Chapter 19

Facilities and Equipment for the Research Kitchen

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The Planning Process

Whether planners are building, remodeling, or contracting kitchen space for research food preparation, thoughtful planning and execution will result in cost savings and improved time management. This chapter highlights considerations for facility design that can be applied to projects as small as redesigning the layout of a cooking area for an existing kitchen or as large as new construction or complete renovation of an existing facility. Most of the information generally applies to small or large research kitchens, but special considerations are noted for those designed for large-volume food preparation.

Planning is integral to the development of a well organized, cost-effective kitchen plan. First, careful consideration of the scope and complexity of facility requirements enables appropriate selection of the planning team (1). Research managers and lead nutrition staff should be included in this panel to help identify common logistical problems and to discuss budgetary issues (2).

A planning team might also include the following individuals:

- Member of board of directors for the research institution (general resource allocation and compatibility with current and future projects).
- Architect (layout and design issues).
- Cook or food technician (site-specific experience).
- Restaurant consultant (time, space, motion, and service issues).
- Subcontractor or general contractor (logistics, planning, and inspection codes).
- Manufacturer representatives or equipment dealers (access to the parent companies' resources, input regarding price and features).
- Engineer (expertise in physical plant systems, ie, heating, air conditioning, and electrical).
- Health department official (addresses health regulations and installation specifications) (1, 2).

If it is not possible to recruit a health inspector for the planning team, an architect, contractor, or consultant could act as a liaison to the local health office. In the university setting the capital resources manager may work with health agency staff who can ensure health codes are met throughout the design phase. When architects, consultants, or contractors are not needed, as is the case for small projects, it remains important to address health regulations and installation specifications. All major or minor structural, electrical, and plumbing alterations must pass building and fire codes.

Planning the research kitchen begins by considering space and function (Exhibits 19-1 and 19-2). The next step is to forecast production and menu requirements. An analysis of space and equipment needs can then be further elaborated. Realistic costs can be forecast based on the identified criteria. Effective remodeling also requires revisions of preexisting design drawbacks. Former "mistakes" are often transposed or, worse yet, additional ones can be included in the new design. Considering the pros and cons of current kitchen designs results in a more efficient, cost-contained plan.

Future expansion also should be considered during the planning stage, when designing for change is possible. Inexpensive remodeling can then be easily done as needs

eat right. American Dietetic Association

Source: "Well-Controlled Diet Studies in Humans, A Practical Guide to Design and Management", American Dietetic Association, © 1999.

EXHIBIT 19-1

Worksheet for Calculating Capacity and Space Requirements[1]

CAPACITY REQUIREMENTS[2]

Number of participants			________
Meals and snacks/participant/day		×	________
Meals and snacks served/day	Total =		________

SPACE REQUIREMENTS[3]

Storage area			
Nonperishable food[4] (0.33 sq ft to 0.5 sq ft/meal)			________
Perishable food[5]			
Refrigerator (0.5 sq ft to 1.0 sq ft/meal)		+	________
Freezer (0.75 sq ft to 1.5 sq ft/meal)		+	________
Nonfood: (0.09 sq ft/meal)[6]		+	________
All storage (1.0 sq ft to 3.0 sq ft/meal)	Total =		________
Preparation area (1.1 sq ft to 1.5 sq ft/meal)[7]		+	________
Serving area[8] (0.57 sq ft/meal)		+	________
Dishwashing and sanitation areas[9] (0.58 sq ft/meal)		+	________
Dining area (12 sq ft to 14 sq ft/participant/seating)		+	________
All areas	Total =		________

[1] Adapted from Pannell D (6).
[2] Capacity represents seating and serving needs.
[3] Actual storage requirements for large research kitchens (facilities feeding 25 to 100 participants) are underestimated by these figures.
[4] Nonperishable food is stored dry and at room temperature.
[5] Depending on type of meal service, refrigerator/freezer space allotments may be reversed (ie, balance space for food served on day of preparation vs advanced prep area and frozen items). Space estimates are for walk-in units.
[6] Estimates for nonfood storage may be increased for carry-out containers and disposables.
[7] Estimates for preparation area include refrigeration and may be increased for multiple ovens and other large equipment.
[8] The figures for estimating serving and dishwashing areas may be increased to meet the needs of large feeding programs. Less space is required when dishwashing and meal service are done in shifts.
[9] Verify requirements set by state sanitation codes.

change. Flexible planning is exemplified by modular designs that use movable equipment, tabletops, and service components to facilitate rearrangement. Equipment contracts also can include provisions for future upgrades.

Space and Equipment

Kitchen Layout

A primary focus of kitchen design is work flow, that is, the actual steps between food procurement, preparation, and cleanup. Simply mapping flow of materials and traffic patterns points out inherent flaws with existing kitchen setups. For example, arranging the sink, range, and cold storage in a triangle configuration facilitates work flow among stations; direct paths between these functional kitchen areas avoid wasted steps. This design solution minimizes backtracking and crossover of kitchen staff (3).

In facility designs each area must be considered according to its specific function (4). Layouts can then accommodate preparation, cooking, storage, and cleanup tasks. Stations require a work table, cutting surface, and adequate storage space. In addition, the placement of a sink and garbage disposal amid areas is useful to enhance work flow. Floor space is needed for tray carts, waste containers, and other movable equipment. A work pattern among production areas must be established that accommodates staff movement and effective use of equipment.

EXHIBIT 19-2

Space Requirements and Considerations for a Cafeteria-style Tray Service Area[1]

Lane space	30 in
Tray slide	12 in
Serving counter width	2 ft to 3 ft
Work space	4 ft
Back counterspace	2½ ft
Holding equipment (cold and hot food)	Depends on number of meals served per day
	Depends on equipment specifications
Self-service areas	Depends on number of meals served per day
	Requires tray and utensil areas
	Requires dessert, salad, and condiment areas

Adapted from Pannell D (6).

Generally, 3 ft to 6 ft of aisle space is required between island or work counters and wall cabinets because open cabinet or equipment doors increase width requirements (3, 5). Consultants can verify state code specifications for aisle width. Additional factors that may be considered in aisle layout are to:

- Avoid arranging aisles along bare walls: space is minimized and work areas are only accessible from one side.
- Consider using equipment with sliding doors: work space is maximized because doors do not open into aisles.
- Design aisles at right angles: total aisle space is otherwise decreased.
- Locate aisles away from high-volume work areas: work flow and productivity are maximized and risk of accidents is lowered.

Plans should first focus on the hot-food preparation area; then development of subsequent workstations can proceed (3). Because the cooking station frequently becomes multifunctional, this area requires adequate storage and counterspace for food preparation and equipment. Placing ovens in close groups provides a more efficient arrangement for ventilation, utility hook-up, maintenance, and sanitation. Oven capacity and storage space should be sufficient for a variety of cookware and utensils.

Similarly, work areas can be arranged with productivity in mind. Adequate storage and work space are desirable in all work centers. Certain pieces of equipment are necessary in each work area (Exhibit 19-3), so the specific layout will be affected by equipment installation and utility hook-up. These requirements need to be considered to determine the best physical arrangement (5). For large facilities, a quantity food production area with ovens and other large equipment may be shared while several work areas are used independently.

Four different configurations are commonly used to arrange work areas: the straight and parallel lines or the L and U shapes (see Figure 19-1). There are advantages and disadvantages to each arrangement; however, the straight line is considered the best with regard to time and space efficiency. Similarly, the L shape uses a limited space while providing a convenient work surface. This arrangement may be used to create a workstation that is separate from the traffic aisle. For example, L shapes are useful in sanitation areas. On the other hand, the U-shape layout offers a large surface area, but it adds more steps walking in and out of the workstation. Lastly, parallel or back-to-back tables are convenient and used frequently in kitchen plans. These arrangements maximize available space and provide ample work surfaces by affording two-sided access.

For larger facilities to accommodate simultaneous feeding studies, two or more L- or U-shaped work areas, or "bays," are desirable. Each bay area may be similar in design or specialized for the food preparation function. Duplicate equipment may be needed for each area.

An island, strategically placed, enhances the efficiency of a work area. Islands that are 4½ ft × 8 ft are functional, whereas narrow islands do not provide sufficient work space for a research kitchen. Islands can be placed among cooking, refrigeration, and sanitation areas to facilitate food preparation and work flow. Islands should be electrically wired to accommodate equipment requirements.

Counterspace is an additional priority in designing floor plans. Research kitchens differ from other kitchens in that they require more counterspace for portioning food items. To prepare meals for 5 to 10 participants, 6 ft to 9 ft of continuous counterspace is recommended in the food preparation center and 3 ft to 6 ft in the cooking area. The amount of counterspace needed increases when staff prepare meals for more participants. Adequate counterspace allows for food processing, preparation, and weighing portions. Additional counterspace may be required if meals are packaged for take-out to accommodate bags, boxes, or coolers.

Because counters may double as hot-food holding and serving areas, countertops next to cooking areas should be heat resistant. In addition, a generous number of electrical outlets should be installed along the wall behind the equipment or backsplash. Horizontal strips can be used to accom-

EXHIBIT 19-3

Equipment Considerations

MAJOR EQUIPMENT

Cooking Area

Comment: Cooking and baking requirements will dictate the type and amount of oven equipment purchased. Residential versions are sufficient for many small facilities.

Suggested Items

Range (2 to 4 burners)
Conventional oven
Convection oven (single-cavity units (18 in × 20 in × 23 in) or double-cavity units (36 in × 40 in × 46 in))
Deck oven
Hood and air filter
Vegetable steamer
Steam kettle

Cold Preparation Area

Comment: Commercial reach-in refrigerators and freezers are manufactured in one-, two-, or three-compartment sections. Purchase options include full-size or half doors and adjustable shelving or tray slides. Walk-in versions can also be considered for larger studies or facilities. Space requirements and installation costs require further investigation. Another option is to contract walk-in space from a main kitchen.

Additional freezer space may be required for studies that require frozen storage with infrequent food pickup; refrigerated space may be required to hold take-out meals. A –70°F freezer is necessary for storing food composites. Walk-in space from the hospital or main kitchen may be negotiated for short-term programs. Movable stainless steel cages that can be secured are efficient for using space and resources well.

Guidelines for Determining Capacities

Number of Participants	Reach-in Refrigerator	Reach-in Freezer	Walk-in Refrigerator	Walk-in Freezer
< 25	1-46.5 cu ft	1-46.5 cu ft	N/A	N/A
25-50	2-46.5 cu ft	3-46.5 cu ft	88 sq ft	N/A
50-100	4-46.5 cu ft	2-46.5 cu ft	100 sq ft	120 sq ft

Sanitation Area

Suggested Items

Deionizer
Dishwasher
Garbage disposal
Sinks
Ice machine
Water distiller

Minor Equipment

Suggested Items

Blender, industrial
Top-loading balances
Mobile tray, silverware, and dish storage carts
Microwave ovens
Appliances—coffee maker, mixer, food processor, and toaster
Stoneware and sturdy service ware
Slicers
Carts and tray racks

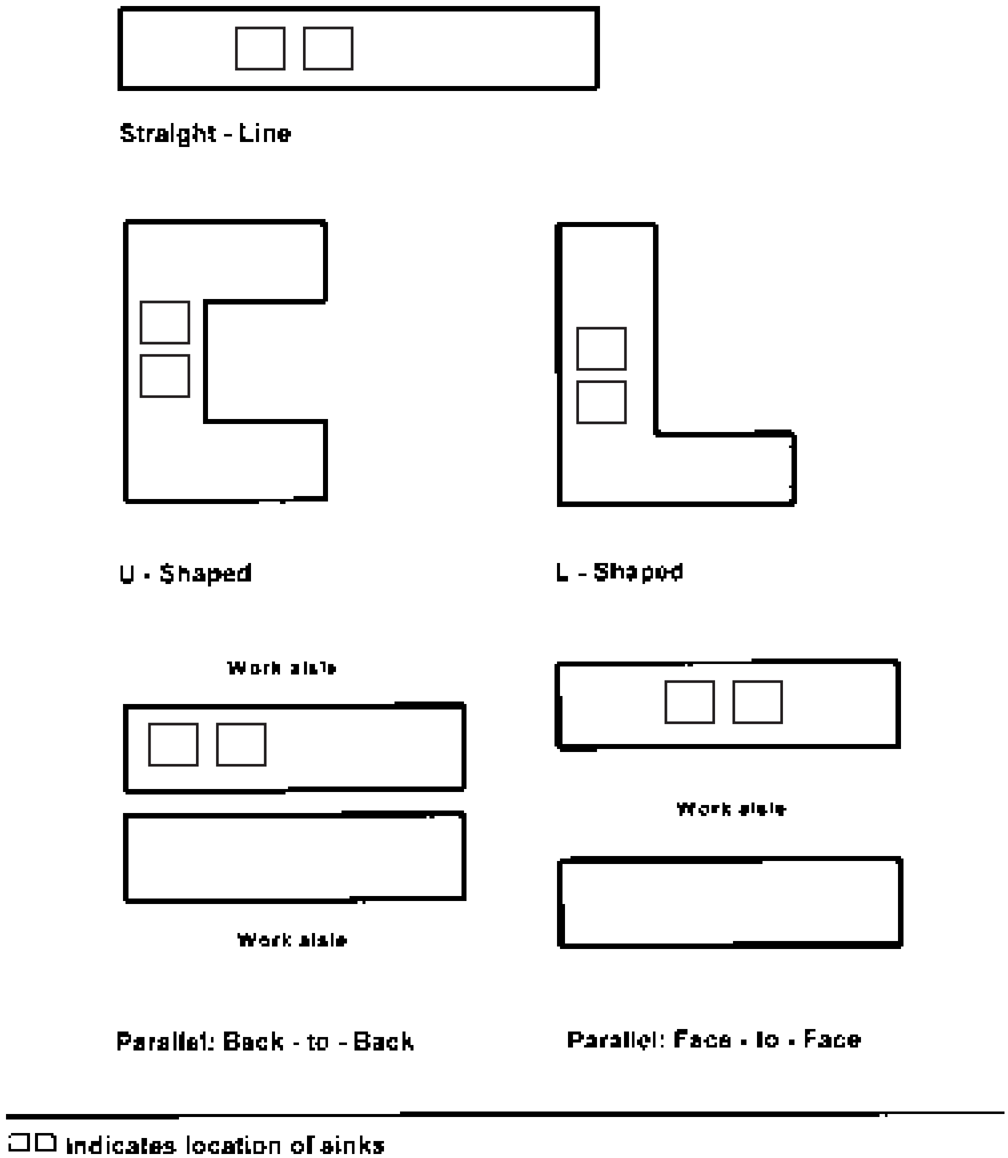

FIGURE 19-1. Common arrangements for work centers.

modate multiple appliance hook-ups. This type of outlet placement eliminates the need for extension cords or connections in the floor, decreases the potential for clutter and accidents, and facilitates sanitation (1). An electrician should review floor plans to make sure sufficient power is provided, particularly for high-voltage equipment, but even small appliances require substantial energy.

Counters should be 3 ft high, a comfortable work level for most adults. Cooking areas may include a lower counterspace for baking purposes or for housing large appliances. This lower section in a baking area facilitates kneading and rolling dough and helps prevent lower back injuries. It can be placed between the preparation area and the cooktop or in the middle of the preparation area (3). Marble surfaces are commonly recommended for baking purposes to facilitate product preparation, cleanup, and sanitation.

Ventilation and Climate Control

Ventilation and climate control must be adequate to minimize heat generated from major appliances. Air and water cooling systems are common requirements. Economic and environmental issues underscore the need to implement a heat recovery system that recycles heat lost by refrigeration, air conditioning, and ice making, and from heat pump systems. Recovered energy is used for partial heating of dishwashing water. This system should reduce the substantial costs of heating water (1). In addition, the kitchen staff can work more efficiently when the ambient temperature is comfortable.

Work Surfaces

Easy-to-clean wall and floor surfaces are recommended. Ceramic or glazed tiles are appropriate wall surfaces; quarry or unglazed ceramic tiles are appropriate for floors because they are grease resistant, durable, low maintenance, and less slippery than other floor coverings when wet (4). Quarry and unglazed ceramic tiles are most useful in high-volume research kitchens or in areas with heavy traffic (3). In the small-scale research kitchen, it may not be necessary to use high-durability floors because there may not be as much traffic or equipment movement as is evident in a commercial or hospital kitchen. Resilient floor materials may be considered as appropriate alternatives in this case. Although these coverings require routine maintenance, initial cost savings over quarry or ceramic tiles are considerable.

Specifications for food, nonfood, and splash contact surfaces have been defined by the National Sanitation Foundation (NSF, 3475 Plymouth Rd, Ann Arbor, MI 48105; phone: (313) 769-8010; toll free: (800) NSF-MARK; fax: (313) 769-0109; Web address: http://www.nsf.org). Food contact surfaces must be smooth, nontoxic, corrosion resistant, stable, and nonabsorbent. They cannot impart color, odor, or taste, and they cannot modify foods in any way. Splash surfaces and surfaces that do not contact food need to be made of smooth, corrosion-resistant materials that do not crack or chip (5). Also, splash surfaces need to be easy to remove (1).

Stainless steel meets the criteria for food contact surfaces. It is a commonly used and widely accepted surface in commercial kitchens and has become an industry standard because of its versatility and durability (2). It can be purchased as is or custom fabricated. Because stainless steel is heat-, stain-, and chip-proof, it requires little maintenance and repairs are infrequent. Stainless steel, which is approximately four times the cost of the plastic laminate surfaces, can be expensive. However, the benefits of stainless steel clearly outweigh the expense.

Artificial stone surfaces such as Fountainhead,® Gibraltar,® and Corian® satisfy NSF standards, but they are somewhat porous. This characteristic decreases their application in commercial kitchens. These synthetic surfaces have many desirable characteristics; they are heat, stain, and scratch resistant and easy to repair. Like stainless steel, they are manufactured to order. Therefore, artificial stone splashboards and countertops can be made without seams and with raised or rolled edges to avoid spills and maximize sanitation. The cost of synthetic surfaces is high—slightly more expensive than stainless steel. A combination of these two surfaces can meet health and sanitation codes and serve the research kitchen well.

Sanitation Area

Sinks with two to four compartments are required to meet sanitation codes for washing large utensils and pots. In smaller facilities, two-compartment sinks may be sufficient when pots are washed off-site. Accommodations also must be made for soiled and clean utensils, waste removal, and recycling. The sanitation area should provide sinks, dishwasher, and cabinets for storage of dishes, utensils, glassware, and cleaning supplies (1). Garbage disposals may or may not be permitted depending on state or local sanitation codes. Other equipment that may be placed in this area includes a hand-washing sink, water deionizer, and ice machine.

Dishwasher capacity will determine the necessary type of model. Commercial models are undercounter, semiautomatic rack types, or automatic rack conveyors. Adequate clearance space is required for loading and unloading dishwashers. Because an open undercounter dishwasher door should not obstruct aisle space or work flow, the dishwasher should not be installed on an angle, especially when it is placed next to the sink area (3). A second consideration for dishwasher installation is water temperature. Often a booster is required to attain temperatures high enough for washing and sanitizing.

Counterspace in the sanitation area should be at least 3 ft to 6 ft long. These specifications include the dishwasher surface area. Countertops should be apportioned on either side of the sink area to separate soiled from clean utensils (3).

Well-equipped and organized workstations also allow for a better use of staff time. Frequently used utensils, appliances, and cookware must be stored between knee and shoulder heights, close to where they are needed. Nonfood items and cleaning supplies are stored separately. Bulky items such as carts and coolers for take-out meals can be stored adjacent to the kitchen. Storage criteria are also dictated by health department codes.

Selecting and Storing Equipment

Well-equipped, logically organized workstations allow for better use of staff time. Kitchen equipment (Exhibit 19-3) should be selected according to necessity, the condition of present equipment, and the possibility of reducing energy and operating costs. The costs of upgrading from home-quality to institutional-quality equipment are often justified by improved durability, capacity, and energy efficiency as well as superior health and safety standards. This is especially true for high-volume research kitchens.

For a small-scale research kitchen, equipment purchases may include range tops and ovens, food processors, and smaller-capacity refrigeration units. Purchases of institutional dishwashers, coffee makers, mixers, toasters, and larger refrigeration units should be considered. Many facilities use a combination of institutional and household equipment in an effort to meet requirements for capacity yet contain costs.

Wall-mounted equipment and equipment racks enhance sanitation by eliminating equipment legs or stands. Mobile

TABLE 19-1

Considerations for Dry Storage[1]

Criteria	Recommended Specifications
Temperature	50°F–70°F
Ventilation	Air turnover, 6 times per hour
Lighting	No direct sunlight; less intense lighting
Environment	Humidity 50%–60% Minimize extraneous heat
Shelving	Rust-proof, off the floor and away from the ceiling, ie, steel wire shelves (per state and local specifications)

[1]Adapted from Pannell D (6).

equipment is helpful when components are used in more than one work area. On the other hand, removing the wheels from seldom-moved equipment can foster better sanitation and maintenance, because less dust and dirt can accumulate beneath and among the pieces of equipment (3).

The NSF also defines sanitation and safety standards for commercial equipment construction. Therefore, the NSF seal of approval has become an industry standard. Comprehensive information about commercial equipment is also provided from manufacturers. By identifying the many types of available kitchen equipment, consultants can provide useful advice before purchase decisions are made.

Examples of good space savers are movable undercounter shelving; deep, pull-out drawers for base cabinets; "tray" cabinets with vertical dividers for storing awkward items including lids and cutting boards; drawer dividers to organize utensils; lazy susans and swing-out shelves for corner cabinets; undersink compartments; and undercounter cart storage. For less frequently used appliances, overhead storage may be permissible if compatible with safety codes (3).

Regular temperature monitoring and back-up alarm systems should be part of the cold storage plan whether on-site or off-site. Power failures are common and must be protected against. Considerable cold storage space is also needed for research diet studies. Adequate refrigerator space is required for raw food items as well as prepared meals. Frozen storage space needs to accommodate food lots and prepared entrees or baked products because many research kitchens use cook/chill procedures. For large facilities, walk-in refrigerators and freezers are a must! For example, long-term storage of bulk frozen meat, purchased from a single lot, might be arranged with a local butcher or frozen storage warehouse or rental refrigerator trailer. Mobile locked cages can be especially useful for shared storage spaces.

Food Storage

Storage space requirements for controlled diet studies are remarkably high. Because specified ingredients with known nutrient composition are a strict requirement of research diets, research food inventories must be maintained separately from the regular foodservice supplies (see Table 19-1). For example, in long-term micronutrient balance studies, adequate space must be allotted for batch lots of canned fruits and vegetables. Therefore, dry storage space requirements may be considerable. The length of the research study and the number of participants also determine the amount of storage space required; longer, larger studies need far more room. Special arrangements can be set up for additional dry storage.

A threefold increase in storage capacity can be achieved with proper planning and well-designed shelving. Mobile, locked, stainless steel cages are excellent for storage of some items because they effectively maintain and secure separate inventories. Storage space may need to be partitioned when several studies with large inventories are ongoing. Dry storage areas that accommodate pallets of food might be necessary. Many investigators find they must arrange additional off-site food storage.

Staff Office Areas

Ideally, staff offices are located near the research kitchen to enhance work flow, quality assurance monitoring, and communication among nutrition and kitchen staff as well as locales for participant and family counseling. Outpatient facilities or conference rooms can be used as needed for large group meetings or clinic visits.

Ample office space is needed to maintain participant records, study files, and educational materials. Participants' records and other confidential information must be stored in securable file cabinets. Office layouts should foster individual and small group interactions among participants and clinicians. Space is also required for obtaining anthropometric measurements and for computer work.

Dining, Serving, and Reception Areas

Estimates for dining room space are based on the number of participants, meal census, the type of meal service, and the arrangement of tables. Twelve to 14 sq ft is usually necessary per participant (5). Therefore, 350 sq ft is required to accommodate 25 participants. Additional space may be needed for guests who accompany study participants. More participants can be accommodated by having multiple seatings for any given meal. Considerable space savings result by employing a continuous meal service and using rectangular rather than round tables. A space allowance of 8 to 10 sq ft per participant is then possible. Serving space can be conserved through off-site delivery of research diets. Space requirements for meal assembly will increase, however, when packaging bulk "to go" meals and plating advance preparation items. Exhibit 19-2 outlines requirements and considerations for a cafeteria-style service area.

Dining, serving, and reception areas should be checked 'carefully to ensure that unpleasant odors from the kitchen garbage disposals and laboratories do not intrude. It may be necessary to revise ventilation systems to avoid these problems. Similarly, temperature control is important; it is preferable to enable staff to adjust the temperature if participants find it too hot or cold in the dining room.

The trend toward larger diet studies and outpatient feeding trials means that expanded food distribution facilities and space for staff interaction with research participants must be considered. A well-furnished, comfortable lounge area is ideal for studies that require extended clinic visits. Additional provisions include a television, VCR, telephone, and typewriter or computer. Similarly, a children's area for special activities can be planned as part of studies that include families with children.

Human Factors

Atmosphere

Another consideration of facility planning is the development of a pleasant work environment and dining atmosphere, which fosters employees' careful menu preparation and participants' compliance with diets. Factors include:

- Environment: lighting, noise, ventilation, temperature.
- Physical layout: floor plans and traffic patterns.
- Interior design and décor.
- Table settings and furniture.
- Dining areas: shape and size of rooms.
- Sanitation (4).

The menu type and meal delivery system are major factors to consider in designing a research kitchen. These two factors and the expectations of staff and participants provide useful insight into proper facility design. For example, when a participant pool consists of men and women who will receive partial meals-to-go as well as enjoy on-site dining, areas designated for food pickup, table dining, and tray disposal are required. Meal pickup may be cafeteria style or window service. Participants appreciate dining in an area that is quiet, well-lit, and tastefully decorated with comfortable tables and chairs.

Lighting and Color

Effective lighting helps to mitigate design problems, accent desirable areas, and improve the overall environment. The best system for lighting a research kitchen and dining facility incorporates direct and indirect lighting. Fixtures or spotlights are examples of direct light. Indirect light from daylight, estimated by the total glass area of windows and skylights, should also be considered in planning additional lighting requirements.

Studies show that environment plays a key role in enhancing worker productivity, morale, sanitation, and performance. Decreased strain and fatigue, accidents, training time, employee turnover, and absenteeism are additional benefits of a well-lit work environment. Professional lighting designers can be consulted to provide insight on the best approaches for illuminating kitchen and dining areas.

Light requirements are dictated by the size of work areas and the contrast and reflection of work backgrounds. Visual acuity is affected by the type and intensity of light sources and placement of fixtures. Fluorescent bulbs are economical and commonly used to light large work areas. Soft white and pink bulbs (2:1) are often used in kitchens to improve the appearance of food material and skin tones. Table 19-2 lists specific lighting requirements for kitchen and dining areas.

Light intensity and glare vary with appliance finishes and countertops. For example, stainless steel may potentiate high-intensity lighting. The reflection of direct lighting on stainless surfaces should be minimized because glare leads to fatigue and eye strain. Proper fixture placement minimizes glare, shadows, and poor contrasts. Less glare is apparent when fluorescent fixtures are arranged parallel to the line of vision. Similar results are realized when bright lights are set overhead at an angle less than 60° from the center of visual acuity. Glare can also be reduced by using several low-intensity light sources or by using grid covers that divert light rays.

Walls should reflect 50% to 60% of available light if equipment is dark and 50% to 70% if stainless steel or light colored equipment is used. Floors should be moderately light and reflect 25% of light; kitchen ceilings should reflect 85% to 95% of light (4). Soft yellow or cream and peach colors are recommended for kitchen walls to complement natural food and skin tones; ceilings should be painted off-white.

Noise

The environment for kitchen and dining areas should be designed to minimize noise. It is important to establish a balanced acoustic level. Noise in dining rooms can be controlled by drapes, carpeting, table pads, and acoustic ceiling tiles.

Similarly, kitchen clamor is tempered by locating loud equipment away from main work areas and dining facilities. Undercoating tables with liquid asphalt or using plastic mesh mats beneath tables and using acoustic tiles, veneers, or panels on upper walls or ceilings also reduces kitchen noise (5).

TABLE 19-2

Lighting Requirements in Different Kitchen Areas[1]

Kitchen Areas	Average Light Levels (Foot Candles)
Storage (to discern package labels)	20
Storage (to discern case labels)	15
Work areas (to discern large print)	25
Work areas (to discern detailed print)	40
Sanitation areas	85
Offices	125
Service areas	75

Adapted from Avery AC (5).

Security

It is a sad reality that theft and vandalism occur frequently in research kitchens. Valuable small equipment (such as analytical balances, scales, computers, knives, and blenders), and expensive supplies (such as meat and spices) are particular targets. Whenever possible, small items must be secured with locking cables, drawers, and cabinets; refrigerators, freezers, and walk-in dry or cold storage should also be lockable. Distribution of keys and security codes must be appropriately conservative. Most experienced investigators have had to contend with at least one incident that has resulted in loss of time, money, data, and trust. Not just unknown intruders but also participants and staff have been implicated on some of these occasions.

Data and specimen security also is of high priority. Some research kitchens are located close to patient examination areas and laboratories. Secure areas for participants' personal belongings and coats may be needed. Confidential paperwork must be kept in locked file cabinets and otherwise protected from prying eyes. Computer file data must be protected appropriately. Freezers with stored biological samples must be locked and must have backup emergency alarm and phone-tree systems in the event of power failures, vandalism, or other damage that can affect the research.

The cost of losing the samples or data from a well-controlled feeding study is nearly incalculable if one considers both the high budget requirements and the enormous human effort that has been expended on the part of staff and participants.

Conclusion: Alternatives to New Construction or Remodeling

If there is insufficient space in which to prepare food in an existing kitchen, work priorities can be adjusted. For example, most cooking and baking can be done during off-peak meal service times, and satellite kitchens can be used for preparation and arrangement of foods in research menus. Bulk meal delivery on an outpatient basis may also be considered depending on study criteria.

Another approach to new construction or remodeling is to contract space from a foodservice unit (such as a hospital kitchen, university dormitory, cafeteria, or sorority or fraternity facility). Large feeding studies may be effectively managed in this way. In this situation, trained staff and dedicated equipment are necessary. Food purchasing, plans, and accommodations for work and storage space arrangements must be highly developed. Written contracts that clearly define terms and conditions are required prior to initiating diet studies as part of an existing foodservice operation.

Whenever space, personnel, or funds are limited, the nutrition research staff will need to be especially creative and flexible. Diet studies that stretch the limits of routine research meal preparation can be accommodated with careful planning.

The authors gratefully acknowledge the helpful contributions of Karen Todd, MS, RD.

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