eden et al. (28) showed that documentation of error rates of trayline employees provided constant feedback to the employees, which enhanced their self-esteem and improved performance. Since constant feedback and positive reinforcement are potent mechanisms for promoting positive behavior changes, it is essential for foodservice operators to maximize such actions as a way to improve employee performance.

One of the end results of the improvement in trayline accuracy is enhancement in customer satisfaction. Eden et al. (28) showed that an increase in tray accuracy resulted in an increase in patient satisfaction. Since customer satisfaction is necessary for business success, an accuracy program offers a mean to monitor the consistency and quality of the service being provided. When services consistently meet high quality standards, the customer begins to expect and appreciate those standards and at the same time, waste and costs are also decreased.

CHAPTER 3
METHODOLOGY

Selection of Participating Facilities

The following research methods were approved by the Institutional Review Board at Texas Woman's University (Appendix A). A dietitian employed by a dietary computer software company assisted the researcher in selecting a total of eight long-term care (LTC) facilities in the north Texas area for participation in the study. A signed approval letter from each LTC facility's administrator was obtained with the assistance of each facility's consulting dietitian (Appendix B). The eight LTC selected were similar in trayline set-up and used a conventional centralized system for tray assembly and delivery. Three to four employees were assigned to the trayline in each of the facilities. The size of all the facilities was small to medium with a census of approximately 80 to 180 residents. All facilities used non-selective menus and had approximately six to eight modified diets. Four of the LTC facilities used disposable tray cards and the other four used individualized tray menus. Each LTC facility was investigated during one weekday at lunchtime. The meal pattern of all facilities was similar in that they served a hot food meal for lunch that contained 6 to 8 menu items.

Facility's Menu Format

The format of the individualized tray menus was similar in design with approximately six menu items printed on each lunch menu slip except for one facility

which did not have any menu items printed on the tray menu (Appendix C). This facility did not fully utilize the feature of the dietary software program to print specific menu items on the tray ticket for each meal. However, the tray menu does state what menu items for that day's lunch should not be given to the resident. Four facilities used the participating company's diet office application program to generate their individualized tray menus. Three facilities used their own Microsoft programs to generate individualized disposable tray cards with each patient's likes, dislikes, allergies, and/or meal condiments printed on each tray card. One facility used a different dietary software program for its tray card generation than the other three (Appendix D). Three out of four facilities that used the individualized tray menus had a list of meal-specific menu items along with the food and beverage preferences printed on each patient's tray menu.

Pilot Testing

Prior to the beginning of data collection at each facility, a consent form developed by the researcher that described the study and a statement that participation was completely voluntary was signed by a dietary manager (Appendix E). Two of the eight facilities served as pilot testing sites, and their data were not included in the analysis. The researcher pilot tested the research procedure at one facility of each menu system to determine the feasibility of the tray auditing method during the trayline assembly period. Revisions were made based on the results of the pilot study.

Trayline Data Collection Process

At the actual data-collecting sites, the researcher sketched a general design of the trayline and its stations (Appendix F) and obtained copies of all the tray menus or tray cards prior to the start of the lunch trayline. These were sorted according to the serving sequence prior to the starting of trayline. In order to minimize possible bias in the data collected, trayline workers except for the dietary manager/trayline supervisor were not informed about the actual purpose of the study prior to the beginning of the tray auditing process. The error recording form developed by the researcher numbered each tray and identified the errors caught by either supervisor or researcher according to the types of error (i.e., omission, substitution, addition, wrong condiments) (Appendix G). The researcher stood near the end of the trayline, observed the tray assembly process, and recorded number and type of tray errors. The total tray assembly time was recorded from the time the first tray was assembled to the removal of the last or the hundredth tray from the trayline if there were more than 100 trays served. The total tray assembly time was then divided by the actual number of trays assembled to determine the average assembly time in seconds per tray. The total errors for each tray were recorded according to the errors detected by both the supervisor and the researcher. The researcher did not comment verbally or point out additional or uncaught errors to any trayline worker or the supervisor. The errors were tallied as four different types - omission, substitution, addition, and wrong condiments.

Dietary Manager Interview Process

Following the noon trayline, the researcher interviewed the dietary manager at each facility using the survey questionnaire that was developed by the researcher and then revised after review by committee members (Appendix H). General demographic questions about each trayline employee were asked, such as their education level, work status, adequacy of English skills, and years of experience working on the trayline. General information about the LTC facilities, foodservice/trayline operation, and the total number of supervisors on duty during lunch mealtime was also obtained from the manager.

Statistical Analysis of the Data

Information concerning characteristics of trayline employees and trayline errors was summarized and analyzed using Statistical Package for Social Science (Version 10.0, 1991, SPSS, Inc., Chicago) statistical software program (29). Characteristic of trayline employees and facilities were summarized as descriptive statistics, including means and frequency distributions. Tray error rate was calculated based on total number of errors divided by total number of trays. Cross-tabulation were used to analyze number of tray errors by error types, diet types, facilities, and system types. A Pearson Chi-Square test was used to analyze the trayline errors based on system types (i.e. individualized tray menus vs. tray cards) and types of error (i.e., omission, substitution, addition, wrong condiments). A Mann-Whitney *U* test was used to determine the effect of employees' education on trayline accuracy. The Spearman's rho correlation coefficient was used to

determine the influence of trayline speed, available number of trayline employees, and employees' trayline experience on trayline accuracy.

CHAPTER 4

RESULTS

Data on tray errors collected from the lunch trayline and demographic information obtained from the dietary manager at each of the six participating nursing home facilities were analyzed using SPSS for Windows®, version10.0 software program (29). Tray errors were analyzed according to the error type, menu system, and diet type. Trayline employees' education level, speed of trayline, number of trayline employees, and average length of employees' trayline experience were also compared to number of tray errors and type of menu system.

Comparison of number and type of tray errors

Statistical analysis of data showed that the facilities using the disposable tray cards had higher numbers of errors (total error = 35) when compared with those facilities using individualized tray menus (total error = 32) (see Table 1). However, Pearson's Chi Square analysis did not demonstrate a significant difference in the total number of trayline errors between the facilities using disposable tray cards and those using individualized tray menus. The null hypothesis stating that there will not be a significant difference in total trayline errors between facilities using disposable tray cards and those using individualized tray menus was accepted. On the other hand, when comparing the number tray errors between facilities with two different menu systems, facilities using the disposable tray cards had a significant higher number of substitution errors than facilities

using individualized tray menus (p value < 0.05) (Figure 1). The most frequent error type in the facilities using disposable tray cards was error of substitution while error of omission happened more frequently in the facilities using individualized tray menus. A common substitution error was serving a disliked menu item instead of substituting a liked food item on the tray. A common omission error was omitting a specially requested food item on the tray. No errors of addition were found in this study.

The most common diet type prescribed to nursing home residents at these facilities was a regular diet (360 trays), and the least common diet type was a bland diet with only three trays (Table 2). The majority of errors occurred in the regular, no added salt (NAS), no concentrated sweet diet (NCS), and mechanical soft diets with total number of errors 35, 28, 24, and 24 respectively. Most of the errors that occurred on regular diet trays were due to omitting or substituting wrong food items. A majority of the errors that occurred in NAS diets (17 out of twenty-eight errors) and NCS diets (14 out of twenty-four errors) resulted from wrong condiments on the tray. The data also showed that puree diets had a high number of omission errors; nine out of 11 total errors for puree diets occurred as a result of omitting menu items on the tray. The missing items were usually a specially requested item or a supplement drink.

Table 3 compares the number and type of tray errors according to diet type between facilities using disposable tray cards and those using individualized tray menus. Facilities using disposable tray cards appear to have a higher number of tray errors compared to those facilities using individualized tray menus in the no added salt, no

concentrated sweet, and low fat/low cholesterol diets (Figure 2). However, the analysis did not show a significant difference in error rate by diet type between facilities with individualized tray menus and those using disposable tray cards; thus the null hypothesis is accepted.

Table 4 categorizes the errors by each facility, type of error, person who detected the error, and type of menu system. A total of 561 trays were audited with 270 of these trays from the facilities using disposable tray cards and the rest (291) trays from facilities using individualized tray menus. The data revealed the majority of the errors were detected by the researcher; however, half of the facilities did not have a supervisor working on the trayline when the researcher checked the accuracy of trays. Errors of substitution and wrong condiments occurred more frequently in the facilities using disposable tray cards while error of omission occurred more frequently in the individualized tray menus. The average tray error rate for facilities using disposable tray cards and facilities using individualized tray menus was 14.4% and 12.4% respectively. Statistical analysis showed no significant difference in error rate between the two different types of menu systems.

Comparison of other influences on trayline accuracy

Trayline employees' education levels compared to number of tray errors are shown in Table 5. The majority of trayline employees except for one had either completed high school or attended some high school. The one employee who had some college education was a trayline supervisor. Analysis of data shows that employees who

had only some high school education made fewer errors when compared with the employees who completed high school. However, Mann-Whitney statistical analysis comparing mean errors for three facilities where a majority of employees had attended only some high school (9.6 errors) with three facilities where a majority of employees had completed high school (15.3 errors) found no significant difference between these two groups.

Spearman's rho coefficient analysis was used to determine if trayline speed, number of employees, and months of trayline employees' experience had any impact on the number of tray errors (Table 6). The table lists average assembly time per tray, number and percentage of regular and modified diet trays, number of trayline employees, average length of trayline experience, number and percentage of errors made for each corresponding facility. A majority of the trays were assembled at the rate of ≤ 30 seconds per tray except for one facility where average assembly time was approximately 39 seconds per tray. This facility had tray assembly time greater than thirty seconds per tray because of frequent interruptions from nursing staff coming to the serving window of the kitchen during the tray assembly period. The percentage of modified diet trays, which ranged from 65% to 76% of total trays at facilities, did not appear to influence speed of trayline. The two facilities with the highest percentage of modified diet were facility B and facility F. Facility B had 74% modified diets and a speed of 15.6 seconds/tray while facility F had 76% modified diets and a speed of 19.2 seconds/tray.

The average length of employee trayline experience varied from 39 to 129 months. Data analysis appears to reflect a non-significant positive relationship between trayline speed and tray errors, which the correlation coefficient was 0.618. This positive *r*-value may reflect a trend that the faster the trayline, the fewer the tray errors. In contrast, number of trayline employees and number of tray errors appears to have an inverse relationship with correlation coefficients of –0.746. Data appear to suggest that the higher the number of trayline employees, the fewer the number of tray errors. Nevertheless the statistical analysis did not give strong evidence that the number of trayline employees affects tray accuracy.

In addition, all trayline employees were full time employees except for one employee who was part-time. All trayline employees were judged to have adequate English skills to work on trayline as indicated by their dietary managers. Thus, the effect of work status and English skills on tray accuracy could not be judged since all employees had similar work status and language skills.

Other demographic information of the trayline operation

Table 7 gives the characteristics of trayline operation at each facility. The six LTC facilities investigated had census ranging from 82-180 residents with lunch count ranging from 80-154 trays. The majority of nursing home facilities were predominately Medicare/Medicaid paid facilities. Two facilities did not have a manager/supervisor on duty during their breakfast trayline while one facility did not have one for their evening trayline during the weekdays. All facilities had a supervisor on duty during their lunch

trayline, and one facility with the highest census had two supervisors during the lunch meal. Three facilities that had census higher than 100 and served more than 100 trays per meal had a supervisor actually working on the trayline. These three facilities had fewer tray errors when compared to facilities who did not have a supervisor working on the trayline. Moreover, three out of six facilities did not have a manager/supervisor during the weekend. The facilities using individualized tray menus appeared to have a greater number of modified diets and trayline stations than facilities using disposable tray cards. All facilities serve condiments on their trayline except for one.

All facilities had a fairly similar trayline layout with three to four employees working on the trayline except for two facilities that use disposable tray cards. These two facilities served the dining room residents directly through the kitchen serving window.

CHAPTER 5

DISCUSSION AND CONCLUSION

This study was designed to determine whether employees at LTC facilities using individualized tray menus produced through diet office software applications make fewer tray errors than employees at facilities using disposable tray cards, and also to determine whether other factors may potentially influence trayline accuracy.

Results show that the facilities using individualized tray menus did not make significantly fewer errors than facilities using disposable tray cards. There are two possible reasons why the results were not statistically significant. One could be the small sample size. The other could be lack of consistency and poor organization of menu formats. Tray menus at one facility did not have specific menu items printed on them because staff did not make full use of this feature of diet office software; therefore these tray menus were made unconsciously similar to the disposable tray cards format. The use of a dot matrix printer in four facilities resulted in a crowded and small font size of the printed letters which made them difficult to read. In addition, an overflow of information was printed in the limited space of the tray note section. Also, there was an uneven distribution of white space between the printed menu items section and other sections on the tray menu. After studying the format of tray menus, Myers et al. (10) concluded that menu slip format significantly affected both worker preference and the accuracy of tray assembly procedures. Their study found that having diet orders and menu items printed

in large type and bold print resulted in the most accurate tray assembly and was preferred by most of the workers. A similar study done by Fankhauser also proved that when the readability of the printed menu was improved by color stripping the menu items and standardizing the position of the menu items in accord with trayline stations, the mean numbers of errors per tray decreased significantly (24).

Data analysis also shows that facilities using disposable tray cards had a significantly higher numbers of substitution errors than those facilities using individualized tray menus with total substitution errors of 18 and 9 respectively. The majority of the substitution errors resulted from serving dislikes or inappropriate items on the tray in the facilities using the disposable tray cards. The font size and limitation of space made it difficult to read all the dislikes printed on the tray cards and at the same time make a good judgment call on accuracy of tray items. While the error of substitution was the most frequent error type occurring within facilities using disposable tray cards, errors of omission appeared more commonly in facilities using individualized tray menus. Errors of omission may be more prevalent in facilities using tray menus because excess information printed in the tray note section may often cause the special requested or extra items printed in this section to be overlooked. The study did not find any errors of addition throughout the tray-auditing period. Therefore, the results were in agreement with studies done by Myers et al. (10) and Dowling and Cotner (19) that omission and substitution were the most common types of error and additions were the least prevalent.

When analyzing errors by type of diet, the study found that regular, no added salt (NAS), no concentrated sweet (NCS), and mechanical soft diets appeared to have the most errors in all facilities combined. More than half of the errors resulted from putting the wrong condiments on the trays that included NCS and NAS diets. When comparing the error rate by diet type between facilities of two different menu types, NAS, NCS and low cholesterol diets had a higher number of errors in the facilities using disposable tray cards. The possible explanation for the higher number of errors found in these diets may be unfamiliarity with special diets and modified food textures. Nonetheless, the study failed to find a significant difference in error rate by diet type between facilities using two different menu systems. The reason why the results were statistically insignificant may be due to the small sample size.

The majority of errors were detected by the researcher since half of the facilities did not have a supervisor working on the trayline. Employees in the facilities that had a supervisor working on the trayline appeared to make fewer total errors when compared with employees at facilities that did not have a supervisor working on the trayline. This finding supported the study done by Glover et al. (21) showing that an increased amount of supervision on trayline had a positive effect on trayline accuracy. The average error rates for facilities using individualized tray menus and facilities using disposable tray cards were 12.4% and 14.4% respectively, which were close to the results found in the Dowling et al. (19) study in which the average error rate for lunch was 12.2%±2.3%.

However direct comparison between these two studies may not be appropriate because of differences in operational parameters and research methods.

Although there were fewer tray errors at facilities where a majority of employees had some high school education compared to facilities where a majority of employees had completed high school, the test of association between number of trayline errors and level of education completed was not statistically significant. This may indicate that education level of the trayline employee is not an important determinate of trayline accuracy. This implies that employees who have a lower education level can do just well on trayline as employees who have a higher education level if they are properly trained. Thus, providing more training to trayline employees might be an important method for improving trayline accuracy, which was also indicated in the Hay et al study (11).

Other potential factors, which could influence trayline accuracy were also tested using correlation analysis. Even though the results showed that trayline speed has a positive relationship with the number of tray errors, the association was not statistically significant. This finding agreed with the Glover et al. study (21), which they did not find any significant correlation between trayline speed and error rates. However, the trayline speed could have been influenced by lack of a specified runner to replenish needed food items, unavailability of special requested items on trayline, and an unequal work distribution between work stations as described in Wise et al. study (16). The distribution of different type diets served in each facility may also affect the trayline speed and accuracy. Facility who had a lower numbers of modified diet trays may tend to have a

faster trayline and may make fewer tray errors than those facilities who have a higher numbers of modified diet trays. Likewise, the greater number of trayline employees did not significantly decrease trayline errors. However, scheduling an adequate number of trayline employees may help to even out the workload between stations. For instance, trayline employee appeared to be making more mistakes when one had to cover for another employee who was not available on the trayline at that time. Also, the study did not find that the work status of the employees and their English skills had any association with the number of errors. All of the employees were full time except for one, and all were perceived to have adequate English skills as indicated by their managers. Moreover, the number of supervisors on duty did not appear to influence trayline accuracy since all facilities had at least one supervisor on duty except one facility which had two supervisors.

Based upon the results of this study, the following recommendations for improving trayline accuracy are made:

1. Managers at LTC facilities need adequate training in terms of how to input patient diet information correctly into the computer.
2. Facilities currently still using the older version of a company's dietary software program should consider upgrading their program to a newer version to obtain better menu format and more useful features (i.e. special item preparation list, substituted menu items for dislikes/allergies, grouping of menu items according to the trayline station and assembly sequence)

3. Facilities should use a laser or ink jet printer in order to improve the clarity and readability of their printed tray menus.
4. Facility still using disposable tray cards should consider using a dietary software program to generate tray menus instead. The program can provide a list of special requested items beforehand and automatically substitute a liked food for the disliked food, thus decreasing the likelihood of substituting a disliked food or omitting a liked food on trayline.
5. Facilities that put individual condiments (i.e. salt, pepper, sugar, sugar substitute) on the tray may want to consider ordering the color-coded condiment packages for each diet combination and stating the color on the tray ticket. Another option would be to print individual condiments on the tray ticket according the diet types.
6. LTC facilities need to schedule adequate staffing during trayline operation.
7. Continuous training on special therapeutic diets (i.e. NAS, NCS, low cholesterol, mechanical soft, puree) should be provided to trayline employees.
8. Supervisors and managers should monitor accuracy of trayline on a regular basis in order to provide constant feedback to the trayline employees.

The study could have been improved in several ways to yield more accurate results. One way would be to increase sample size of the study either by auditing more trays/meals or investigating more facilities. Also LTC facility should be more willing to participate in this type of research since we experienced a great deal of difficulty to obtain approval letter from each facility in this study. Another way is to improve the

accuracy of the auditor by checking trays on the floor while they are being delivered to the patients. This will give the auditor more time to determine the errors on the tray without interrupting the trayline employees' daily routine and emotional state. In addition, when calculating percent of tray error, the actual number of errors could be divided by the possible number of errors on each tray instead of using the total number of trays in order to arrive at more accurate error rate comparison. Lastly, before selecting the facilities for actual research sites, the researcher should go into a number of facilities to obtain general information about each facility and then, based on information gathered, select the facilities according to research criteria.

In conclusion, one of the major objectives for an LTC food service director or manager is to serve nutritious meals to residents. Thus trayline accuracy serves an important role in ensuring that residents receive high quality meals appropriate for individual health status and food preference. Proper training of trayline employees and improvement of menu format for readability may reduce the number of tray errors. Even though this study did not prove that individualized tray menus improve overall trayline accuracy, diet office software programs may still have some advantages in reducing certain types of tray errors.

Table 1. Comparison of number and type of tray errors at selected long term care facilities using disposable tray cards and individualized tray menus.

	Facilities Using Disposable Tray Cards (N = 270)		**Facilities Using Individualized Tray Menus** (N= 291)	
Type of Error	Number of Errors	% Tray Error	Number of Errors	% Tray Error
Omission	9	3.3	16	5.5
Substitution	18*	6.7	9*	3.1
Addition	0	0	0	0
Condiments	12	4.4	8	2.8
Total Errors	**35**	**12.9**	**32**	**11.0**

*There is a significant difference in the error of substitution between facilities using disposable tray cards and those using individualized tray menus, $P<.05$.

Table 2. Comparison of number and type of tray errors according to diet type for selected long-term care facilities using disposable tray cards and individualized tray menus.

		Type of Error								
Diet Types	**Total no. of trays**	**Omission**		**Substitution**		**Addition**		**Condiments**		
		Total Error	% Tray Error	Total Error	%Tray Error	Total Error	%Tray Error	Total Error	%Tray Error	**Total**
Regular	360	19	5.3*	16	4.4	0	0	0	0	35
No Added Salt	108	6	5.6	5	4.6	0	0	17	15.4*	28
No Concentrated Sweet	109	3	2.8	7	2.8	0	0	14	12.8*	24
Diabetic	9	0	0	0	0	0	0	0	0	0
Low Fat Low Cholesterol	14	0	0	1	7.1	0	0	4	28.6*	5
Bland	3	1	33.3*	1	33.3*	0	0	0	0	2
Mech. Soft	168	10	6.0	12	7.1*	0	0	2	1.2	24
Puree	96	9	9.4*	1	1.0	0	0	1	1.0	11

Note: The total number of trays of all diet types is higher than actual number of trays because some of the combination diet orders overlapped each other.

*Represent highest error rate in the error types made within each diet type.

Table 3. Comparison of number and type of tray errors according to diet types between the facilities that using disposable tray cards and those using individualized tray menus.

	Facilities Using Disposable Tray Cards							Facilities Using Individualized Tray Menus						
		Type of Error							Type of Error					
Diet Types	Total no. of trays	Omit.	Sub.	Add.	Cond.	Total Error	Tray Error (%)	Total no. of trays	Omit.	Sub.	Add.	Cond.	Total Error	Tray Error (%)
Regular	155	7	9	0	0	16	10.3	205	12	7	0	0	19	9.3
No Added Salt	72	2	5	0	11	18	25.0	36	4	0	0	6	10	27.8
No Concentrated Sweet	61	1	6	0	11	18	29.5	48	2	1	0	3	6	12.5
Diabetic	3	0	0	0	0	0	0	6	0	0	0	0	0	0.0
Low Fat Low Cholesterol	9	0	1	0	3	4	44.4	5	0	0	0	1	1	20.0
Bland	0	0	0	0	0	0	0	3	1	1	0	0	2	66.7
Mech. Soft	83	3	8	0	1	12	14.5	85	7	4	0	1	12	14.1
Puree	33	2	0	0	1	3	9.1	63	7	1	0	0	8	12.7

Note: The total number of trays of all diet types is higher than actual number of trays because some of the combination diet orders overlapped each other.

Table 4. Analysis of the number and type of tray errors at selected long-term care facilities using disposable tray cards and individualized tray menus (N=6).

		Disposable Tray Cards				**Individualized Tray Menus**			
Type of Error		B	E	H	**Error Totals**	D	F	G	**Error Totals**
		Number of Errors				Number of Errors			
Omission	S	0	0	0	0	0	1	0	1
	R	4	4	1	9	4	10	4	18
	Subtotals	**4**	**4**	**1**	**9**	**4**	**11**	**4**	**19**
Substitution	S	0	0	0	0	0	1	0	1
	R	4	5	9	18	3	2	3	8
	Subtotals	**4**	**5**	**9**	**18**	**3**	**3**	**3**	**9**
Addition	S	0	0	0	0	0	0	0	0
	R	0	0	0	0	0	0	0	0
	Subtotals	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Condiments	S	0	0	0	0	1	0	0	1
	R	0	4	8	12	6	0	1	7
	Subtotals	**0**	**4**	**8**	**12**	**7**	**0**	**1**	**8**
Total error for facility(ies)		**8**	**13**	**18**	**39**	**14**	**14**	**8**	**36**
Total no. of trays audited		**100**	**90**	**80**	**270**	**91**	**100**	**100**	**291**
Tray error (%)		**8.0**	**14.4**	**22.5**	**14.4**	**15.4**	**14.0**	**8.0**	**12.4**

S = Supervisor detected the error and **R** = Researcher detected the error.

Table 5. Comparison of employee education levels and mean tray errors at selected long-term care facilities (N=6).

	Total no. of employees	**Number of employees at various education levels**			**Tray Errors**	
Facilities with more education		Some High School	High School completed	Some College	Number	Percent %
D	3	0	3	0	14	15.4
F	4	0	4	0	14	14.0
H	3	0	3	0	18	22.5
Mean tray errors					**15.3**	**17.0**
Facilities with less education						
B	4	3	0	1	8	8.0
E	4	3	1	0	13	14.4
G	4	4	0	0	8	8.0
Mean tray errors					**9.6**	**10.0**

Table 6. Comparison of number of tray errors and other demographic factors such as speed of trayline, number of regular and modified diet trays, number of trayline employees, and average length of employees' trayline experience at selected long-term care facilities (N=6).

Facility	Speed of trayline* (Seconds/tray)	Regular diet trays		Modified diet trays		No. of trayline employees**	Avg. length of trayline experience*** (Month)	Number of tray errors
		Numbers	Percentage (%)	Numbers	Percentage (%)			
B	15.6	26	26	74	74	4	39.3	8
D	23.7	30	33	61	67	3	94.0	14
E	30.0	27	30	63	70	4	57.0	13
F	19.2	24	24	76	76	4	129.0	14
G	22.8	35	35	65	65	4	126.1	8
H	39.0	28	35	52	65	3	74.7	18

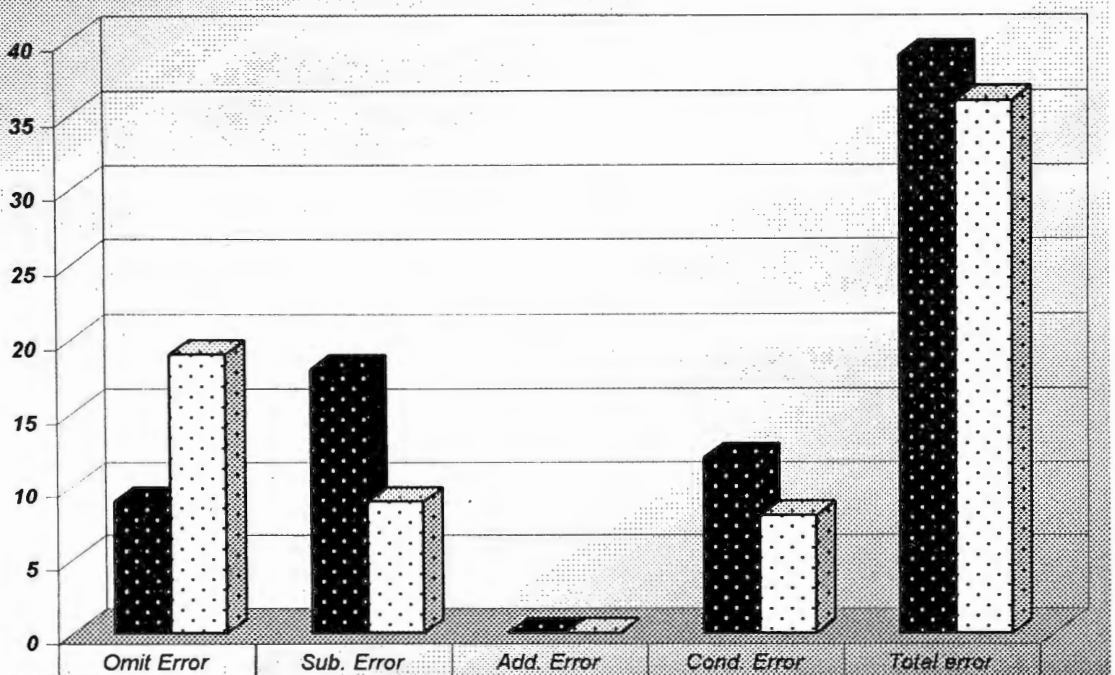
*Spearman's Rho correlation coefficient of the speed of trayline and number of tray errors is 0.618.
**Spearman's rho correlation coefficient of the number of trayline employees and number of tray error is –0.746.
***Spearman's rho correlation coefficient of the average month of trayline experience and number of tray error is 0.265.

Table 7. Characteristics of trayline operation at selected long-term care facilities (N=6).

Facility	No. Manager/Supervisor on Duty				Census	Lunch Count	Supervisor works on trayline	No. of tray errors	No. of modified diets	No. of trayline stations	Served condiments on trayline
	Breakfast	Lunch	Dinner	Weekend							
B	1	1	0	0	143	142	Yes	8	6	3	Yes
E	1	1	1	0	100	90	No	13	6	3	Yes
H	0	1	1	1	82	80	No	18	6	2	Yes
D*	0	1	1	0	98	91	No	14	6	3	Yes
F*	1	1	1	1	160	154	Yes	14	8	4	No
G*	1	2	1	1	180	132	Yes	8	8	4	Yes

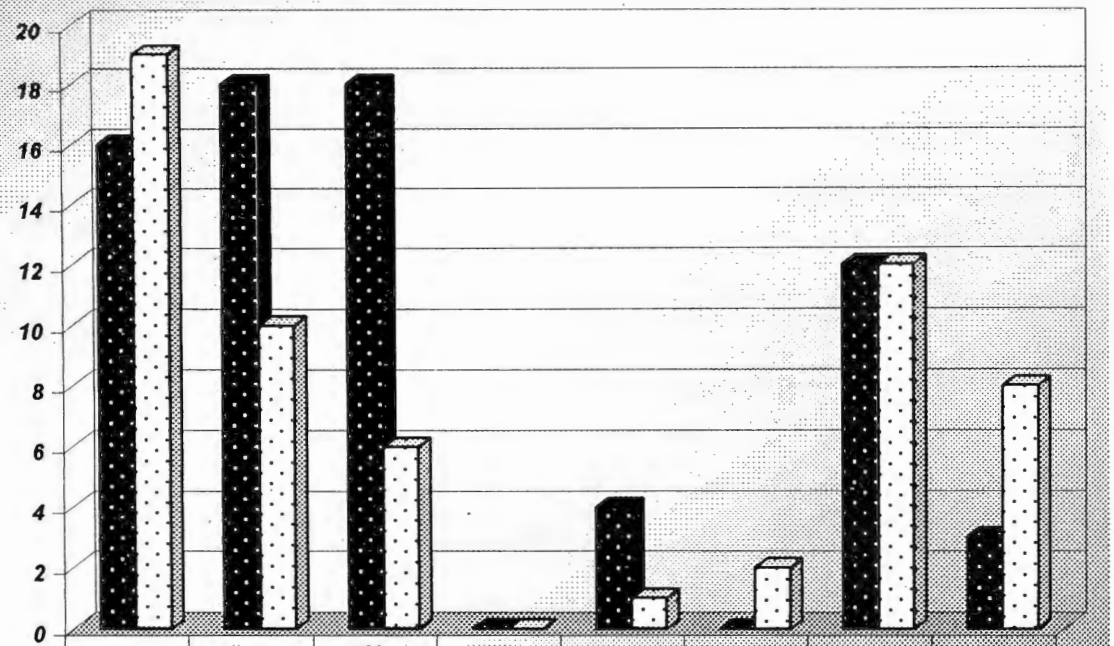
* Represent facilities using the individualized tray menus

Figure 1. Comparison of Number and Type of Tray Errors



	Omit Error	Sub. Error	Add. Error	Cond. Error	Total error
■ Facilities Using Disposable Tray Cards	9	18	0	12	39
□ Facilities Using Individualized Tray Menus	19	9	0	8	36

Figure 2. Comparison on Number of Tray Errors by Diet Types



	Regular	No Added Salt	No Concentrated Sweet	Diabetic	Low chol Low Fat	Bland	Mech Soft	Puree
Facilities Using Disposable Tray Cards	16	18	18	0	4	0	12	3
Facilities Using Individualized Tray Menus	19	10	6	0	1	2	12	8

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APPENDICES

APPENDIX A

Research Approval Letter from Institution Review Board

TEXAS WOMAN'S UNIVERSITY

INSTITUTIONAL REVIEW BOARD
P.O. Box 425619
Denton, TX 76204-5619
Phone: (940) 898-3377
Fax: (940) 898-3416
e-mail: IRB@twu.edu

August 28, 2001

Dear Ms. Zhao:

Re: Factors that Influence Trayline Accuracy at Long-Term Care Facilities that Use Tray Menus and Disposable Tray Cards

The above referenced study has been reviewed by a committee of the Institutional Review Board (IRB) and appears to meet our requirements in regard to protection of individuals' rights.

If applicable, agency approval letters obtained should be submitted to the IRB upon receipt prior to any data collection at that agency. A copy of your newly approved consent form has been stamped as approved by the IRB and is attached, along with a copy of the annual/final report. Please use this consent form which has the most recent approval date stamp when obtaining consent from your participants. The signed consent forms and final report are to be filed with the Institutional Review Board at the completion of the study.

This approval is valid one year from the date of this letter. Furthermore, according to HHS regulations, another review by the IRB is required if your project changes. If you have any questions, please feel free to call the Institutional Review Board at the phone number listed above.

Sincerely,

Dr. Linda Rubin, Chair
Institutional Review Board - Denton

enc.

cc Dr. Carolyn Bednar, Department of Nutrition & Food Sciences
Graduate School

APPENDIX B

Approval Letters from Eight Long-Term Care Facilities' Administrators

GRACE
PRESBYTERIAN VILLAGE, INC.

8-22-01

Grace Presbyterian Village
550 E. Ann Arbor
Dallas, TX 75216

Dear Cecelia:

In regards to your research project "Factors that influence trayline accuracy at long-term care facilities that use tray menus and disposable tray cards", I am giving you the permission to use our facility as one of your research study sites to observe trayline during lunch time and check the accuracy of the food items on resident's trays. You are also given permission to interview the trayline supervisor regarding trayline operation and trayline employees. I understand that your study and the subjects involved are affiliated with our nursing home. You may use this letter as approval to utilize our facility for your research project and you have approval to have access to the facility. I do request that you communicate with the Dietary Manager as to the dates you will be in the facility so that she may communicate to the staff.

Best regards,

Teresa Whittington

Teresa Whittington
Director of Healthcare and Residential Operations

Denton
Good Samaritan
Village
In Christ's Love, Everyone Is Someone.

2500 Hinkle Drive
Denton, TX 76201-0739

940-383-2651 *phone*
940-382-9306 *fax*

Sept 24, 2001

Dear Cecilia:

In regard to your research project "Factors that influence trayline accuracy at long-term care facilities that use tray menus and disposable tray cards", I am giving you the permission to use my facilities as one of your research study site to observe trayline during lunch time and check the accuracy of the food items on patients' trays. You are also given the permission to interview the trayline supervisor regarding trayline operation and trayline employees. I understand that information you collect during your study will be for educational purposes and that the facility will not be identified by name. Please use this letter as an approval for you to use our facility for your project.

Sincerely,

Phil Elmore
Administrator

Christian Care Center

Sept 17, 2001

Dear Cecilia:

In regard to your research project "Factors that influence trayline accuracy at long-term care facilities that use tray menus and disposable tray cards", I am giving you the permission to use my facilities as one of your research study site to observe trayline during lunch time and check the accuracy of the food items on patients' trays. You are also given the permission to interview the trayline supervisor regarding trayline operation and trayline employees. I understand that information you collect during your study will be for educational purposes and that the facility will not be identified by name. Please use this letter as an approval for you to use our facility for your project.

Sincerely,

Jon Gulley

Jon Gulley
Administrator

1000 WIGGINS PKWY.
MESQUITE, TX 75150-9974
(972) 686-3000

SCC
Senior Care at Lake Pointe

July 31, 2001

Dear Cecilia:

In regard to your research project "Factors that influence trayline accuracy at long-term care facilities that use tray menus and disposable tray cards:. I am giving you the permission to use my facility as one of your research study sites to observe trayline during lunch time and check the accuracy of the food items on patients' trays. You are also given the permission to interview the trayline supervisor regarding trayline operation and trayline employees. I understand that your study and the subjects involved are affiliated with my nursing home. Please use this letter as an approval for you to use to have access to my facility.

Best regards,

Greg Nelson
Administrator

6700 Heritage Parkway
P.O. Box 1907
Rowlett, Texas 75030-1907
972/412-4000 • FAX 972/412-8366

Hilltop Haven
CHRISTIAN CARE CENTERS, INC.

July 30, 2001

Hilltop Haven

Dear Cecilia:

In regard to your research project "Factors that influence trayline accuracy at long-term care facilities that use tray menus and disposable tray cards", I am giving you permission to use my facility as one of your research study sites to observe trayline during lunch time and check the accuracy of the food items on patients' trays. You are also given the permission to interview the trayline supervisor regarding trayline operation and trayline employees. I understand that your study and the subjects involved are affiliated with my nursing home. Please use this letter as an approval for you to use to have access to my facility.

Best regards,

David Boggs
Administrator

P.O. BOX 39, 308 E. COLLEGE
GUNTER, TX 75058-0039
(903) 433-2415

Pioneer Rehabilitation & Care Center

225 Sowers Rd. Irving, Texas 75061
Phone: (972) 253-4173
Fax: (972) 254-0927

July 16, 2001

Pioneer Rehab & Care Center in Irving

Dear Cecilia:

In regard to your research project "Factors that influence trayline accuracy at long-term care facilities that use tray menus and disposable tray cards", I am giving you the permission to use my facilities as one of your research study site to observe trayline during lunch time and check the accuracy of the food items on patients' trays. You are also given the permission to interview the trayline supervisor regarding trayline operation and trayline employees. I understand that your study and the subjects involved are affiliated with my nursing home. Please use this letter as an approval for you to use to have access to my facility.

Best regards,

Stacy Staley
Administrator

SCC

Whitesboro Nursing Center

July 31, 2001

Dear Cecilia:

In regard to your research project "Factors that influence trayline accuracy at long-term care facilities that use tray menus and disposable tray cards:. I am giving you the permission to use my facility as one of your research study sites to observe trayline during lunch time and check the accuracy of the food items on patients' trays. You are also given the permission to interview the trayline supervisor regarding trayline operation and trayline employees. I understand that your study and the subjects involved are affiliated with my nursing home. Please use this letter as an approval for you to use to have access to my facility..

Best regards,

Dan Marick

Dan Marick
Administrator

1204 Sherman Drive
Whitesboro, Texas 76273-0250
903/564-3508 • FAX 903/564-7028

Heartland of Bedford
2001 Forest Ridge Drive
Bedford, Texas 76021
817-571-6804
817-267-4176 Fax

HCR·ManorCare

September 10, 2001

Dear Cecilia,

In regards to your research project "Factors that influence trayline accuracy at long-term care facilities that use tray menus and disposable tray cards." I am giving you permission to use our facility as one of your research study sites to observe trayline during lunch and to check the accuracy of the food items on patient trays. You are also given permission to interview the trayline supervisor regarding trayline operation. I understand that the information you collect during your study will be for educational purposes and that the facility will not be identified by name. Please use this letter as an approval for you to use our facility for your project.

Sincerely,

Amy Diamond, Administrator

APPENDIX C

Sample Individualized Tray Menus

Room: FACILITY D D.R. 6

08/26/2001

Diet Order: REGULAR

NO FRIED FOODS, NO SPICY FOODS NO TOMATOES, NO CORN,SANDWICH BLUE

Beverages for Lunch: , TEA & WATER

GRN BEAN CASS PIE, LEMON CHICKEN BAKED POTATOES

MARGARINE ROLL

Do Not Serve: BBQ

Room: FACILITY F E 2-RM

09/11/2001

COTT.CHEESE @ LUNCH BABY FOOD Diet Order: PUREED REGULAR

SEND VARIETY OF SOUP LUN&SUP NUBASIC SOUP FORT.PUDDING

Beverages for Lunch: WHOLE MILK, FORT.JUICE

NO PATTERN

Do Not Serve: NOODLES MARGARINE

Room :

FACILITY G

CARTORANGE34

09/17/2001

SCRAMLED EGG X3 soup cornbread Diet Order: REGULAR

cream of wheat x3. soup cornbre CRM/WHEAT/APPLESAUCE/SCRAMB/EG

Beverages for **Lunch:** COFFEE, MILK, WHOLE & CRANBERRY JUICE

STRAWBERRIES	ALOHA CHICKEN	RICE PILAF	VEG, MIX
MARGARINE	ROLL		

Do Not Serve: N/A

APPENDIX D

Sample Disposable Tray Cards

FACILITY H

B-20-L-2-S-20

Food Allergy:

Room #:

Diet: Regular,NCS DIET

Breakfast

Beverage: 2%, Jc, Cf
Fruit: fruit yogart
Cereal: Dry
Egg:
Bacon: ☐ Bread: ☐
Toast: ☐
Margarine: ☑

Lunch

Beverage: 2% milk/HEALTHSHAKE
Meat: ☑ Potato: ☑
Vegetable1: ☑ Salad: ☐
Vegetable2: ☐ Dressing:
Bread: ☑
Margarine: ☑ Fruit: Any
Dessert: ☐

Dinner

Beverage: 2%r milk/HEALTHSHA
Meat: ☑ Fruit: any
Vegetable1: ☑ Soup: ☑
Vegetable2: ☐ Potato: ☑
Bread: ☑ Salad: ☐
Margarine: ☑ Dressing:
Dessert: ☐

Likes: CB & apple juice, hominy, corn casserole, corn bread, pinto beans, fried okra, black-eyed peas, bran

Dislikes: apples, caulif..carrots, greenbeans, brocc.oatmeal, mashed pot, yellow squash/BRUSS.SPROUTS,zucc/tom

Lunch: FRUIT FOR DESSERT UNLESS REQUESTS DESSERT

Supper: FRUIT FOR DESSERT UNLESS REQUESTS DESSERT

Cart No. 2 | Cart No. 2 | Cart No. 2

FACILITY B

Diet MECHSOFT*CHOP MEAT LRG.PORTIONS	Diet MECHSOFT*CHOP MEAT LRG.PORTIONS	DIET MECHSOFT*CHOP MI LRG.PORTIONS
Bkfst FEEDER DR/3	Lunch FEEDER DR/3	Supper FEEDER DR/3
SM BOWL CORNFLAKES PIMENTO CHEESE SANDWICH	NO BREAD FISH,BAKED ONLY NO:ORANGE SHERB,MEATLOAF T.GREENS,SAUERKRT BR.SPROUTS, CORNBREAD	NO BRD FISH, BKD ONL NO:ORANGESHERB,MEATL TURNIP GRN, SAUERKRT BR.SPRT, CORNBREAD
	*ICECREAM & BANANA	*ICECREAM & BANANA
Bev MILK, TOMATO JC Cond SALT,PEPPER,SUGAR	DISLIKES SLAW,CABBAGE, CRM CORN,GOULASH,BROCCO	DISLIKES SLAW,CABBAG CRM CORN,GOULASH,BRO
505.2 1103.0	Bev MILK,WATER SALT,PEPPER,SUGAR	Bev MILK,WATER SALT,PEPPER,SUGAR

FACILITY E

Lunch
Monday
09/10/01

MechSft,
ENHANCED F, RED NAPKIN

ALLERGIES:

DISLIKES: pepper, SPICY FOOD, Sausage, Tom, Broc, greens, no cranber, no orange, grits, OATMEAL

BEVERAGES: IceTea, Wh Milk

MEAL PREFS:

NOURISHMENTS:

APPENDIX E

Sample Subject Consent Form

TEXAS WOMAN'S UNIVERSITY
SUBJECT CONSENT TO PARTICIPATE IN RESEARCH

Title: Factors that Influence Trayline Accuracy at Long-Term Care Facilities that Use Tray Menus and Disposable Tray Cards

Investigator: Ms. Cecilia Zhao, RD.....972/252-2056
Advisor: Carolyn Bednar, Ph.D., R.D.....940/898-2658

You are being asked to participate in a research study for Ms. Zhao's thesis at Texas Woman's University. The purpose of this research is to compare trayline accuracy between long-term care facilities that use computer generated individualized tray menus and those that use disposable tray cards at eight nursing home facilities. For this study, the trayline supervisors will be interviewed face-to-face with the researcher at a private location agreed upon by you and the investigator to get group demographics about the trayline employees. The interview will last approximately less than 30 minutes. The researcher will stand at the end of the trayline and check the accuracy of each tray with the supervisor for a total of hundred trays at each facility. However, the researcher will not comment or interfere with the supervisor during the trayline. The study will be conducted on site during one weekday's lunch meal at your facility.

This investigation involves the risks of release of confidential information, improper release of data, and loss of privacy. Confidentiality will be protected to the extent that is allowed by law. The interview will take place in a private location agreed upon by you and the researcher. You should not state names of trayline employees; instead they will be revealed and recorded in the form of trayline positions (i.e. starter, hot food assembler, loader, etc). Also, the researcher will not interact in any way with individual trayline employees or identify any tray as tied to an individual employee. All data collected from you as supervisor will be non-identifiable group data. If you inadvertently do state a name, this name will not be recorded. Your nursing home will be identified by code for any information presented in public or published for thesis. Names or other identifying information will not be included in any publication. Data will be stored in a locked file cabinet at Dr. Bednar's office in the Department of Nutrition and Food Sciences at Texas Woman's University. Data will be shredded within 2 years from date of collection (no later than August 2003). The computer files will be also erased within 2 years from date of collection (no later than August 2003).

Another risk is that of possible discomfort as a result of the supervisor being watched by researcher. If discomfort is experienced during the trayline period, the supervisor has the right to ask the researcher to leave the trayline and come back at another time when appropriate.

_____
Subject Initial

This study can be useful in helping a trayline supervisor/manager identify the possible problem areas on the trayline, thus assisting you to design an individualized training program for your trayline employees to improve their tray accuracy. A summary of the results will be mailed to you upon request.

If you have any questions about the research study you should ask the researchers; their phone numbers are at the top of this form. If you have questions about your rights as a participant in this research or the way this study has been conducted, you may contact Ms. Tracy Lindsay in the Office of Research & Grants Administration at 940-898-3377 or e-mail HSRC@TWU.EDU.

The researchers will try to prevent any problem that could happen because of this research. You should let the researchers know at once if there is a problem and they will help you. However, TWU does not provide medical services or financial assistance for injuries that might happen because you are taking part in this research.

Participation in this study is completely voluntary and you may withdraw at any time without penalty. If you have any questions, please contact the investigators at the above phone number. You will be given a copy of this dated and signed consent form to keep.

_____ _____

Signature of Participant Date

The above consent form was read, discussed, and signed in my presence. In my opinion, the person signing said consent form did so freely and with full knowledge of its contents.

_____ _____

Signature of Investigator Date

☐ *Check here if you would like to receive a summary of the results of this study and list below the address to which this summary should be sent.*

_____

_____

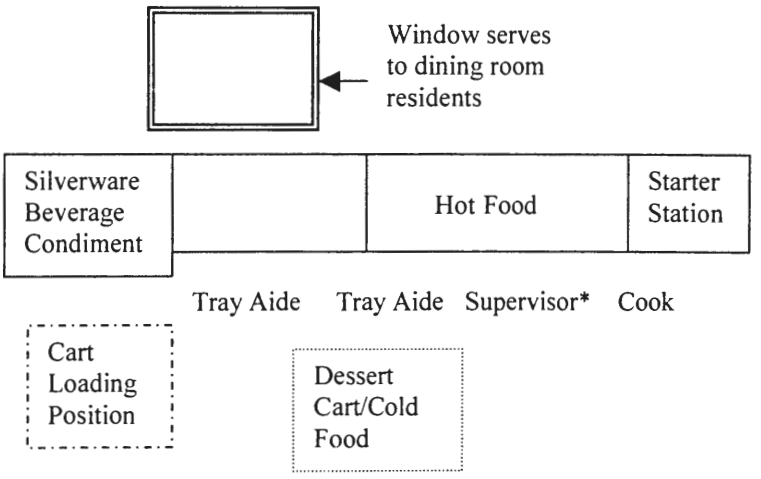
_____

☐ *Check here if you do not wish to receive a copy of the results of the study.*

APPENDIX F

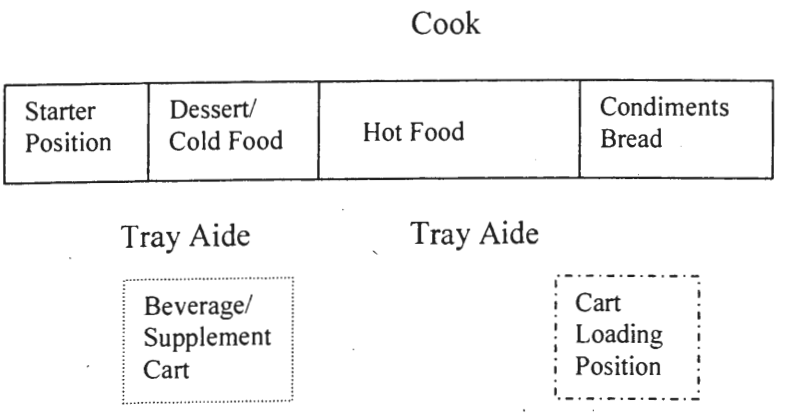
General Designs of Trayline and Stations in Six Facilities

Facility B Trayline Stations

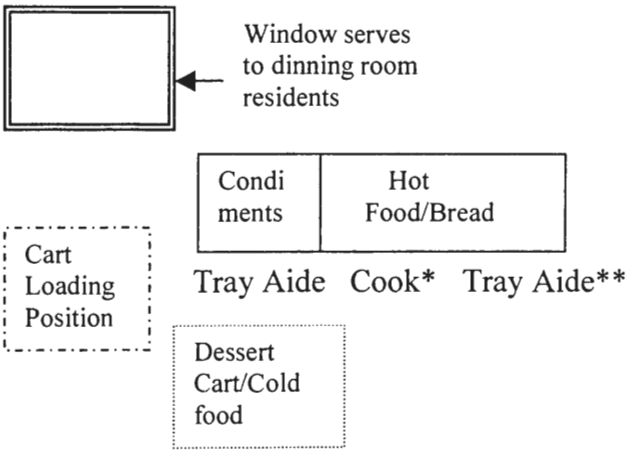


*This person just happens to be helping with trayline during the time of research.

Facility E Trayline Stations

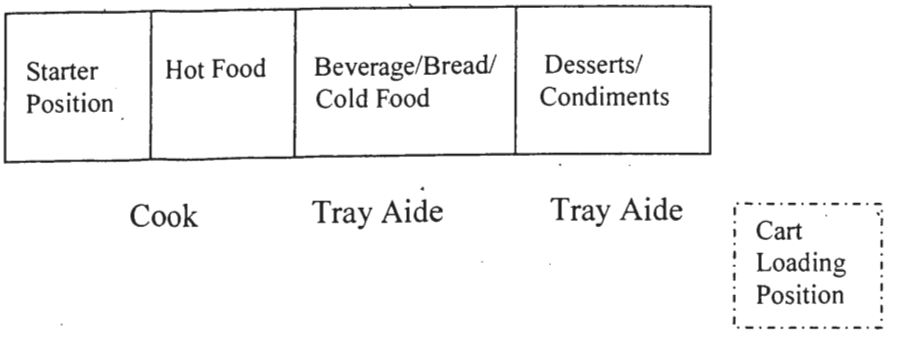


Facility H Trayline Stations

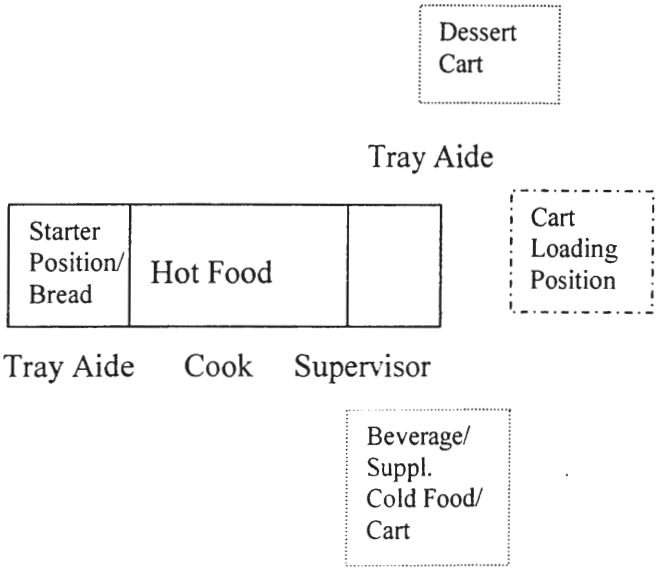


*This person does not always work on the trayline.
**This person set-up each tray with silverware/condiments/salad/dessert for all non-dinning room residents prior to trayline starts.
For dinning room residents, salad/fruit is already set-up on the table, and beverage/supplement are served by nursing staffs.

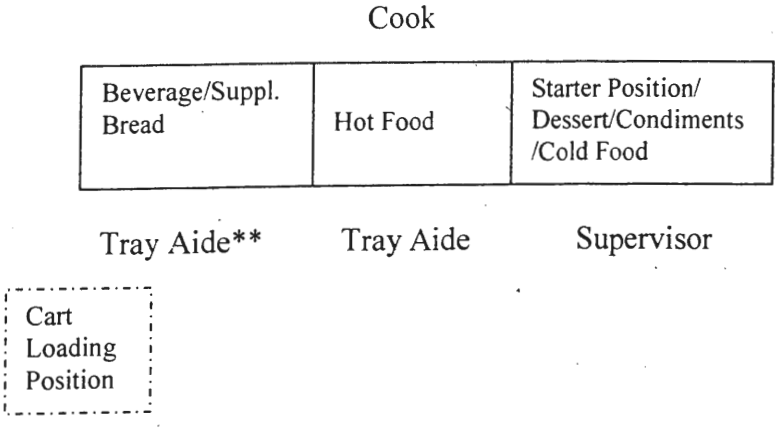
Facility D Trayline Stations



Facility F Trayline Stations



Facility G Trayline Stations



** This person also transported the food carts to the floor after finishing loading each cart.

APPENDIX G

Sample Tray Error Recording Form

Facility: _____

Date: _____

Time the trayline begin: _____

Time the 100th trays end: _____

Time the trayline end: _____

Tray No.		Diet type	Error Type: No. of **Omission** S	R	No. of **Substitution** S	R	No. of **Addition** S	R	Wrong **Condiment** S	R	Comments
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											

APPENDIX H

Sample Interview Questionnaire

Supervisor Interview Form

Facility: _____
Date: _____

Trayline employee	**Work Status***	**Highest education completed****	**Number of years working on trayline**
Trayline Supervisor			

*Work status is classified as full time/part time/temporary
**Education levels are classified as some high school/high school completed/some college/associate's degree/bachelor's degree/master's degree

1) Total Census: _____ Lunch Count: _____

2) Is the facility predominately a private paid or medicare/medicaid paid nursing home?

3) Total number of modified diets available:_____

4) Total number of supervisors on duty for Breakfast: _____ Lunch:_____ Dinner:_____

5) Total number of stations on trayline:_____

6) Do you serve condiments on the trayline?_____

7) Does each employee have adequate English skills to participate in trayline? If no, which are not?