

ANALYSIS OF REFRIGERATION EQUIPMENT IN SCHOOL NUTRITION PROGRAMS  
IN THE USDA/FNS SOUTHWEST REGION

by

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B.S., Louisiana Tech University, 1976  
M.S., Colorado State University, 1978

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Hospitality Management and Dietetics  
College of Human Ecology

KANSAS STATE UNIVERSITY  
Manhattan, Kansas

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## **Abstract**

Equipment to store foods at proper temperatures is critical to serving safe and nutritious meals in schools yet little is known about the amount or the adequacy of refrigerated storage in school nutrition programs. The purposes of this study were to identify the types and capacity of refrigeration equipment used in schools, determine the perceived adequacy of refrigerated storage capacity to meet new meal pattern requirements, and examine differences in adequacy and capacity.

A modified Delphi technique, site observations, pilot study, and electronic survey were used for data collection. School nutrition directors in the USDA/FNS Southwest Region (N=2392) served as the population. Respondents provided an inventory of refrigeration equipment for one of the schools in their district and information about perceived adequacy of refrigerated storage, barriers to purchasing refrigeration equipment, resources used to develop specifications, and practices to compensate for inadequate refrigerated storage in their program. Data analysis included descriptive statistics, independent sample t-tests, regression, and ANOVA.

Over a third of directors indicated that refrigerated equipment was inadequate to meet new meal pattern requirements. Directors with more experience rated adequacy higher than directors with less experience. Milk coolers (n=212, 88.3%) and walk-in freezers (n=180, 75.0%) were the types of refrigeration equipment found most often in schools. Walk-in freezers and refrigerators provided over 95% of refrigerated storage space. The mean average cubic feet of refrigerated storage per school was  $1423 \pm 1152$ . School enrollment is a significant predictor of refrigerated storage capacity.

Refrigerated storage is a concern for school nutrition directors who reported practices to compensate for inadequate storage including maintaining low inventory and decreasing the number of items purchased. School nutrition professionals may use the results of this study to implement practices to compensate for inadequate refrigerated storage. Results cannot be generalized due to the regional nature of the survey and low response rate and possible non-response bias.

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# Table of Contents

Table of Contents .....	viii
List of Figures .....	xii
List of Tables .....	xiii
Acknowledgements .....	xv
Dedication .....	xvi
Chapter 1 - Introduction.....	1
Statement of the Problem.....	3
Justification.....	4
Purpose.....	4
Objectives .....	4
Research Questions.....	5
Hypotheses.....	6
Significance of Study.....	6
Limitations of Study .....	7
Definition of Terms .....	8
References.....	10
Chapter 2 - Review of Literature .....	13
National School Lunch Program.....	14
History of the National School Lunch Program.....	14
After World War II .....	18
1960s and 1970s.....	20
1980s and 1990s.....	23
2000 to 2012 .....	24
Implementation of Recent NSLP Legislation.....	25
Organization of Schools in NSLP.....	27
Foodservice Equipment .....	29
Historical Perspective of Equipment in Schools.....	29
Factors in Equipment Selection .....	30



Equipment Standards .....	31
ENERGY STAR .....	31
NSF Food Equipment Certification .....	31
Underwriters' Laboratories .....	32
Equipment Life .....	32
Refrigeration Equipment.....	33
History of Refrigeration Equipment .....	33
Refrigerants.....	34
Types of Refrigeration Equipment.....	35
Measures of Refrigeration Capacity .....	37
Refrigeration Capacity Needs .....	37
Trends in School Nutrition Programs .....	40
Chapter 3 - Methodology .....	52
Human Subjects Review .....	53
Population and Sample .....	53
Instrument Development.....	55
Site Observation.....	56
Pilot Study.....	58
Survey Administration.....	59
Statistical Analysis.....	60
Determining Cubic Feet by Equipment Descriptions .....	60
Creating a Decision Model and Testing of Model.....	61
Testing the Preliminary Decision Model .....	63
References.....	64
Chapter 4 - Refrigeration Equipment in School Nutrition Programs: Current Use, Perceived Adequacy and Practices .....	67
Abstract.....	67
Purpose/Objectives .....	67
Methods.....	67
Results.....	68
Applications to Child Nutrition Professionals .....	68

Key words: refrigeration equipment, school nutrition, adequacy of refrigeration .....	68
Introduction.....	69
Methodology.....	72
Sample.....	72
Instrument Development.....	73
Results and Discussion .....	75
Applications to Child Nutrition Professionals .....	91
Limitations .....	92
Recommendations.....	93
References.....	95
Chapter 5 - A Study of Refrigeration Equipment Capacity and Preliminary Decision Model for School Nutrition Programs in the USDA Southwest Region .....	98
Abstract.....	98
Introduction.....	100
Methods .....	103
Sample.....	103
Instrument Development.....	103
Refrigerated equipment.....	104
Cubic feet of refrigerated storage .....	105
Demographic and operational variables.....	106
Survey Distribution.....	107
Data Analysis .....	107
Results and Discussion .....	107
Discussion .....	117
Preliminary decision model .....	119
Limitations .....	123
Conclusions and Applications .....	125
References.....	127
Chapter 6 - Summary and Conclusions .....	130
Summary of Study .....	130
Summary of Major Findings.....	131

Research question 1: What type of refrigeration equipment is used in schools in the USDA/FNS Southwest Region? .....	131
Research question 2: What are the barriers to purchasing refrigeration equipment in school nutrition programs? .....	131
Research question 3: What management practices are used or recommended by directors to compensate for inadequate refrigerated storage space in school nutrition programs? .....	132
Research question 4: What resources are directors likely to use in developing specifications for refrigeration equipment? .....	132
Research question 5: What are perceptions of school nutrition directors regarding adequacy of refrigerated storage in meeting new meal patterns? .....	132
Research question 6: How does perceived adequacy of refrigerated equipment differ based on characteristics of school nutrition directors? .....	133
Research question 7: What is the refrigeration capacity by type of refrigeration equipment available in schools in the USDA/FNS Southwest Region?.....	134
Research question 8: Are there differences in refrigerated equipment capacity by type of school and perceived adequacy?.....	134
Research question 9: What factors predict the refrigeration capacity of school nutrition programs in the USDA/FNS Southwest Region? .....	135
Preliminary decision model .....	135
Study Limitations.....	139
Future Research .....	142
Conclusions.....	142
References.....	145
Appendix A- IRB Approval Letter .....	146
Appendix B – Questions Developed to Guide Delphi Panel .....	148
Appendix C – Letter Sent with Survey Instrument.....	182
Appendix D – Kansas Onsite Survey Instrument .....	184
Appendix E – Kansas Pilot Survey Instrument.....	200
Appendix F – Southwest Region Survey Instrument.....	214
Appendix G – Cubic Feet by Type of Refrigeration Equipment .....	229

## List of Figures

Figure 5.1. Refrigeration Equipment Inventory List with Examples.....	105
Figure 5.2. Preliminary Decision Model for Enrollment to 300 Students* .....	121
Figure 5.3. Preliminary Decision Model for Enrollment 301 to 500 Students* .....	122
Figure 5.4. Preliminary Decision Model for Enrollment Greater than 500 Students* .....	123
Figure 6.1. Preliminary Decision Model for Enrollment to 300 Students* .....	137
Figure 6.2. Preliminary Decision Model for Enrollment 301 to 500 Students* .....	138
Figure 6.3. Preliminary Decision Model for Enrollment Greater than 500 Students* .....	139

## List of Tables

Table 1.1. Acronyms and Abbreviations in Child Nutrition Programs .....	9
Table 2.1. Comparison of Current and New Regulatory Requirements for the National School Lunch Program Meal Pattern in January 2012.....	26
Table 2.2. Comparison of Current and New Regulatory Requirements for the School Breakfast Program Meal Pattern in January 2012.....	27
Table 2.3. School District Size Categories in Research.....	28
Table 2.4. Useful Life of Kitchen Equipment in Years .....	33
Table 2.5. Number of Walk-ins and Square Feet by Type of Operation <sup>a</sup> .....	38
Table 3.1. Research Procedures .....	52
Table 3.2. Number and Percent of Children Participating in NSLP by USDA/FNS Region <sup>a</sup> .....	54
Table 3.3. Sampling Frame Matrix .....	57
Table 4.1. Characteristics of School Nutrition Directors (n=240).....	78
Table 4.2. Characteristics of Schools (n=240).....	79
Table 4.3. Availability of Refrigeration Equipment (n=240) .....	80
Table 4.4. Equipment to be Purchased based on Greatest Need (n=240).....	81
Table 4.5. Barriers to Purchasing Refrigeration Equipment (n=240).....	82
Table 4.6. Practices to Compensate for Inadequate Refrigerated Storage (n=240).....	84
Table 4.7. Resources to Use in Development of Refrigeration Specifications (n=240).....	85
Table 4.8. Overall Adequacy of Refrigerated Storage at School and School District (n=240)....	87
Table 4.9. Comparison of Adequacy of School Refrigeration and School Nutrition Director Characteristics .....	88
Table 4.10. Comparison of Adequacy of School Refrigeration and School Characteristics .....	89
Table 5.1. Characteristics of School Nutrition Directors (n=116).....	109
Table 5.2. Characteristics of Schools (n=116).....	110
Table 5.3. Frequency of Type of Equipment, Total Cubic Feet Capacity, and Numbers of Equipment by Type of Refrigerated Equipment (n=116) .....	112
Table 5.4. Total Refrigerated Capacity in Cubic Feet, Average Cubic Feet of Refrigerated Storage per School and Average Cubic Feet per Meal by Chilled, Frozen, and Total Refrigerated Storage (n=116) .....	113

Table 5.5. Perceived Adequacy of Refrigerated Storage at School and School District by Chilled and Frozen Storage at School and Refrigeration Capacity for School District (n=116) ....	113
Table 5.6. ANOVA Analysis of Cubic Feet of Refrigerated Storage based on Type of School (n=116).....	115
Table 5.7. ANOVA Analyses of Cubic Feet of Refrigerated Storage based on Perceived Adequacy (n=116) .....	117
Table 5.8. Multiple Regression on Total Meals, School Enrollment, Percent Free and Reduced Price Status, and Participation Rate Predicting Cubic Feet of Storage (n=116).....	117

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## **Dedication**

This dissertation is dedicated to my parents, Vernon E. and Annie Mae Brown Webb. They instilled an appreciation for the value of education and a strong work ethic in their children that has lived beyond their lifetimes. I imagine Daddy's reaction when I quit my job without another was not a good one. I wish you could be here for the celebration!



## **Chapter 1 - Introduction**

The National School Lunch Program (NSLP) operates in over 100,000 school facilities in the United States (U.S. Department of Agriculture (USDA), 2012a). In fiscal year 2011, over 5.2 billion lunches were served (USDA, 2012a) with federal funding of \$11.1 billion (USDA, 2012b). The NSLP is administered by the Food and Nutrition Service (FNS) of the USDA (USDA, 2012c). School nutrition programs have been subject to scrutiny recently due to public concerns about food safety and increased childhood obesity rates (National Academy of Sciences, 2009). The new NSLP meal pattern requirements call for additional servings of fruits and vegetables, more whole grains, and lower fat milk (Federal Register, 2012). These changes will impact the space needed and use for refrigeration equipment in school nutrition programs.

The foundation of the NSLP is built on social consciousness and agricultural markets (Educational Facilities Laboratories, 1968). According to Martin and Oakley (2008), major cities in the United States served school meals as early as the 1890s, often through the efforts of Children's Aid Societies. Smedley (1930) attributed the physical defects of World War I draftees in 1917 as a driving force behind implementation of school feeding programs. The Great Depression brought even more focus on feeding hungry children (Gunderson, 1971). According to Bryan (1938), there were an estimated 64,500 cafeterias operating in 1931 and many state and local governments assisted with feeding programs in their communities. Prior to World War II, school feeding programs received federal government assistance through the Works Progress Administration (WPA), the National Youth Assistance (NYA), and donated foods programs (Gunderson, 1971).

The health concerns for Americans were again brought to the nation's attention when President Truman reported that 30% of draftees had to be rejected due to health related issues

(Perrott, 1946). This may have been the result of sporadic funding of school feeding programs which caused education administrators to drop the programs. Congress responded by passing the National School Lunch Act in 1946 (Gunderson, 1971) and legislation has mandated many changes to this program over the years. In addition to lunches and donated foods, there are now breakfast programs, after school feeding, summer feeding programs, fresh fruit and vegetable programs, and child and adult care food programs (USDA, 2012).

The National School Lunch Act of 1946 also provided funds for foodservice equipment (Gunderson, 1971). The time following World War II and passage of the NSLA was a period of school construction in general. Rydeen (2008) reported that 43% of existing public schools were built during the 1950s and 1960s and these schools now have outdated facilities and equipment. A similar gap in funding for school foodservice equipment and facilities followed the original nonfood (equipment) appropriations for fiscal 1947. There was an absence of such funds until 1966-67 (Gunderson). Through the American Recovery and Reinvestment Act (2009), Congress provided \$100,000,000 for purchase of equipment by local educational authorities participating in the NSLP. Recent changes in the regulations linked to concerns about food safety and the childhood obesity rate have implications for the foodservice equipment used in schools, particularly refrigeration equipment.

Refrigeration equipment is required for safe storage of perishable food items. Extending the shelf life allows a greater variety of foods to be served in foodservice operations. Prior to the development of refrigeration equipment, the only perishable foods available were produced locally. Refrigerators were first mass-produced in 1927 and are now a necessity in every home and every quantity food production kitchen (Constable, 2003).

Refrigeration guidelines for school nutrition programs are available from few sources and the original sources are dated. Fryett (1996) used the type of operation as an indicator for determining the number of walk-ins and the number of square feet of refrigeration space needed. Educational Facilities Laboratories, Inc. (1968) estimated 120 square feet of floor space was needed for refrigeration to serve 200 meals in one service period. Almanza (2009) provided square foot estimates for school food service based on the number of meals served per day. She recommended 130 square feet for 200 meals served per day and up to 600-750 square feet for 1201 to 1500 meals served. Almanza also suggested approximately 1 square foot of shelf space per meal (p. 101) and 159 cubic feet of refrigerated space for every 250 lunches prepared (p. 236).

### **Statement of the Problem**

Today school nutrition programs must meet increasing expectations and requirements without expanding resources. School districts are faced with implementing new meal patterns in 2012 that will require serving increased variety and additional servings of fruits and vegetables. It is anticipated that additional resources in the form of funding and refrigeration equipment will be needed. Foodservice equipment plays a role in providing efficient, cost effective, safe and nutritious food to children. Guidelines currently in use for refrigeration space were developed over 15 years ago. These estimated refrigeration requirements did not separate frozen food and chilled food storage spaces. Information about refrigeration equipment in schools is required to make informed decisions to successfully manage school nutrition programs and to keep food safe.

## **Justification**

Recent studies on food service equipment in schools are limited in number and scope. During a time of increased scrutiny and increasing expectations, school nutrition programs are particularly vulnerable due to lack of resources to support new requirements. Refrigeration equipment is of importance because of quality and extended shelf life and many foods require proper use of refrigeration for safe food storage. New meal patterns in the NSLP require increased amounts of fruits and vegetables. Research conducted in school nutrition programs operations indicates that the top three significant issues facing professionals at the district and national level are implementation of the new nutrition standards and meal patterns, cost of food, and funding (School Nutrition Association, 2011). Published guidelines for the amount of refrigeration space for school nutrition programs are over 15 years old and do not appear to have been based on scientific research. To better establish current guidelines for refrigeration space in school nutrition programs, examination of existing refrigeration capacity is necessary.

## **Purpose**

The purpose of this research was to gain insight into the refrigeration availability and needs of school districts in the USDA/FNS Southwest Region and to develop resources to assist directors of school districts in determining refrigeration equipment needs. Arkansas, Louisiana, New Mexico, Oklahoma, and Texas are the states in the USDA/FNS Southwest Region.

## **Objectives**

The specific objectives of this research were to:

1. Identify the type of refrigeration and the refrigeration capacity available in schools in the USDA/FNS Southwest Region.

2. Identify practices to compensate for inadequate refrigeration equipment in the USDA/FNS Southwest Region.
3. Examine barriers to purchasing refrigeration equipment in school nutrition programs.
4. Identify resources utilized in development of refrigeration equipment specifications in school nutrition programs.
5. Determine if directors feel there is adequate refrigeration space to meet the new NSLP meal patterns released in 2012.
6. Develop a preliminary decision model for determining refrigeration equipment needs for school nutrition programs.

### **Research Questions**

The research questions guiding this research in the USDA/FNS Southwest Region were as follows:

1. What type of refrigeration equipment is used in schools?
2. What are the barriers to purchasing refrigeration equipment in school nutrition programs?
3. What management practices are used or recommended by directors to compensate for inadequate refrigerated storage space in school districts?
4. What resources are directors likely to use in developing specifications for refrigeration equipment?
5. What are perceptions of school nutrition directors regarding adequacy of refrigerated storage in meeting 2012 meal patterns?
6. How does perceived adequacy of refrigerated equipment differ based on characteristics of school nutrition directors and schools?

7. What is the refrigeration capacity by type of refrigeration equipment available in schools?
8. Are there differences in refrigeration equipment capacity by type of school, student enrollment, number of meals served, and perceived adequacy?
9. What factors predict the refrigeration capacity of school nutrition programs?

## **Hypotheses**

Hypothesis 1. There is no significant difference in perceived adequacy of refrigerated storage based on director's years of school nutrition experience.

Hypothesis 2. There is no significant difference in perceived adequacy of refrigerated storage based on director's years of school nutrition experience.

Hypothesis 3. There is no significant difference in perceived adequacy of refrigerated storage based on sex of the school nutrition director.

Hypothesis 4. There is no significant difference in perceived adequacy of refrigerated storage based on education level of the school nutrition director.

Hypothesis 5. There is no significant relationship between number of meals, school enrollment, percent free and reduced meals, and student participation rate and refrigerated capacity.

## **Significance of Study**

This study was significant because it contributed to the literature and to the resources available to school nutrition programs. Increasing meal pattern requirements for additional foods in the NSLP make it imperative that adequate refrigeration be available to schools. There are several long-term impacts of this research. School nutrition programs now have guidelines based on research to determine the adequacy of refrigerated storage space, and directors have data for analyzing refrigeration guidelines in their school nutrition programs. This research identifies information about existing refrigeration capacity and resources to assist school nutrition directors

in writing specifications for refrigeration equipment. Results of this study may provide facts to support policy development and funding for refrigeration equipment in school nutrition programs.

### **Limitations of Study**

Decisions about methodology impact research limitations. The limitations of this study are linked to the methods used, particularly the sample. Use of a specific geographic region precludes generalizing this research to all school nutrition programs. The small sample size means that results of this research cannot be generalized to all school nutrition programs. Results of this study cannot be generalized to the foodservice industry. Using a specific geographic region allows a focused study of the region but may result in regional bias. Also, non-response bias may exist with the regional director's study. When the response rate is not 100%, there is the chance that the responses do not reflect those of the overall population.

## Definition of Terms

**Child Nutrition Programs** describes the nutrition assistance programs administered by the Food and Nutrition Service of the U.S. Department of Agriculture. These programs include the National School Lunch Program, the School Breakfast Program, the Child and Adult Care Food Program, Summer Food Service Program, Food Distribution Program (USA Foods), and the Special Milk Program.

**Equipment life** refers to the expected time a piece of equipment will function (Birchfield, 1988, p. 92).

**Large school district** for this study is defined as a school district with enrollment greater than 30,000 students (Rushing & Nettles, 2011).

**Medium school district** for this study is defined as a school district with enrollment of 2,800 to 30,000 students (Rushing & Nettles, 2011).

**Local education agency (LEA)** is the entity operating the National School Lunch Program, commonly known as school districts. The LEA is responsible for the application, certification, and verification activities for the federally assisted meal programs.

**National School Lunch Program (NSLP)** refers to meal program supported by the federal government that operates in public schools, nonprofit private schools and residential child care institutions.

**School Food Authority (SFA)** refers to the entity responsible for operation of the school meal programs, typically the school district.

**School nutrition program** is general term for all USDA program in schools, including SBP, Special Milk Program, and NSLP.

**Small school district** for this study is defined as a school district with enrollment of less than 2,800 students (Rushing & Nettles, 2011).

**Southwest Region (SWR)** is one of seven USDA/FNS regions and is comprised of five states: Arkansas, Louisiana, New Mexico, Oklahoma, and Texas. The Regional Office is located in Dallas, Texas (USDA/FNS, 2011b).



**Table 1.1. Acronyms and Abbreviations in Child Nutrition Programs**

Acronym or Abbreviation	Definition
ARRA	American Recovery and Reinvestment Act of 2009
CFR	Code of Federal Regulations
DGA	Dietary Guidelines for Americans
FNS	Food and Nutrition Service
HUSSC	Healthier U.S. School Challenge
IOM	Institute of Medicine
LEA	Local Educational Agency
NSLP	National School Lunch Program
SA	State Agency
SBP	School Breakfast Program
SFA	School Food Authority
SMI	School Meals Initiative for Healthy Children
SMP	Special Milk Program
USDA	U.S. Department of Agriculture
WIC	Women, Infants, and Children

## References

- Almanza, B. (2009). *Equipment purchasing and facility design for school nutrition programs*. Retrieved from <http://nfsmi.org/documentlibraryfiles/PDF/20090312115009.pdf>
- American Recovery and Reinvestment Act. (2009). Public Law 111-5. (February 17, 2009). 120Stat. 115. Retrieved from <http://www.gpo.gov/fdsys/pkg/PLAW-111publ5/pdf/PLAW-111publ5.pdf>
- Birchfield, J. C. (1988). *Design and layout of foodservice facilities*. New York: Van Nostrand Reinhold.
- Bryan, M. de G. (1938). *The School Cafeteria*. New York: Appleton-Century-Crofts, Inc.
- Constable, G. (2003). Air conditioning and refrigeration. In (Eds.), *A century of innovation: Twenty engineering achievements that changed our lives* (pp. 107- 110). Washington, DC: Joseph Henry Press.
- Education Facilities Laboratories. (1968). *20 Million for lunch*. New York: Author.
- Federal Register. (January 26, 2012). *7CFR parts 210 and 220*. 77:17, p. 4088.
- Fryett, D. K. (1996). *An introduction to the foodservice industry*. Chicago, IL: North American Association of Food Equipment Manufacturers.
- Gunderson, G. W. (1971). *The National School Lunch Program: Background and Development*. Washington, DC: U. S. Government Printing Office.
- Martin, M. J.& Oakley, C. B. (Eds.).(2008). *Managing child nutrition programs: Leadership for excellence (2<sup>nd</sup> ed.)*. Sudbury, MA: Jones and Bartlett Publishers.
- National Academy of Sciences, Institute of Medicine. (2009). *School meals: Building blocks for healthy children report brief*. Retrieved from [http://www.iom.edu/~media/Files/Report %20Files/2009/School-Meals/School%20Meals%202009%20%20Report%20Brief.pdf](http://www.iom.edu/~media/Files/Report%20Files/2009/School-Meals/School%20Meals%202009%20%20Report%20Brief.pdf)

Perrott, G. St. J. (1946). Selective Service rejection statistics and some of their implications.

*American Journal of Public Health*, 36, 336-342.

Rushing, K. & Nettles, M. F. (2011). *Exploring the uniqueness of school nutrition programs in*

*small school districts*. Retrieved from

<http://nfsmi.org/documentlibraryfiles/PDF/20110722044912.pdf>

Rydeen, J. E. (2008). School renewals. *American School & University*, 80(11), 44.

School Nutrition Association. (2011a). *School Nutrition Operations Report 2011*. National

Harbor, MD: Author.

Smedley, E. (1930). *The school lunch: Its organization and management in Philadelphia*.

Media, PA: Author.

U.S. Department of Agriculture, Food and Nutrition Service. (2011a). National School Lunch

Program fact sheet. Retrieved from

<http://www.fns.usda.gov/cnd/lunch/AboutLunch/NSLPFactSheet.pdf>

U.S. Department of Agriculture, Food and Nutrition Service. (2011b). USDA Food and

Nutrition Service Regional Offices. Retrieved from

<http://www.fns.usda.gov/cga/Contacts/RegionContacts.htm>

U.S. Department of Agriculture, Food and Nutrition Service. (2011c). National School Lunch

Program total participation: September 1, 2011 [state data]. Retrieved from

<http://www.fns.usda.gov/pd/01slfypart.htm>

U.S. Department of Agriculture, Food and Nutrition Service. (2012a). National School Lunch

Program fact sheet. Retrieved from

<http://www.fns.usda.gov/cnd/lunch/AboutLunch/NSLPFactSheet.pdf>

U.S. Department of Agriculture, Food and Nutrition Service. (2012b). School meals programs

Retrieved from <http://www.fns.usda.gov/cnd/>

## Chapter 2 - Review of Literature

This chapter provides a review of literature on child nutrition programs and refrigeration equipment. The history of the National School Lunch Program (NSLP) provides a perspective for the accomplishments and challenges of the operations and the importance of refrigeration in providing safe and nutritious foods to children. The National School Lunch Program (NSLP) operates in over 100,000 school facilities in the United States (U.S. Department of Agriculture (USDA), 2012). In fiscal year 2011, over 5.2 billion lunches were served (USDA, 2012) with federal funding of \$11.1 billion (USDA, 2012). The NSLP is administered by the Food and Nutrition Service (FNS) of the USDA. The hierarchy of the NSLP flows from the USDA/FNS federal agency, through the seven USDA/FNS Regional offices to the respective State agencies then to the local education authority (or school district) and to the individual school (USDA, 2012).

School nutrition programs have been subject to scrutiny recently due to public concerns about food safety and increased childhood obesity rates (National Academy of Sciences, 2009). Recent research investigated the impact of school wellness policies (Belansky et al., 2010; Boles et al., 2011; Nanney et al., 2010). Belansky et al. identified improvements in the percent of schools with prescriptive policies requiring healthy items for classroom parties, using skinless poultry, and presenting fresh fruit daily but indicated that policies were often weak. Boles et al. studied local school policies and practices after Washington State mandates on physical activity and nutrition. The researchers found increased physical activity and better nutrition policies and practices after the Washington State mandates. Nanney et al. used the 2006 School Health Policies and Programs Study (SHPPS) state data to identify prevention-policy questions. The data indicated correlation between the adoption of policies and youth obesity.

Over the years, fewer and fewer schools cook from basic ingredients often referred to as “from scratch” and more use convenience items such as pizza and chicken nuggets. The evaluation of foods served in the NSLP has focused on the nutritive content, not on the actual food source. Data on the amount of processed foods served in the NSLP appear to be nonexistent but studies have reported on food production systems. According to the research by Brown (2008) the number of on-site food production kitchens providing school food service is 45.3 percent and the number of combination systems (central kitchen delivers to on-site kitchen) is now at 40.5 percent. The School Nutrition Dietary Assessment Study-III (SNDA-III) reported that 70 percent of schools use on-site food production for consumption of meals on-site (Gordon & Fox, 2007). SNDA-III found 19 percent of schools received foods from another kitchen and 11 percent of schools sent food to other kitchens. Equipment needs vary according to the amount of food processing needed and the type of food production system in use. Frable (1997) challenged the generally accepted statement that the menu is the determining factor for the type and size of equipment purchased since menus now change rapidly.

## **National School Lunch Program**

### ***History of the National School Lunch Program***

The history of school lunch in America predates the National School Lunch Act of 1946. Gunderson (1971) recognized the early European efforts of Count Rumford who was born in America but established public mass feeding in Europe. Many of the first lunches served in American schools were the result of charitable organizations such as the Children’s Aid Society (Martin & Oakley, 2008). Bryan (1938) indicated that the first record of school feeding was in New York when the Children’s Aid Society opened an industrial school and gave food to all

students. These industrial schools sought to train children in trades and the food served as an inducement for attendance. Boston, Cleveland and New York provided school meals as early as the 1890s according to Martin. In 1906, two books drew attention to the plight of malnourished children and generated interest in how society would address the problem. The books were *Poverty* by Robert Hunter and *The Bitter Cry of the Children* by John Spargo (Bryan, Gunderson, Martin & Oakley). Martin attributes the support of school feeding to the plight of children described in these two books. Gunderson indicated that *Poverty* had significant influence on feeding poverty-stricken children in the U. S. Efforts in Milwaukee began in 1904 when the Women's School Alliance of Wisconsin started providing lunch to needy children (Gunderson). The Milwaukee efforts resulted in higher attendance rates and improved scholarship of students. The books by Spargo and Hunter in 1906 spread the message that physical and mental health status were impacted by food intake and discussed the waste of education dollars being spent on children who were malnourished (Gunderson).

Many major cities in the U. S. operated school feeding programs prior to the NSLP legislation. Boston, Chicago, Cincinnati, Los Angeles, Milwaukee, New York, Philadelphia and St. Louis offered meals to school children (Gunderson, 1971). Rural schools had more facility problems than urban schools due to lack of space in school buildings and lack of other facilities and services in rural areas. Gunderson noted that rural students often traveled long distances to school and did not have access to food preparation and service facilities at the school. Teachers coordinated feeding efforts by organizing methods of heating food as illustrated by the Wisconsin "pint jar method" which allowed food brought from home in pint jars to be heated in a bucket of water placed on top of the heater in the room (Gunderson). In some instances, families provided donations of foods and students prepared the food before classes began.

Parent-teacher organizations became involved in school lunch through provision of equipment and funds for the feeding program. The county Extension Service assisted through planning menus and in 1914 a Florida health department provided a pint of milk a day for school children. This program expanded to include soup, provided through the efforts of the school principal and some of the mothers. The food served at the school was often soup and milk.

Bryan (1938) commented on the school lunch box as being the first school feeding—the type in which schools had no responsibility. According to Bryan, in 1931 there were an estimated 64,500 school cafeterias with an estimated increase of 7,500 cafeterias annually. The facilities and equipment were often provided by the parents of students and community members.

Smedley (1930) wrote of the history of school lunch in Philadelphia and commented the “phenomenal development of the school lunch throughout this country in the last ten years indicates that such service fills a real need in the life of all school children” (p. v.). Smedley attributes the physical defects of World War I (WWI) draftees in 1917 as a driving force behind the development of school feeding. The economic depression of the 1930s brought even more focus on feeding hungry children leading state and local governments to provide support for school feeding (Gunderson, 1971). Josephine Martin reported that the first state agencies overseeing school lunch programs were established in 1943 prior to the National School Lunch Act of 1946 to oversee these school feeding sites (Anonymous, 2010).

Gunderson (1971) reported that that the early federal support for school lunch in the 1930s was in the form of loans and funds to pay labor used in provision of school lunches. Federal public assistance programs during the Great Depression expanded to include farm product surpluses diverted for use in feeding needy children and provision of school lunch labor



through the Works Progress Administration (WPA). The school lunch programs provided for effective use of farm products that were not going to be purchased on the open market. Farmers benefited by sales of their products at a reasonable price and needy families benefited through the nourishment of children who were hungry (Gunderson). The distribution of these commodities involved coordination of government agencies at the federal, state and local level.

The Community Service Division of the WPA would hire women to prepare and serve school lunches. This WPA program was administered through the State and labor was provided to the school district, allowing school lunches to be produced at minimal cost and therefore serve more needy children. The National Youth Assistance (NYA) was founded in 1935 to provide job training for youth. The NYA employees provided part-time help to the school lunch programs not only through preparing and serving food, but through making furniture and equipment for lunchrooms (Gunderson). The WPA, NYA, and donated food program were providing assistance to over 92,000 schools in serving six million children in early 1942. Because of the cost of WWII, federal funds were diverted from public assistance programs to support of the U.S. troops. By the spring of 1944, the federal support of school lunch was reduced to serving five million children in about 34,000 schools.

In July of 1943, Congress authorized funding up to \$60 million in funds in Section 32 of the Agricultural Act (Library of Congress, 1976) for the school lunch and school milk programs for fiscal 1944 (July 1, 1943 to June 30, 1944). These funds were only for food purchases and could not be spent on labor or equipment. Communication of the availability of funds was a problem and it took time for schools with closed programs to reopen. For the 1945 fiscal year, \$50 million in Section 32 funds were appropriated for the school meal programs and child care centers were eligible for funds. Prior to 1945, there were no conditions established for states to

receive funds. Gunderson (1971) reported that for the first time, conditions were established to receive 1945 funds, including restrictions on payments not exceeding cost of food, maintenance of accurate food cost records, and federal funds could not exceed the funds provided by other sources (such as sponsors, school districts, or State donations). Fiscal 1946 funds were also appropriated in the amount of \$50 million, with a limit of two per cent to be allocated to child care centers. The school lunch programs expanded so much that the original funding was allocated by December 1945 and an additional \$7.5 million was appropriated. Although the program was growing, the number of schools operating a lunch program was about half of the 1942 figures. Local school boards were hesitant to begin programs that might have abrupt funding cuts as experienced in the early 1940s. Investing funds in facilities and kitchen equipment was risky when program support was decided on a year-to-year basis by Congress (Library of Congress, Gunderson). The political and social atmosphere of the U.S. was changing as WWII ended.

### *After World War II*

The roots of the NSLP are in social consciousness and agricultural markets (Educational Facilities Laboratories, 1969). Bryan (1938, p. 15) identified the key roles of the school cafeteria in education: help combat malnutrition and contribute to the health of children needed for success in the classroom; teach proper food selection and good health habits; correlate teaching in the classroom with food experiences of children; and interest the community in school foodservice therefore educating parents. The need for school feeding was reinforced by President Truman's message to Congress in November 1945 when he reported a draft rejection rate of around 30 per cent (Perrott, 1946). The rejection rates were viewed as a call to action to improve the health of the citizens of the U.S. Perrott noted that mortality rates had improved in

the time between WWI and World War II (WWII) but the overall health of Americans did not improve proportionately.

The health concerns for Americans and the recognition of the need for permanence in the school lunch programs led to passage of the National School Lunch Act of 1946 (NSLA) (Gunderson, 1971). Section 2 of the NSLA gave the purpose:

It is hereby declared to be the policy of Congress, as a measure of national security, to safeguard the health and well-being of the Nation's children and to encourage the domestic consumption of nutritious agricultural commodities and other food, by assisting the States, through grants-in-aid and other means, in providing an adequate supply of food and other facilities for the establishment, maintenance, operation, and expansion of nonprofit school lunch programs.

The NSLA gave specific directions on distribution of the funds to the states, based on the number of school children and the need for assistance as determined by the difference in the state per capita income and the national per capita income. Therefore, the states with lowest per capita income would receive the highest proportion of federal funds. School foodservice equipment purchases were funded with \$10 million and were to be apportioned in the same manner as the funds for food purchases. Administrative expenses for the state could be up to 8.5 per cent of the appropriation received by the state. Matching funds from the state had to be provided, again, with consideration given to lower per capita income states which had reduced the matching requirement. Written agreements were required between the state and federal agencies and between the state and the sponsoring agency for the school (Gunderson, 1971; Library of Congress, 1976).

Minimum nutritional requirements were established in the NSLA using three types of lunches: Type A, Type B, and Type C meal patterns and reimbursement rates were different for each type of lunch. Type A and Type B lunches were based on specific amounts of foods/food groups, with Type B having higher amount of milk and lower amounts of food items than Type

A. Type C lunch was ½ pint of whole milk. The maximum reimbursement rates were 9 cents for Type A, 6 cents for Type B and 2 cents for Type C lunches (Library of Congress, 1976).

School lunch programs received donated foods as authorized by the Agricultural Act of 1935. In the Agricultural Act of 1949, Congress directed the Commodity Credit Corporation to contribute commodity items purchased to provide price supports to agencies and school lunch was the first priority. These donated items were in addition to commodities provided by the Section 32 funds of the 1935 Agricultural Act (Library of Congress, 1976).

The provisions of the NSLA continued as passed by Congress in 1946 until the first amendment of the act in 1952. (Library of Congress, 1976). This amendment changed the school lunch apportionment for Alaska, Hawaii, Puerto Rico, Guam, and the Virgin Islands. These states and territories were recognized as having the lowest per capita income of all states and funding was adjusted for that reason. The funding provisions of the NSLA were designed to provide proportionately higher funds to the most needy states, but the noble intent presented practical challenges to local districts. The funding was not based on the number of meals served, so the district with more needy children often did not have resources to support the program throughout the school year (Gunderson, 1971).

### ***1960s and 1970s***

During the 1960s and 1970s the NSLP continued to grow. Problems with apportionment of funds became more evident and the NSLA was amended in 1962 to change the basis of funding. The participation rate for the state and the assistance need rate became the basis of funding (Library of Congress, 1976). The participation rate was the number of lunches served in the previous fiscal year. The assistance need rate was determined by comparing the state and the U.S. per capita income rates. This allocation change meant that the funding for some states was

to be greatly reduced so a three year, phased-in approach was used. The 1962 legislation also included provisions for cash reimbursements based on free or reduced price meals provided to economically disadvantaged children but funds for this section of the Act were not appropriated (Library of Congress; Gunderson, 1971).

The Child Nutrition Act of 1966 included provisions to strengthen and expand the school meals programs (Martin & Oakley, 2008). The Special Milk Program was authorized through 1970, the School Breakfast Program was established as a pilot program, and the Nonfood Assistance Program provided grants-in-aid to purchase foodservice equipment. Funding for State administrative expenses was authorized and preschool programs operated by school systems became eligible for benefits available through the NSLA. Any donated foods available for the lunch program became available to other programs, for example, donated foods could be used in the School Breakfast Program. The 1966 Act also moved all federal school food service programs to the Department of Agriculture (USDA). The Health, Education and Welfare, Bureau of Indian Affairs, and Office of Economic Opportunity operated programs in school feeding and these funds were consolidated into the USDA budget (Library of Congress, 1976; Gunderson, 1971).

The Special Food Service Program for Children became a part of the NSLA in the 1968 amendment. This pilot program focused on non-residential child-care in economically depressed areas. The 1968 amendment also addressed substitution of foods due to special dietary needs, extension of the School Breakfast Program through FY 1971, and authorization of state administrative expense (SAE) funds for the new programs. The NSLP continued to grow and States did not have sufficient funds to support free and reduced price meals. The 1970

amendments to the NSLA provided additional funds to States to support the free and reduced price meals (Library of Congress, 1976; Gunderson, 1971).

The major legislation of the 1970s, Public Law 91-248, dealt with the free and reduced price meals. National guidelines were established to determine free and reduced price eligibility and prevent overt identification of children receiving free or reduced price meals was prohibited. Matching funding requirements of the NSLA were changed to eliminate program revenue from the State matching. Funding for nutrition training and education was provided by one per cent of the funds appropriated for the NSLA and could be used for school lunch employees, children participating in the program, and others cooperating with the NSLP (Library of Congress; Gunderson, 1971).

Amendments during the 1970s also provided guaranteed funding on a per meal basis, creation of the Special Supplement Food Program for Women, Infants and Children (WIC), extension of the School Breakfast Program, and increased appropriations for the Nonfood Assistance Program. In 1975, the Child Care Food Program (CCFP) was created as a new section of the NSLA. The CCFP was formerly a part of the Special Food Service Program for Children (SFSPC). The SFSPC became the Summer Food Service Program for Children and was expanded to include summer camps. Commodity distribution was changed to allow purchase at market price, require 75 percent of the donated commodity value be in the form of donated foods, ensure that specifications did not eliminate local producers, and allow States to receive cash in lieu of commodities under certain conditions. "Offer vs. Serve" was mandated in high schools, allowing students a greater choice in the amount of foods they accept in order to reduce plate waste. P.L. 95-627 (1978) encouraged expansion of the SBP by providing

additional financial resources and food service equipment to participating schools initiating breakfast programs (Library of Congress; Gunderson, 1971).

### *1980s and 1990s*

The 1980s brought major funding cuts and reduction in participation. Under the Omnibus Reconciliation Act of 1981, reimbursements were reduced for paid and reduced price categories in the SBP (Martin & Oakley, 2008). Private schools with tuition of \$1,500 or more were not permitted to participate in the SBP or SMP (this provision was eliminated in 1987). Under P.L. 97-35, SMP participation was limited to schools and institutions not participating in another federally funded food service program. "Offer vs. Serve" was extended as a local option to elementary schools, national average payments for NSLP were reduced and income eligibility guidelines became more stringent (Library of Congress, 1976; Gunderson, 1971).

In 1986, P.L. 99-500 provided direct certification, automatic free eligibility, to those children whose families receive food stamps or Aid to Families with Dependent Children (AFDC). P.L. 99-661 restored the SMP eligibility for children enrolled in split-session kindergarten programs if they do not have access to another federally assisted school meal program and increased reimbursement to NSLP and SBP sponsors (Library of Congress, 1971).

The National Food Service Management Institute (NFSMI) was established by Congress in 1989 and funded at The University of Mississippi in 1991 by a grant administered through USDA/FNS (Martin & Oakley, 2008). The specific duties of the NFSMI are found in Section 21 of the Richard B. Russell National School Lunch Act and include conducting activities to improve the quality and general operation of federally assisted child nutrition programs. The required activities included conducting research, providing training and technical assistance, establishing a national network of trainers, developing training materials, serving as a

clearinghouse, and training personnel to meet program requirements. NFSMI is also charged with development of materials to promote healthier food preparation and assisting State agencies in providing training (Martin & Oakley).

### *2000 to 2012*

Congress has recently enacted laws that impact food production in school nutrition operations. Public Law 108-265, the Child Nutrition and WIC Reauthorization Act (2004), added requirements for participation in the NSLP. The frequency of mandatory health inspections increased from once per year to twice per year and implementation of a food safety program based on Hazard Analysis and Critical Control Points (HACCP) was required by school year 2005-2006 (Child Nutrition and WIC Reauthorization Act, 2004). Through the American Recovery and Reinvestment Act of 2009, Congress appropriated \$100,000,000 for purchase of equipment by local educational agencies participating in the NSLP.

The Healthy, Hunger-Free Kids Act of 2010 focused on improving nutrition and reducing hunger of children served by the NSLP. Based on this act, USDA/FNS issued proposed regulations in the January 13, 2011 Federal Register (p. 2494) addressing the NSLP meal patterns. FNS received 133,268 comments regarding the proposed regulations, indicating high public interest in school meals (USDA, 2012). The revised nutrition standards ensure that both fruits and vegetables are offered every day; require offering whole grain-rich foods more often; require that only fat-free or low-fat milk varieties are offered; limit calories based on the age of children, contributing to proper portion sizes; and focus on reducing the amounts of saturated fat, trans fats, and sodium (Federal Register, 2012).

The changes to the meal patterns have implications for equipment needs in school kitchens. Requiring increased amounts of fruits and vegetables will affect storage and food



preparation equipment. Food safety may be impacted if schools have inadequate refrigeration storage. Food safety and preparation of healthy meals require adequate and appropriate equipment in school kitchens.

A collaborative position on comprehensive school nutrition services was issued by the American Dietetic Association (ADA), School Nutrition Association (SNA) and the Society for Nutrition Education (SNE) (ADA, SNA, & SNE, 2010). The position supports comprehensive, integrated school nutrition services as a part of coordinated school health programs. The importance of nutrition education and promotion, availability of food and nutrition programs in school facilities, and partnerships among the school, home and community was recognized in this paper. The position paper described the need for new kitchen equipment for schools and training of school employees in offering healthier food choices in school nutrition programs (ADA, SNA, & SNE).

### ***Implementation of Recent NSLP Legislation***

The Final Rule “Nutrition Standards in the National School Lunch and School Breakfast Programs” was issued in January 2012 (Federal Register, 2012). The meal pattern changes will require increasing the amount of fruits, vegetables, and whole grains; reducing the sodium content of meals; offering only low-fat or fat-free milk; minimizing trans fat; and controlling saturated fat and calorie levels needed to meet meal pattern requirements (Federal Register, 2012). Table 2.1 provides a comparison of the existing and new meal pattern requirements for lunch and Table 2.2 provide a comparison of the existing and new meal pattern requirements for breakfast.

**Table 2.1. Comparison of Current and New Regulatory Requirements for the National School Lunch Program Meal Pattern in January 2012**

National School Lunch Program Meal Pattern		
Food Group	Current Requirements K-12	New Requirements K-12
Fruit and Vegetables	½ - ¾ cup of fruit and vegetables combined per day	¾ - 1 cup of vegetables <u>plus</u> ½ - 1 cup of fruit per day Note: Students are allowed to select ½ cup fruit or vegetable under OVS.
Vegetables	No specifications as to type of vegetable subgroup	Weekly requirement for: <ul style="list-style-type: none"> <li>• Dark green</li> <li>• Red/orange</li> <li>• Beans/peas (legumes)</li> <li>• Starchy</li> <li>• Other (as defined in 2010 Dietary Guidelines)</li> </ul>
Meat/Meat Alternate (M/MA)	1.5 – 2 oz equivalent (daily minimum)	Daily minimum and weekly ranges: Grades K-5: 1 oz equivalent minimum daily (8-10 oz weekly) Grades 6-8: 1 oz equivalent minimum daily (9-10 oz weekly) Grades 9-12: 2 oz equivalent minimum daily (10-12 oz weekly)
Grains	8 servings per week (minimum of 1 serving per day)	Daily minimum and weekly ranges: Grades K-5: 1 oz equivalent minimum daily (8-10 oz weekly) Grades 6-8: 1 oz equivalent minimum daily (9-10 oz weekly) Grades 9-12: 2 oz equivalent minimum daily (10-12 oz weekly)
Whole Grains	Encouraged	At least half of the grains must be whole grain-rich beginning July 1, 2012. Beginning July 1, 2014, all grains must be whole grain rich.
Milk	1 cup Variety of fat contents allowed; flavor not restricted	1 cup Must be fat-free (unflavored/flavored) or 1% low fat (unflavored)

**Table 2.2. Comparison of Current and New Regulatory Requirements for the School Breakfast Program Meal Pattern in January 2012**

School Breakfast Program Meal Pattern		
Food Group	Current Requirements K-12	New Requirements K-12
Fruit	½ cup per day (vegetable substitution allowed)	1 cup per day (vegetable substitution allowed) Note: Quantity required SY 2014-15. Students are allowed to select ½ cup fruit under OVS.
Grains and Meat/Meat Alternate (M/MA)	2 grains, or 2 meat/meat alternates, or 1 of each per day	Daily minimum and weekly ranges for grains: Grades K-5: 1 oz equivalent daily (7-10 oz weekly) Grades 6-8: 1 oz equivalent minimum daily (8-10 oz weekly) Grades 9-12: 1 oz equivalent minimum daily (9-10 oz weekly) Note: Quantity required SY 2013-14. Schools may substitute M/MA for grains after the minimum daily grains requirement is met.
Whole Grains	Encouraged	At least half of the grains must be whole grain-rich beginning July 1, 2013. Beginning July 1, 2014, all grains must be whole grain rich.
Milk	1 cup Variety of fat contents allowed; flavor not restricted	1 cup Must be fat-free (unflavored/flavored) or 1% low fat (unflavored)

### ***Organization of Schools in NSLP***

The NSLP is administered by the Food and Nutrition Service (FNS) of the U.S. Department of Agriculture (USDA). The hierarchy of the NSLP flows from the USDA/FNS federal agency, through the seven USDA/FNS Regional offices to the respective State agencies then to the school district and to the individual school (USDA, 2012c). The National School Lunch Program (NSLP) operates in over 100,000 school facilities in the United States (USDA, 2012a). In fiscal year 2011, over 5.2 billion lunches were served (USDA, 2012b) with federal funding of \$10.8 billion (USDA, 2012a).

### *USDA Regions*

The seven USDA/FNS regions are the Mid-Atlantic, Midwest, Mountain Plains, Northeast, Southeast, Southwest, and Western. The states in the Southwest Region are Arkansas, Louisiana, New Mexico, Oklahoma, and Texas (USDA, 2012c). Using the states as a variable allows the examination of differences within the region. Child nutrition professionals are familiar with the USDA regions and since regional meetings are held, region-specific data will be of interest.

### *School district size*

School district enrollment is used to establish the size of a school district. The National Food Service Management Institute (NFSMI) district size has been categorized as small, medium, and large size districts. Child nutrition researchers at the NFSMI have identified small districts as those with less than 2,800 students (Rushing & Nettles, 2011), medium districts as those with 2,800 to 30,000 students, and large districts as those with greater than 30,000 students (Rushing & Nettles, 2008). Table 2.3 provides information on school district size categories from three national sources.

**Table 2.3. School District Size Categories in Research**

National Food Service Management Institute (NFSMI) <sup>a</sup>	School Nutrition Dietary Assessment III (SNDA-III) <sup>b</sup>	National Center for Educational Statistics (NCES) <sup>c</sup>
Less than 2,800 (small)	Enrollment 5,000 or fewer	1 to 299
2,800 to 30,000 (medium)	More than 5,000	300 to 599
Greater than 30,000 (large)		600 to 999
		1,000 to 2,499
		2,500 to 4,999
		5,000 to 9,999
		10,000 to 24,999
		25,000 or more

<sup>a</sup>Rushing & Nettles, 2011.

<sup>b</sup>USDA/FNS/OANE, 2007.

<sup>c</sup>NCES, 2011.

## **Foodservice Equipment**

The food produced by any type of operation is intrinsically linked to the equipment and facilities of the operation. Rydeen (2008) reported that 43% of existing public schools were built during the 1950s and 1960s. Morton (2010) estimated the life span of a school kitchen to be 15 to 40 years. Many of the old facilities have old foodservice equipment in need of replacement. Rydeen suggested that upgrading buildings at a cost of \$50 to \$75 per square foot may be more practical than creating a new building at a cost greater than \$200 per square foot. Morton states that since kitchens are not updated often, the directors in schools may not be aware of changes in the foodservice equipment industry. School kitchens have the highest cost per square foot of any school area and the lack of knowledge of administrators of the complexity of the NSLP also raise issues in school programs (Morton). A pilot survey in three states found a median estimate of \$52,500 in expected costs to update equipment to meet the new meal patterns (Kids' Safe & Healthful Foods Project, 2012).

### ***Historical Perspective of Equipment in Schools***

Gunderson (1971) noted that children in rural schools brought cold sandwiches for lunch in the early years due to the distances traveled to attend school and the lack of space for kitchens and dining. Government money was not available, leaving the acquisition of any equipment for preparing or heating foods up to the teachers or parents. Sublette (1976) identified "a stove, double boiler, large kettle with top, a large baking pan, and tea kettle" as the basic equipment in schools in the 1930s and 1940s. Lack of refrigeration was one problem, not only in storing foods, but in distribution of commodity foods to schools. Electricity was not available in many rural areas in the 1940s. Sublette worked for the Tennessee agency administering the NSLP and noted that schools with a range, refrigerator, and small equipment were approved by the

program. Parent teacher groups often completed renovations of existing rooms into kitchens and provided equipment (Sublette, 1976).

### ***Factors in Equipment Selection***

The success of a business is dependent in part on equipment choices (Payne-Palacio & Theis, 2012). As with other businesses, the equipment choices are related to the activity and service provided in school nutrition programs. The menu is identified as the single most important factor in selection of equipment (Payne-Palacio & Theis, Almanza). Data on the amount of processed foods served in the NSLP appear to be nonexistent but studies have reported on food production systems. According to the research by Brown (2008), the number of on-site food production kitchens providing school food service is 45.3 percent and the number of combination systems (central kitchen delivers to on-site kitchen) is now at 40.5 percent. The School Nutrition Dietary Assessment Study-III (SNDA-III) reported that 70 percent of schools use on-site food production for consumption of meals on-site (Gordon & Fox, 2007). Nettles, Carr and Conklin (1996) reported approximately 70% of schools use conventional food production systems. SNDA-III found 19 percent of schools received foods from another kitchen and 11 percent of schools sent food to other kitchens. Equipment needs vary according to the amount of food processing needed and the type of food production system in use.

Budget, purchase costs and operating costs are significant factors in selection of foodservice equipment (Birchfield, 1988; Almanza, Payne-Palacia, & Theis). The purchase cost and operating costs must be considered when buying energy efficient equipment. Twenty-nine percent of the respondents to a 2007 Industry Forecast Operator Report indicated energy efficiency would be a major factor in purchasing equipment and 45 percent indicated energy efficiency would be somewhat of a factor (Gale, 2007).

## ***Equipment Standards***

Industry standards exist for a number of characteristics of foodservice equipment. Energy conservation is of interest to many foodservice operators and the government established ENERGY STAR® to assist in purchase of equipment. The NSF Mark and the UL designation assist equipment purchasers in identifying equipment that meets safety and sanitation standards.

### ***ENERGY STAR***

The US Environmental Protection Agency (EPA) began ENERGY STAR® in 1992 (History of ENERGY STAR, 2011). The voluntary ENERGY STAR label indicates an energy-efficient product that meets the EPS standards. The US Department of Energy joined the EPA in covering certain product categories (History of ENERGY STAR, 2011). Certain commercial foodservice equipment is now available with ENERGY STAR labeling. Dishwashers, fryers, griddles, hot food holding cabinets, ice machines, ovens, refrigerators, freezers, and steam cookers are currently listed on the ENERGY STAR website at [http://www.energystar.gov/index.cfm?c=products.pr\\_find\\_es\\_products](http://www.energystar.gov/index.cfm?c=products.pr_find_es_products). Equipment must meet performance requirements established by ENERGY STAR to carry the label. Austin Public Schools in Minnesota purchased \$19,000 in ENERGY STAR equipment that is projected to save \$3,560 in annual utility costs (Austin Public Schools, 2011).

### ***NSF Food Equipment Certification***

The National Sanitation Foundation was founded in 1944 through the University of Michigan's School of Public Health with the purpose of standardizing food safety and sanitation requirements (NSF International, 2011). The NSF mark signifies that the product meets the NSF

standards. In 1990 the name was changed to NSF International and work continues in certifying food, water, environment and consumer products.

### ***Underwriters' Laboratories***

The Underwriters' Laboratories (UL) symbol on a product indicates sample products have passed UL tests and met product requirements (Underwriters' Laboratories, 2011). The history of the UL mark began in 1894 as the Underwriters' Electrical Bureau of the National Board of Fire Underwriters and tested materials for fire safety. The company expanded services and in 1921 certified its first refrigerator based on 28 safety requirements. The foodservice equipment segment of UL began in 1988 and now includes a variety of equipment in food processing plants, vending machines, thermometers and food service.

### ***Equipment Life***

Equipment decisions can affect the foodservice operation for many years. Equipment is expensive and the expected life of some equipment is greater than 15 years (Ninemeir, 2000). Almanza (2009) credits preventive maintenance with extended equipment life. Equipment life is greatly influenced by the care (maintenance) and the use of the equipment in the foodservice operation (Birchfield, 1988). Other factors that affect the life expectancy include fabrication materials, quality of equipment, usage hours, and volume. Since there are so many variables impacting the usefulness of equipment, the life of foodservice equipment can only be an estimate (Almanza).

Comparison of the different estimates of life of food service equipment is complicated by the fact that different terms are used to describe food service equipment. Table 2.4 compares equipment life according to estimates by Birchfield (1988) and by Katsigris and Thomas (2006).



Because different descriptions of the equipment were used by the authors, terms were consolidated to allow comparisons of equipment life according to the two sources.

**Table 2.4. Useful Life of Kitchen Equipment in Years**

Item	Probable useful life <sup>a</sup>	Projected years of use <sup>b</sup>
Broilers	8 to 12	9
Convection oven	7 to 10	-
Deck oven	10 to 15	-
Dishwashing machines	10 to 15	10
Freezers	-	9
Fryers/Deep-fat Fryers	8 to 12	10
Grills	8 to 12	-
Hoods and ventilator systems/Range Hoods	8 to 12	15
Ice-Making Machines	-	10
Milk Dispensers	-	8
Ranges/Ovens and Ranges	10 to 15	10
Refrigerator/freezer-reach-in/storage refrigerators	12 to 20	10
Refrigerator/freezer-walk-in	12 to 20	-
Rotary oven	12 to 20	-
Steam Tables		12
Steamers-high pressure	10 to 15	-
Steam-jacketed kettles	15 to 25	13
Tilting fry pans	12 to 20	-

<sup>a</sup>Adapted from Birchfield, p. 94.

<sup>b</sup>Adapted from Katsigris & Thomas, p. 245.

### ***Refrigeration Equipment***

#### ***History of Refrigeration Equipment***

Prior to the development of refrigeration equipment, the only perishable food available was produced locally. In certain locations, food could be stored in spring houses to allow longer holding periods before spoilage. During winter weather, foods could be stored outside in

locations secured from animals. Eventually the icebox was developed that made use of blocks of ice stored in a lower compartment and food stored in the upper compartment, but this method of storage only increased the shelf life to two or three days (Constable & Somerville, 2003). The development of refrigeration changed what people ate and the way food was prepared, not only at home, but also in schools.

Constable and Somerville (2003) provided a timeline for refrigeration, including the first exhibition of a mechanical refrigerator at the 1904 St. Louis World's Fair. This unit was composed of a wooden icebox with the refrigerating system mounted on the side. Ammonia was used as the refrigerant. General Electric was a leader in developing refrigerators and was the first to manufacture a refrigerator with a sealed refrigerating system rather than an external unit (Constable & Somerville). This refrigerator was produced for ten years and so durable that some units were used in homes until after 2000, making some of the operating units over 70 years of age.

### ***Refrigerants***

Early refrigerants were not always safe. Toxic gases such as ammonia and sulfur dioxide were used before chlorofluorocarbon (CFC) refrigerants were developed for Frigidaire in 1928 and distributed using the trade name Freon. CFC refrigerants were important because they were nontoxic and nonflammable, greatly increasing safety in the refrigeration industry (Constable & Somerville, 2003). The problem with CFC refrigerants is their contribution to depletion of the ozone (Foszcz, 2002). In 1930 the R134a refrigerant was developed and recognized in the 1980s as being the best non-ozone-depleting replacement for CFCs. Hydrochlorofluorocarbons (HCFC) are another group of refrigerants that are less damaging than CFCs but still contain chlorine that may damage the ozone layer (Foszcz). CFC production was phased out in

developed nations in 1996 and HCFCs are scheduled to be phased out by 2020 (Environmental Protection Agency, 2012). Currently, hydrofluorocarbon (HFC) refrigerants are used in most refrigeration appliances; examples of HFC refrigerants are R404A, R410A and R134a (Balachander, Raja, & Lal, 2012). Milnes (2011) questioned the continued use of R404a based on its energy efficiency and its high global warming potential (GWP). The concern with global warming will continue to drive the type and use of commercial refrigerants. *Refrigerants, Naturally!* is a public-private partnership recognized by Harvard University as the recipient of the Roy Family Environmental Award (Anonymous, 2011). *Refrigerants, Naturally!* worked to gain agreement to begin phasing out HFC refrigerants and replace with natural refrigerants. Over 400 manufacturers and retailers have pledged to begin this by 2015 (Anonymous, 2011).

Refrigeration equipment is available in thousands of models, with improvements in the technology of the refrigeration mechanical unit and the storage “box” (Durocher, 2002). There are many types of refrigeration equipment available, offering extended shelf life for chilled and frozen foods.

### ***Types of Refrigeration Equipment***

The term refrigeration equipment refers to equipment that removes heat and therefore cools products. Basic refrigeration equipment extends shelf life of perishable food products and reduces the reproduction rate of many harmful pathogens. In the food service industry, reach-in refrigerators and freezers and walk-in refrigerators and freezers are common types of equipment (Fryett, 1996). Additional types of refrigeration equipment include under-counter, roll-in, and pass-through refrigerators and freezers. Under-counter refrigeration equipment allows storage of food items in work areas that gives easy access to foods needed without sacrificing counter space. Roll-in refrigerators also contribute to labor efficiency by allowing carts to be rolled from

one refrigerated storage area to another. One example of the use of roll-in refrigerators is having a roll-in refrigerator in the service area that is stocked with salads prepared in a refrigerated salad area and transported efficiently using a cart that rolls directly into the service area refrigeration. Blast chillers are a type of refrigeration equipment designed to quickly reduce the temperature of food. Blast chillers can assist with food safety by quickly moving heated foods through the temperature danger zone to appropriate cold storage temperatures (Traulsen, 2011). Display refrigerators are used to merchandise products and include refrigerated display cases, vending merchandisers, deli counters, or salad bars. Reach-in units may be described as single compartment, double compartment, or triple compartment.

Ice machines, milk coolers, ice cream cabinets, and soft serve ice cream machines are specialty types of refrigeration equipment (Almanza, 2009; Fryett, 1997) that are named for the product produced and/or stored in the particular design. Ice machines freeze water to make ice and can produce a variety of types of ice—cubed, flaked, crushed. Ice machines have a unit that makes the ice and has optional storage and dispensing components. Milk coolers are often used in schools since milk is a meal component. Milk coolers are often located in the serving area and allow storage and service from the equipment. This reduces labor needed to transport milk from storage to service areas. Ice cream cabinets or units store ice cream at temperatures that keep the product firm. These units may be located in the service area for self-service by customers. Soft serve ice cream machines may dispense ice cream or frozen yogurt and may be countertop or freestanding units. A refrigerated “thawing” unit is a type of specialty refrigeration equipment that can be programmed to safely and quickly thaw and then hold foods (Warfel & Cremer, 2000).

### ***Measures of Refrigeration Capacity***

Equipment capacity measures vary according to the type of equipment. Walk-in refrigeration is reported in total square feet and reach-in units are reported in cubic feet (Fryett, 1996). Almanza (2009) reported refrigeration/freezers estimates in square feet. Nettles, Carr and Conklin (1996) described pass-thru or reach-in refrigerators as 1 section and 2 section. Fryett reports interior capacities of reach-in refrigeration as follows:

- Single compartment – 21.5 cubic feet of storage
- Double compartment – 46.5 cubic feet of storage
- Triple compartment – 70.0 cubic feet of storage

Almanza (2009) reported ranges of 20-25 cubic feet for single, 46-52 cubic feet for double, and 70-80 cubic feet for triple compartment reach-in refrigeration. The terms section and compartment are interchangeable when describing reach-in, pass-through and roll-in refrigerators and freezers.

Ice machine capacity is reported in the pounds of ice produced per day. Different size bins are available, with bin sizes specified as width by depth by height and/or pounds of ice storage capacity (Manitowic, 2011). Milk cooler capacity is determined by the number of milk crates the unit will hold. Two sizes of milk crates are used in the industry, 13” x 13” x 11” (16 quarts) and 19” x 13” x 11” (24 quarts) (Beverage-Air, 2011).

### ***Refrigeration Capacity Needs***

Estimates of refrigeration space requirements for school nutrition programs are available from very few sources. Factors influencing the appropriate size of refrigerated storage space include the frequency of delivery, food purchasing practices, and the location of the school (Educational Facilities Laboratories, Inc., (EFL) 1968). Fryett (1996) uses the type of operation

as an indicator for determining the number of square footage of refrigeration space needed and the number of walk-ins needed (see Table 2.5), without distinguishing between frozen and chilled walk-in refrigeration space.

In 1968, EFL estimated that 120 square feet of floor space was needed for refrigerated storage to serve 200 meals in one service period (shift). EFL projected refrigerated storage for 600 to 1800 meals, served in three shifts, to range from 160 to 320 square feet. Fryett (1996) provides a rule of thumb estimate for walk-in space of ½ cubic foot of usable storage space per meal served. Almanza (2009) suggested 159 cubic feet of refrigerated space for every 250 lunch meals served with the caveat that additional space may be needed if other types of meals are served.

**Table 2.5. Number of Walk-ins and Square Feet by Type of Operation<sup>a</sup>**

Type of operation	Number of walk-ins	Total square feet
Fast food	1	90 – 120
Small restaurant	1	120 – 150
Medium restaurant or small institution	2	180 – 240
Large restaurant or medium institution	3	240 – 400
Large institution	3	400 – 600
Large hotel, restaurant, or institution with a complex menu and catering facilities	4	600 – 900

<sup>a</sup>Adapted from Fryett, pages 7-27.

Almanza (2009) also provided square footage estimates for refrigeration/freezer for school food service based on the number of meals served. Recent original estimates of refrigeration needed in schools are not available in the literature. Nettles, Carr, and Conklin (1996) studied equipment in conventional kitchens in schools and provided guidelines for pass-

thru or reach-in refrigerators. Almanza's figures were adapted from *The New Design Handbook for School Food Service* (Silberberg, 1997). The 1997 handbook was revised from the *Child Nutrition Programs Design Handbook* (Auburn University, 1994). The 1994 handbook did not reference a research source to support these estimates.

Nettles, Conklin, and Carr (1996) asked school foodservice directors to indicate their agreement with statements about equipment in schools. Eighty-nine percent agreed to strongly agreed with the statement "additional refrigerated space is needed when fresh fruits and vegetables are offered" and 83% agreed with the statement "back-up refrigerators and warmers close to the serving line are necessary when offering menu choices" (page 3).

Walk-in refrigeration equipment is desirable due to the efficiency provided (EFL, 1968) and is often used for central storage (Warfel & Cremer, 2000, p. 302). The open shelving and ability to roll mobile carts into the walk-in unit provide labor efficiencies. Suggestions for purchase and use of walk-in refrigeration include:

- Minimum interior dimensions of 8 feet by 10 feet are needed to allow adequate space for stocking shelves (EFL, 1968).
- Walk-in refrigeration should include aisle space for rolling in a cart (Almanza, 2009).
- Floors should be level to permit use of carts (EFL, 1968).
- Ensure your installer is competent and experienced (K. Kabus, personal communication, April 4, 2012).

Refrigeration equipment in work and service areas offers the advantages of increasing productivity (Warfel & Cremer, 2000). Almanza (2009) recommends milk coolers and other refrigerated equipment in the service area.

## **Trends in School Nutrition Programs**

Recent focus on school nutrition programs regarding childhood obesity and food safety has influenced legislation guiding the USDA Child Nutrition Programs. The Child Nutrition and WIC Reauthorization Act (2004) increased the number of required food inspections and required each school to implement a wellness plan. The Healthy Hunger-Free Kids Act (2010) continues to focus on healthy foods to be served in the National School Lunch Program. The legislation has influenced trends in school nutrition programs.

A major trend is to offer healthier foods, in particular, more fruits, vegetables, and whole grains and use equipment that allows healthy food preparation. White (2010) indicated reduced numbers of fryers, kettles, and mixers and increased numbers of combi-ovens, refrigerators, freezers, milk coolers, tabletop steamers, and multiuse equipment in schools. When some states forced schools to remove fryers from their kitchens, the program operators looked at other types of equipment. When Texas scheduled fryers to be eliminated by the 2009-10 school year, Klein Forrest High School purchased more convection ovens for their new facility (Boss, 2007). White (2009) gave the example of replacing fryers with tilting skillets that allow cooking methods of sautéing, grilling, and steaming. Combi-ovens allow baking and steaming of foods instead of frying.

Alamanza (2009) reported that foodservice equipment with new or blended technologies is more common, giving the example of combi-ovens and central cooking units which include multiple cooking sources. Equipment is trending to be smaller and more mobile, offering flexibility for current and future needs. White (2009) indicated that multi-purpose equipment is being used to save space, increase efficiency, and minimize labor costs. Examples of multi-



purpose equipment include tilting skillets, combi-ovens, and wells on the serving line that can be heated or cooled. Warfel and Cremer (2000) observed that older facilities tended to have a higher proportion of refrigerated storage than frozen storage. Increased availability and use of frozen products changed this proportion.

Schools interested in exceeding minimum requirements for healthy school meals contributed to the trend of becoming a Healthier US School Challenge (HUSSC) school. HUSSC is a voluntary initiative organized by USDA/FNS in 1994 to recognize schools demonstrating excellence in serving healthy school meals and offering physical activity opportunities to students. HUSSC schools exceed the minimum NSLP requirements. Criteria were established by USDA/FNS for Silver, Bronze, Gold and Gold of Distinction awards. The school provides application materials to the State agency who works with the Regional and national FNS offices in confirming that criteria is met by the school. In 2010, monetary awards were provided in addition to the recognition. First Lady Michele Obama included HUSSC in her *Let's Move* physical activity campaign. As of February, 2012, 2,862 schools are HUSSC certified.

Farm-to-school programs and purchasing local food products is on the rise. The National Farm to School Network (2012) estimates 2,305 school districts and 9,807 schools are involved with farm-to-school programs. In 2000, USDA/FNS published a guide describing how to develop local farm-to-school programs. The use of locally grown foods and the number of school gardens are both on the increase. Rothschild (2011) reported that Washington State University received \$1 million grant from USDA to establish vegetable gardens at 70 elementary schools in four states.

Conservation measures in energy, supplies, and water use are part of the trend of going green (White, 2009). Energy efficient commercial equipment is available for purchase. Schools are joining with their commercial counterparts to analyze the cost/benefit ratio of purchasing equipment that uses less energy. Gale (2007) reports commercial operators show energy efficient equipment makes good business sense, with return on investment on higher priced energy efficient equipment showing they are a sound investment. White reports 42% of respondents to a School Nutrition Association survey reported use of energy-efficient equipment. Water conservation is engineered in newer models of dish machines. Water can be recycled for other uses in the foodservice operation.

School nutrition programs are required to implement HACCP-based food safety systems. Peter Healy, a food equipment consultant, attributes the increased numbers of cook-chill systems to the HACCP guidelines (Hume, 2002). Increased focus on food safety is a major trend in school nutrition programs. Temperature monitoring (including documentation) is a critical activity in food safety systems and more schools are investigating the use of wireless technology to meet requirements (White, 2009).

Technology use in school nutrition programs has become the rule rather than the exception and a multitude of applications has been developed. Matsumoto (2001) describes the use of technology in a large school district that includes scanning of applications, card readers at point of service, communication, monitoring of refrigerated equipment, digital security cameras, and tracking of food trucks. Biometric identification systems use finger scan technology to link the student with their personal account—and allow parental access via the Internet (Biometric Identification, 2008). Online payment systems are preferred by many school nutrition directors (Levin, 2007). Electronic communication is common in school nutrition programs. Email and

listservs are used by State agencies to communicate with school nutrition directors. According to Doris Schneider (personal communication, October 22, 2011), the Child Nutrition Unit operating the NSLP in Mississippi required all school nutrition program directors to use the electronic system operating the state purchasing program prior to 1996.

Equipment purchasing trends were reported by SNA in their trendSETS newsletter (2008). The top three categories of replacement equipment included ovens, refrigerators/freezers, and transport cabinets/carriers/holders. The top three categories of new equipment (excluding equipment for remodeling or building new kitchens) included refrigerators/freezers, ovens, and transport cabinets/carriers/holders.

School nutrition programs are facing serious operational challenges. In the *School Nutrition Operations Report 2011*, the School Nutrition Association reported the most significant issues facing professionals at the district level and national level include implementation of the new nutrition standards and meal patterns, cost of food, and funding. The increased amounts of food required in the meal patterns and the types of foods needed to meet the nutrition and caloric standards must be supported by adequate refrigeration space. This research will provide assistance to school nutrition directors as they transition to the new meal patterns and continue to meet the challenges of operating in the NSLP.

## References

- Almanza, B. (2009). *Equipment purchasing and facility design for school nutrition programs*. Retrieved from <http://nfsmi.org/documentlibraryfiles/PDF/20090312115009.pdf>
- American Dietetic Association. (2010). Local support for nutrition integrity in schools. *Journal of the American Dietetic Association, 110*, 1244-1254.
- American Dietetic Association, School Nutrition Association, & Society for Nutrition Education. (2010). Comprehensive School Nutrition Services. *Journal of the American Dietetic Association, 110*, 1738-1748.
- American Recovery and Reinvestment Act. (2009). Public Law 111-5. (February 17, 2009). 120Stat. 115. Retrieved from <http://www.gpo.gov/fdsys/pkg/PLAW-111publ5/pdf/PLAW-111publ5.pdf>
- Anonymous. (2010). Josephine Martin. *Food Management, 45*(11), 12.
- Anonymous. (2011). Global warming and climate change; Harvard University recognizes Refrigerants, Naturally! With prestigious award. *Genetics & Environmental Business Week, (April 7, 2011)*, 658.
- Auburn University. (1994). *Child Nutrition Programs design handbook*. Montgomery, AL: Alabama Department of Education, Child Nutrition Programs.
- Austin Public Schools uses energy savings to put healthier food on the menu. Retrieved from [http://www.energystar.gov/ia/products/commercial\\_food\\_service/Austin\\_Public\\_School\\_CS.pdf](http://www.energystar.gov/ia/products/commercial_food_service/Austin_Public_School_CS.pdf)
- Balachander, P., Raja, B., & Lal, D. M. (2012). Evaporative heat transfer characteristics of R404a and R134a under varied heat flux conditions. *Experimental Heat Transfer, 25*(3), 254-265.

- Belansky, E. S., Cutforth, N., Delong, E., Litt, J., Gilbert, L., Scarbro, S., Beatty, B., ... Marshall, J. A. (2010). Early effects of the federally mandated local wellness policy on school nutrition environments appear modest in Colorado's rural, low-income elementary schools. *Journal of the American Dietetic Association*. 110, 1712-1717.
- Beverage-Air. (2011). School milk coolers specification sheet. Retrieved from: <http://docs.google.com/viewer?url=http://www.shortorder.com/files/documents/products/0000/2166/BEV0162pdf.pdf&pli=1>
- Biometric Identification. (2008). *District Administration*, 44(1), p. 64.
- Birchfield, J. C. (1988). *Design and layout of foodservice facilities*. New York: Van Nostrand Reinhold.
- Boles, M., Dilley, J. A., Dent, C., Elman, M. R., Duncan, S. C., & Johnson, D. B. (2010). Changes in local school policies and practices in Washington State after an unfunded physical activity and nutrition mandate. *Preventing Chronic Disease* 8(6), 1-13.
- Boss, D. (2007). Klein Forest High School: Klein, Texas. *Foodservice Equipment & Supplies*, 60(7), 43.
- Brown, D. M. (2008). Prevalence of food production systems in school foodservice. *Journal of the American Dietetic Association*. 105, 1261-1265.
- Bryan, M. de G. (1938). *The school cafeteria*. New York: Appleton-Century-Crofts, Inc.
- Child Nutrition and WIC Reauthorization Act. (2004). Public Law 108-265. (June 30, 2004). 118 STAT. 729. Retrieved from [http://www.fns.usda.gov/cnd/Governance/Legislation/Historical/PL\\_108-265.pdf](http://www.fns.usda.gov/cnd/Governance/Legislation/Historical/PL_108-265.pdf)
- Constable, G. & Somerville, B. (2003). *A century of innovation: Twenty engineering achievements that changed our lives*. Washington, DC: Joseph Henry Press.

- Durocher, J. (2002). The cold facts. *Restaurant Business*, 101(8), 125.
- Education Facilities Laboratories. (1968). *20 Million for lunch*. New York: Author.
- Environmental Protection Agency. (2012). What you should know about refrigerants when purchasing or repairing a residential A/C system or heat pump. Retrieved from <http://www.epa.gov/ozone/title6/phaseout/22phaseout.html>
- Federal Register. (January 13, 2011). *7CFR parts 210 and 220*. 76:9, p. 2494.
- Foszcz, J. L. (2002). Using refrigerants. *Plant Engineering*, 56(2), 73-77.
- Frable, F. Jr. (1997). The changing role of foodservice equipment in successful operations. *Nation's Restaurant News*, 31(30) 10-11.
- Fryett, D. K. (1996). *An introduction to the foodservice industry*. Chicago, IL: North American Association of Food Equipment Manufacturers.
- Gale, D. (2007). Efficiency experts. *Restaurants and Institutions*, 117,53.
- Gordon, A. & Fox, M. K. (2007). *School Nutrition Dietary Assessment Study-III Summary of Findings*. Retrieved from <http://www.fns.usda.gov/ora/menu/published/CNP/FILES/SNDAAIII-SummaryofFindings.pdf>
- Gunderson, G. W. (1971). *The National School Lunch Program: Background and Development*. Washington, DC: U. S. Government Printing Office.
- Healthy and Hunger-Free Kids Act. (2010). Public Law 111-296 (December 13, 2010) 124 Statute3183. Retrieved from <http://www.gpo.gov/fdsys/pkg/PLAW-111publ296/pdf/PLAW-111publ296.pdf>
- History of ENERGY STAR. (2011). Retrieved from [http://www.energystar.gov/index.cfm?c=about.ab\\_history](http://www.energystar.gov/index.cfm?c=about.ab_history)
- Hume, S. (2002). Blowing hot and cold. *Restaurants and Institutions*, 112(21), 100, 102.

- Katsigris, C. & Thomas, C. (2006). *Design and equipment for restaurants and foodservice* (2<sup>nd</sup> ed.). Hoboken, NJ: Johns Wiley & Sons, Inc.
- Kids' Safe & Healthful Foods Project. (2012). *Serving safe and healthy meals at schools takes equipment and training*. Retrieved from [http://www.schoolnutrition.org/uploadedFiles/School\\_Nutrition/110\\_SNFoundation/SNFRResearch/KSHF\\_SNF\\_Survey\\_05-19-2011\\_FINAL.pdf?n=5985](http://www.schoolnutrition.org/uploadedFiles/School_Nutrition/110_SNFoundation/SNFRResearch/KSHF_SNF_Survey_05-19-2011_FINAL.pdf?n=5985)
- Levin, A. (2007). Saved by the ...cafeteria? *Foodservice Equipment and Supplies*, 60(1), 38.
- Library of Congress. Congressional Research Service. (1976). Legislative history of the child feeding programs. Retrieved from <http://www.lexisnexis.com.er.lib.k-state.edu/congcomp/getdoc?CRDC-ID=CRS-1976-EPW-0023>
- Manitowic. (2011). F-style large capacity ice storage bins. Retrieved from [http://www.manitowocice.com/docs/uploaded/mii/spec\\_sheets/bins\\_f.pdf](http://www.manitowocice.com/docs/uploaded/mii/spec_sheets/bins_f.pdf)
- Martin, M. J.& Oakley, C. B. (Eds.).(2008). *Managing child nutrition programs: Leadership for excellence* (2<sup>nd</sup> ed.). Sudbury, MA: Jones and Bartlett Publishers.
- Matsumoto, J. (2001). Buying into efficiency. *Restaurants & Institutions*,111(9), 103-108.
- Milnes, J. (2011). Is it time to stop using R404A? *Refrigeration and Air Conditioning Magazine*, Retrieved from <http://www.racplus.com/issues/-is-it-time-to-stop-using-r404a/8610668.article>
- Morton, J. (2010). Beefing up your school kitchen. *Buildings*, 104(12), 35-38.
- Nanney, M. S., Nelson, T., Wall, M., Haddad, T., Kubik, M., Laska, M. N., Story, M. (2010). State school nutrition and physical activity policy environments and youth obesity. *American Journal of Preventive Medicine*. 38, 9-16.

- National Academy of Sciences, Institute of Medicine. (2009). *School meals: Building blocks for healthy children report brief*. Retrieved from <http://www.iom.edu/~media/Files/Report%20Files/2009/School-Meals/School%20Meals%202009%20%20Report%20Brief.pdf>
- National Center for Education Statistics, USDOE. (2011). *State Education Data Profiles*. Retrieved from <http://nces.ed.gov/programs/stateprofiles/>
- National Farm to School Network. (2012). Retrieved from <http://www.farmentoschool.org/>
- Nettles, M. F., Carr, D. H., & Conklin, M. T. (1996). *Equipping school kitchens to prepare healthful meals*. Insight No. 6. University, MS: National Food Service Management Institute.
- Ninemeier, J. D. (2000). *Management of food and beverage operations (3<sup>rd</sup> ed.)*. Lansing, MI: Educational Institute of the American Hotel & Lodging Association.
- NSF International. (2011). *About NSF*. Retrieved from [http://www.nsf.org/business/about\\_NSF/](http://www.nsf.org/business/about_NSF/)
- Payne-Palacio, J. & Theis, M. (2012). *Foodservice management principles and practices (12<sup>th</sup> ed.)*. Upper Saddle River, NJ: Pearson Education, Inc., publishing as Prentice Hall.
- Perrott, G. St. J. (1946). Selective Service rejection statistics and some of their implications. *American Journal of Public Health*, 36, 336-342.
- Ralston, K., Newman, C., Clauson, A., Guthrie, J., & Buzby, J. (2008). *The National School Lunch Program: Background, trends, and issues*. Economic Research Report Number 61. USDA Economic Research Service.
- Rushing, K. & Nettles, M. F. (2008). *Identification of issues associated with operating school nutrition programs in districts with less than 30,000 student enrollment*. Retrieved from <http://nfsmi.org/documentlibraryfiles/PDF/20110722044912.pdf>



Rushing, K. & Nettles, M. F. (2011). *Exploring the uniqueness of school nutrition programs in small school districts*. Retrieved from <http://nfsmi.org/documentlibraryfiles/PDF/20110722044912.pdf>

Rydeen, J. E. (2008). School renewals. *American School & University*, 80(11), 44.

School Nutrition Association. (2008). School foodservice equipment purchases. *trendSETS*, 2(4), 8-11.

School Nutrition Association. (2010). *2010 Back to School Trends Report*. National Harbor, MD: Author.

School Nutrition Association. (2011a). *School Nutrition Operations Report 2011*. National Harbor, MD: Author.

School Nutrition Association. (2011b). School nutrition operators detail their equipment procurement needs. Retrieved from <http://www.schoolnutrition.org/Blog.aspx?id=16267&blogid=622>

Silberberg, S. C. (1997). *The new design handbook*. University, MS: National Food Service Management Institute.

Smedley, E. (1930). *The school lunch: Its organization and management in Philadelphia*. Media, PA: Author.

Sublette, L. (1976). *I Remember School Lunch*. Martin, TN: S & S Book Company.

Traulsen. (2011). Blast chiller. Retrieved from <https://my.hobartcorp.com/resourcecenter/ProductDocumentation/TR35799%20rbc200.pdf>

Underwriters' Laboratories. (2011). *About UL*. Retrieved from <http://ul.com/global/eng/pages/corporate/aboutul/history/>

- U.S. Department of Agriculture, Food and Nutrition Service. (2000). Small Farms/School Meals Initiative (FNS-316). Retrieved from <http://www.fns.usda.gov/cnd/lunch/Downloadable/small.pdf>
- U.S. Department of Agriculture, Food and Nutrition Service. (2012a). National School Lunch Program fact sheet. Retrieved from <http://www.fns.usda.gov/cnd/lunch/AboutLunch/NSLPFactSheet.pdf>
- U.S. Department of Agriculture, Food and Nutrition Service. (2012b). National School Lunch Program participation and lunches served. Retrieved from <http://www.fns.usda.gov/pd/slsummar.htm>
- U.S. Department of Agriculture, Food and Nutrition Service. (2012c). USDA Food and Nutrition Service Regional Offices. Retrieved from <http://www.fns.usda.gov/cga/Contacts/RegionContacts.htm>
- U.S. Department of Agriculture, Food and Nutrition Service. (2011). National School Lunch Program total participation: September 1, 2011 [state data]. Retrieved from <http://www.fns.usda.gov/pd/01slfypart.htm>
- U.S. Department of Agriculture, Food and Nutrition Service, Office of Research, Nutrition and Analysis. (2007). *School Nutrition Dietary Assessment Study-III, Vol. I: School Foodservice, School Food Environment, and Meals Offered and Served*. Retrieved from <http://www.fns.usda.gov/Ora/menu/Published/CNP/FILES/SNDAIII-Vol1.pdf>
- Warfel, M. C. & Cremer, M. L. (2000). *Purchasing for Food Service Managers*. (Fourth Edition). Berkeley, CA: McCutchan Publishing Corporation.
- White, L. (2009). Getting educated on K-12. *Foodservice Equipment & Supplies*, 62(1), 64.

White, L. (2010). K-12 School Foodservice Revised. *Foodservice Equipment &Supplies*, 63(1),

28.

## Chapter 3 - Methodology

This chapter includes the methods to achieve research objectives. A non-experimental research design was used for this study with mixed methods research techniques. The study methodology included the use of a Delphi panel, ten site observations, a pilot study in one state, and a regional survey of school nutrition directors to identify refrigeration equipment capacity by type of equipment and perceived adequacy of refrigeration equipment. The specific objectives were to: 1) identify the refrigeration capacity available in schools in the USDA/FNS Southwest Region; 2) identify practices to compensate for inadequate refrigerated storage; 3) examine barriers to purchasing refrigeration equipment in school nutrition programs; 4) identify resources utilized in development of refrigeration equipment specifications in school nutrition programs; 5) determine if directors feel there is adequate refrigeration space to meet the new NSLP meal patterns released in 2012; and 6) develop a preliminary decision model for estimating refrigeration equipment needs for school districts. Table 3.1 lists research procedures in chronological order.

**Table 3.1. Research Procedures**

Identify research questions and variables.
Develop questions for the Delphi panel.
Use modified Delphi method to refine survey.
Have ten Kansas directors complete the survey.
Conduct on-site observation of ten school sites in Kansas.
Pilot the survey instrument with directors in Kansas.
Conduct regional electronic survey.
Analyze data.

## **Human Subjects Review**

The Kansas State University Committee for Research Involving Human Subjects (IRB) reviewed the research protocols prior to the beginning of the study. The communication from the University Research Compliance Office is found in Appendix A.

## **Population and Sample**

The population of the NSLP is approximately 100,000 schools (USDA, 2012). The local education authority (LEA), the entity contracting with the State agency to provide the NSLP, is usually a school district but may be a private non-profit school system or a residential child care institution. The USDA estimates include the number of LEAs participating in the NSLP regardless of the type. For example, the LEA represented in the USDA data may be a public school district, a single private school, or a residential child care institution, such as a juvenile detention facility. The National Center for Education Statistics (NCES) in 2009-10 reported 13,600 public school districts composed of over 98,888 public schools and 33,300 private schools. NCES does not track NSLP participation by private schools. The School Nutrition Association reports that approximately 95% of schools participate in the NSLP (White, 2010).

The USDA Southwest Region was selected for this study due to its proportionate representation of the 31.7 million children participating daily in the NSLP, the geographic proximity to the researcher, and the cooperative attitude of the state directors. According to USDA (2011), over 15% of the children participating in the NSLP are located in the USDA Southwest Region (Table 3.2). This region is represented by five states and during the planning stages of the research, the state directors indicated a willingness to assist with the study.

Arkansas, Louisiana, New Mexico, Oklahoma, and Texas are the five states in the USDA Southwest Region. The total number of school nutrition directors in the region was 2,501, based

on the email lists provided to the researcher. The completed sample size needed for a population of 2,500 with 95% confidence level is 223 for 80/20 split and 337 for 50/50 split (Dillman, Smyth & Christian, 2009, p. 57). Since the survey was a combination of question types with approximately 20% of the questions having a 50/50 split (two choices for answers), a minimum of 245 completed surveys were needed for the 95% confidence level. This number was calculated using a weight of 80% for the 80/20 split.

**Table 3.2. Number and Percent of Children Participating in NSLP by USDA/FNS Region<sup>a</sup>**

USDA Region	# Children Participating (daily)	Percent
Mid-Atlantic	3,790,303	11.95%
Midwest Region	5,265,133	16.60%
Mountain Plains Region	2,728,212	8.60%
Northeast Region	3,028,171	9.55%
Southeast Region	6,611,031	20.84%
Southwest Region	4,979,976	15.70%
Western Region	5,316,492	16.76%
<b>Total</b>	<b>31,719,318</b>	<b>100.00%</b>

<sup>a</sup>Adapted from U.S. Department of Agriculture, Food and Nutrition Service. (2011). National School Lunch Program total participation: September 1, 2011 [state data].

The anticipated response rate for the school nutrition director’s electronic survey was 12%. This was based on the average response rates for research conducted with school nutrition/managers reported during 2010-2011 in the *Journal of Child Nutrition Management*. The response rate of school nutrition directors/managers in four studies ranged from 9.2% to 28.9% for 2010-2011 year (Stinson, Carr, Nettles, & Johnson, 2011; Moliason and Nettles, 2010); Rice, Strohbehn, Shelly, Arendt & Gregoire, 2010; Paez, Arendt, and Strohbehn, 2011).

Two dissertations surveying school nutrition directors had response rates of 24.16% (Jirka, 2006) and 58% (Giampaoli, 2001). Jirka studied school foodservice directors' perceptions of commodities using an electronic survey and Giampaoli studied food safety using a mail survey.

### **Instrument Development**

Instrument development began with the use of a modified Delphi technique. The Delphi technique is an anonymous written survey process which includes multiple rounds with feedback provided from the researcher after each round (Gracht, 2008). Salasin, Bregman, Entingh and Thackston (1981) reported the Delphi method resulted in more details from a larger group than the nominal group technique. The Delphi technique provides the advantages of obtaining the opinions of experts without face-to-face interaction (deVilliers, deVilliers, & Kent, 2005). The anonymity and the ability to elicit feedback with the use of multiple rounds offer an objective and inexpensive method to refine the survey instrument. For this research, a modified Delphi technique was used to allow electronic feedback from panelists. The ability to obtain feedback from multiple rounds, the opportunity to use electronic communication, the low cost, and the ability to obtain more detailed information were the determining factors in choosing this method over a focus group.

The Delphi panel was composed of 12 members: one school nutrition director (current or former director) from each of the seven USDA regions (except the Southwest Region), an equipment industry representative, a National Food Service Management Institute (NFSMI) staff member, two university faculty, a School Nutrition Association (SNA) representative, and one retired USDA/FNS staff (Table 3.3). Panelists were recommended by faculty at Kansas State University and through a review of school nutrition research literature, with attention to a geographic dispersion of panelists. Axio, an online survey tool developed at Kansas State

University, was utilized to administer the three rounds of the modified Delphi method. The first round obtained feedback from panelists regarding the information needed to meet research objectives. Panelists worked independently and anonymously to complete their responses. The researcher used the feedback from the panelists to refine the survey and sent out revisions for additional feedback in round two. The third round provided the survey instrument for a final review by panelists.

Questions for round 1 of the modified Delphi method are found in Appendix B. Panelists had the opportunity to answer open-ended questions about types of information to be collected to achieve research objectives. In some instances, proposed questions were provided and the panelists made suggestions for improvement. Demographics, purchasing practices, measuring storage space, food production systems, types of refrigeration equipment, recent equipment purchases, methods to improve response rate, refrigeration best practices, and frequency of delivery were topics included in the Delphi process.

Variables for feedback included 1) student enrollment, 2) free and reduced price status, 3) type of food production system, 4) type of school, 5) type of school district, 6) number of meals served, 7) refrigeration capacity, and 8) type of refrigeration equipment.

### ***Site Observation***

After the Delphi panel completed their review, a draft electronic survey was developed and used to elicit ten onsite responses from school nutrition directors in Kansas. Using convenience sampling, ten districts in Kansas suggested by the State director were selected for on-site observations. The researcher contacted the school nutrition director by telephone and/or email to request participation. Once agreement was obtained, the school nutrition director was asked to complete the electronic survey.



**Table 3.3. Sampling Frame Matrix**

Description:	Delphi Panel	District Directors (on-site)	Pilot Survey of Kansas Directors	Survey of Directors
Population	Experts in School Nutrition and Research	State director provided suggestions of directors	Approximately 427 school nutrition directors in Kansas	Approximately 2,392 directors from school districts participating in NSLP in the Southwest Region
Participants	12 members	10 districts from Kansas; Schools were selected by identifying the 2 <sup>nd</sup> school on an alphabetical list of district schools.	All Kansas directors (except the 10 who received visit from researcher)	All school nutrition directors in the Southwest Region
How population identified	Recommendations from faculty at Kansas State University, identified through research literature with geographic dispersion	Recommendations from faculty at Kansas State University and staff at Kansas Department of Education	State agency director distributed message using Kansas listserv	State Agency provided email addresses of directors or use of their listserv to distribute the survey message and link
Method	3 rounds via online survey tool to refine survey instrument	Online survey completed by local school nutrition director before site observation by researcher	Online survey completed by local school nutrition director	Online survey link sent via email message
Actual response	6-12	10	69	240

The protocol used required the school nutrition director to complete the electronic survey in advance of the researcher’s appointment. The researcher met with the director at the beginning of the observation to review the completed survey and then the researcher visited the selected school to complete the observation. If the school district had more than one school, the

second school on an alphabetical list was selected for the survey and that school was observed to determine the accuracy of the refrigeration equipment information provided.

Site observations checked the reliability of the information given by the school nutrition director. For example, did the school nutrition director select the second school from an alphabetical list to use in answering school specific information? The reported refrigeration capacity of the school was compared to the actual refrigeration capacity to indicate accuracy and reliability of the data. Also, the researcher obtained verbal feedback from the school nutrition director about the survey and the survey process. The school nutrition director was asked how much time was used in answering the survey that was not reflected in the online time recorded by the survey system. The information obtained from the site observations was utilized to revise the survey instrument and process.

### ***Pilot Study***

The state director in Kansas was contacted by telephone and email to discuss the research project. The 427 school nutrition directors in Kansas pilot tested the survey. The Kansas Department of Education State Agency distributed the message from the researcher and the survey link electronically. The researcher provided a message that included directions for collecting information before beginning the online survey (Appendix C). School nutrition directors who participated in the site observation survey (Appendix D) and the onsite visits were asked to not respond to the pilot survey (Appendix E).

The responses from the pilot study were used to test validity of the survey instrument. Changes were made in the instrument based on validity tests and responses. The final survey instrument is found in Appendix F.

## **Survey Administration**

All school nutrition directors in the Southwest Region with valid email addresses received the survey. The state agency assisted by providing access to email listings or distributing the message from the researcher and survey link to all directors in the state. The child nutrition director was the school district representative who completed the survey.

The researcher made a personal phone call to each state director in the Southwest Region to request assistance with the research. If the state director was not available via phone, a follow-up email message was sent. The state director was asked to email school nutrition directors about participation in the survey and provide the link to the survey. After one week, a reminder message was sent to the school nutrition directors by the State agency.

The objective was to obtain 245 usable responses. Since survey response rates are often a problem for researchers, incentives were provided for respondents. There are reports on the usefulness of incentives, drawings, lotteries and variations of each. The external validity of the research may be called into question. For example, Dake, et al (2006) studied health survey response rates of a questionnaire sent to adults in rural areas and did not find a significant difference in a \$5 and a \$2 incentive. However, this principle seems to be disputed in other research. A study of physicians showed marked improvement in returns when the incentive went from \$25 to \$50 (Keating, Zaslavsky, Goldstein, West, & Ayanian, 2008).

For the current study, those directors who completed the survey were asked to provide their email address to be eligible for the incentive. Their email address was separated from their responses to maintain anonymity. After the deadline for survey completion, a winner was selected using the survey tool and the winner received a training session for school nutrition staff in their district. The topic of the training session was selected by the school nutrition director

from the choices provided by the researcher (suggested topics included New Meal Pattern, Smart Use of Refrigerated Storage, HealthierUS School Challenge, or Customer Service) or a mutually agreed upon topic. Once the winner was selected and notified, all names and contact information were deleted.

## **Statistical Analysis**

The use of the Axio survey tool at Kansas State University allowed data from the completed survey to be downloaded into Microsoft Excel® spreadsheets. SPSS® version 20.0 was used to analyze the data. A probability of  $p < 0.05$  was used for testing significance.

For demographic data, frequency of responses and percentages were calculated and reported. Descriptive statistics included means, frequencies and standard deviations for refrigeration capacity of different types of refrigeration storage equipment. T-tests, ANOVA and regression were used in statistical analysis.

### ***Determining Cubic Feet by Equipment Descriptions***

Instructions for the survey included sample descriptions of refrigeration equipment. Respondents were asked to measure walk-in refrigerators and walk-in freezers and report width, length, and height. With the three dimensions, the researcher would then calculate cubic feet for the walk-ins. If respondents did not include all three dimensions the cubic feet could not be calculated and response was coded as no response.

Determining the cubic feet for other refrigeration equipment was based on the description of the unit. Fryett (1996) reported interior capacities of reach-in refrigeration as 21.5 cubic feet for a single compartment, 46.5 cubic feet for double compartment, and 70.0 cubic feet for triple compartment units. To determine the cubic feet used in calculating storage capacity of

refrigeration equipment reported in the survey, the researcher reviewed specifications for current models of refrigeration equipment to obtain an average number of cubic feet per type of equipment.

### **Creating a Decision Model and Testing of Model**

The amount of refrigerated storage needed in a school can vary greatly. In reviewing existing facilities, the adequacy is dependent on many factors such as the complexity of the menu, the number of fresh (refrigerated) and frozen items offered, the amount of “scratch” cooking, the frequency of food deliveries, the number of meals served, space available and efficiency of refrigerated storage (Almanza, 2009; Birchfield, 1988; Payne-Palacio & Theis, 2012). It is difficult to determine if limited refrigeration space led the operation to restrict the complexity of the menu or other factors, or if the availability of refrigeration space allowed the operation to offer more complex menus, more fresh and frozen items, less frequent food deliveries, and more meals.

Decisions about the type and capacity of the refrigeration equipment are made at the local level. The school nutrition director is often the individual who determines the need for purchasing equipment in an existing school nutrition operation. In the event of new construction, the foodservice consultant and/or architect often determine the amount and type of refrigeration equipment purchased with approval by the school district administrator (Almanza, 2009).

A common unit of measure for refrigeration space is the cubic foot. Survey respondents were asked to provide descriptions of the size of equipment that would allow the researcher to calculate cubic feet capacity for the equipment. This information was used to determine the number of cubic feet of refrigeration storage for frozen and refrigerated foods, regardless of the type of refrigeration equipment available in the school.

Steps in the decision making process are identified as recognizing and defining the situation, identifying alternatives, evaluating alternatives, selecting the best alternative, implementing the chosen alternative, and follow-up and evaluation (Gregoire, 2010). Decision models are built for different reasons. The preliminary decision model for this study was developed to identify what should be done in a particular context, in this case, when school enrollment falls into one of three categories. A number of cubic feet of refrigerated storage space for both chilled and frozen food was applied to the equipment. The amount of cubic feet was determined through analysis of data provided by schools with perceived adequate refrigerated space.

Data furnished by survey respondents was used to identify the cubic feet of refrigerated and frozen storage space available by school. Refrigerated storage equipment, for the purpose of model development, included walk-in refrigerators, reach-in, pass-through and roll-in refrigerators, milk boxes and blast chillers. Frozen storage equipment included walk-in freezers, reach-in, pass-through and roll-in freezers. Total refrigeration storage is equal to the sum of refrigerated storage space and frozen storage space, all expressed in cubic feet. In developing the model for purchasing refrigeration equipment for school nutrition programs, the following measures were identified:

- Total refrigeration storage (cubic feet of refrigerated and frozen) based on school student enrollment
- Refrigerated storage (cubic feet of refrigerated storage) based on school student enrollment
- Frozen storage (cubic feet of frozen storage) based on school student enrollment
- Total refrigeration storage (cubic feet of refrigerated and frozen) per meal served

- Refrigerated storage (cubic feet of refrigerated storage) per meal served
- Frozen storage (cubic feet of frozen storage) per meal served

### ***Testing the Preliminary Decision Model***

Linear regression analysis was used to investigate the relationships between the dependent variable (total cubic feet of refrigeration storage) and independent variables (school enrollment, number of meals served, percent free and reduced price status, and student participation rate). Significant variables were included in the model. A preliminary check of the model was conducted using data provided by Kansas schools in the pilot test.

## References

- Almanza, B. (2009). *Equipment purchasing and facility design for school nutrition programs*. Retrieved from <http://nfsmi.org/documentlibraryfiles/PDF/20090312115009.pdf>
- Birchfield, J. C. (1988). *Design and layout of foodservice facilities*. New York: Van Nostrand Reinhold.
- Dake, J. A., Jordan, T. R., Price, J. H., Silvestri, K. S., & Ward, B. L. (2006). Effects of small monetary incentives on return rates of a health survey to adults in rural areas. *Psychological Reports* 98(3), 849.
- deVilliers, M. R., de Villiers, P. J. T., & Kent, A. P. (2005). The Delphi technique in health sciences education research. *Medical Teacher*, 27(7), 639.
- Dillman, D. A., Smyth, Jo. D., & Christian, L. M. (2009). *Internet, mail, and mixed-mode surveys* (3<sup>rd</sup> ed.). Hoboken, NJ: John Wiley & Sons, Inc.
- Fryett, D. K. (1996). *An introduction to the foodservice industry*. Chicago, IL: North American Association of Food Equipment Manufacturers.
- Giampaoli, J. M. (2001). *Challenges and procedures relative to food safety in school foodservice*. Retrieved from ProQuest Database (AAT 3024374).
- Gracht, H. A. (2008). *The Future of Logistics*. Retrieved from <http://www.springerlink.com.er.lib.k-state.edu/content/u403u7/#section=214484&page=1>
- Jirka, B. A. (2006). *School foodservice directors' perceptions of value and cost of using agriculture commodities in child nutrition programs*. Retrieved from ProQuest Database (AAT 3243836)



- Keating, N. L., Zaslavsky, A. M., Goldstein, J., West, D. W., & Ayanian, J. Z. (2008). Randomized trial of \$20 versus \$50 incentives to increase physician survey response rates. *Medical Care*, 46, 878.
- Moliason, E. F. & Nettles, M. F. (2010). Special food and nutrition needs in school nutrition programs. *Journal of Child Nutrition Research*, 34(1). Retrieved from <http://www.schoolnutrition.org/Content.aspx?id=14018>
- Paez, P., Arendt, S., & Strohbahn, C. (2011). Training: An opportunity for people with disabilities in school foodservice operations. *Journal of Child Nutrition Management* 35(1), Retrieved from <http://www.schoolnutrition.org/Content.aspx?id=15320>
- Payne-Palacio, J. & Theis, M. (2012). *Foodservice management principles and practices (12<sup>th</sup> ed.)* Upper Saddle River, NJ: Pearson Education, Inc., publishing as Prentice Hall.
- Rice, B. W., Strohbahn, C. Shelly, M. C., Arendt, S., & Gregoire, M. B. (2010). Comparison of cooperative and noncooperative purchasing in school nutrition programs. *Journal of Child Nutrition Management*, 34(2), Retrieved from <http://www.schoolnutrition.org/Content.aspx?id=14666>
- Salasin, J., Bregman, H., Entingh, D., & Thackston, K. (1981). A comparison of two group-process techniques. *IEEE Transactions on Engineering Management*, 28(4), 97.
- Shelleymatic. (2012). Self-contained milk or beverage dispenser with air curtain. Retrieved from [www.delfield.com](http://www.delfield.com)
- Stinson, W. B., Carr, D., Nettles, M. F., & Johnson, J. T. (2011). Food safety programs based on HACCP principles in school nutrition programs: Implementation status and factors related to implementation. *Journal of Child Nutrition Management* 35(1), Retrieved from <http://www.schoolnutrition.org/Content.aspx?id=15320>

U.S. Department of Agriculture, Food and Nutrition Service. (2011). National School Lunch Program total participation: September 1, 2011 [state data]. Retrieved from

<http://www.fns.usda.gov/pd/01slfypart.htm>

U.S. Department of Agriculture, Food and Nutrition Service. (2012). National School Lunch Program fact sheet. Retrieved from

<http://www.fns.usda.gov/cnd/lunch/aboutlunch/NSLPFactSheet.pdf>

## **Chapter 4 - Refrigeration Equipment in School Nutrition Programs: Current Use, Perceived Adequacy and Practices**

### **Abstract**

#### ***Purpose/Objectives***

Equipment to store foods at proper temperatures is critical to serving safe and nutritious meals in schools yet little is known about the type of refrigeration equipment or the adequacy of refrigerated storage in school nutrition programs. The purposes of this study were to identify the types of refrigeration equipment used in schools; determine the perceived adequacy of refrigerated storage capacity to meet new meal pattern requirements; and identify practices to compensate for inadequate refrigerated storage, barriers to purchasing refrigeration equipment and resources utilized in development of equipment specifications. The differences in perceived adequacy of refrigerated storage based on characteristics of schools and school nutrition directors were explored.

#### ***Methods***

A mixed methods research design was used, including a modified Delphi technique, site observations, and electronic surveys. The study population and sample included school nutrition directors in the USDA/FNS Southwest Region (N=2392). Data were collected via an online survey. Respondents provided an inventory of refrigeration equipment for one of the schools in their district, information about perceived adequacy of refrigerated storage, barriers to purchasing refrigeration equipment, resources used to develop specifications, and practices to compensate for inadequate refrigerated storage in their school nutrition program. Data analysis included descriptive statistics, independent sample t-tests and ANOVA.

## ***Results***

Milk boxes (n=212, 88.3%) were the type of refrigeration equipment found most often in schools, followed by walk-in freezers (n=180, 75.0%). The perceived adequacy of refrigeration equipment to meet new meal patterns was  $3.2 \pm 1.3$  on a five-point scale ranging from strongly disagree (1) to strongly agree (5). Closer scrutiny of the data indicates that over a third of directors rated refrigerated equipment as inadequate. Years of experience in school nutrition and education level of the school nutrition director were significantly related to perceived adequacy of refrigeration equipment. Directors with more school nutrition experience rated adequacy higher than directors with less experience. Perceived adequacy of refrigeration equipment to meet new meal patterns was not significantly related to characteristics of the school.

## ***Applications to Child Nutrition Professionals***

This study provides valuable information on the use of different types of refrigeration equipment in school nutrition programs. School nutrition professionals may use the results as they consider purchasing different types of equipment and be motivated to identify the types of refrigerated equipment and the adequacy of refrigerated storage in their district. The practices to compensate for inadequate storage can be implemented in the local schools if refrigerated storage is inadequate. Results cannot be generalized due to the regional nature of the survey and low response rate with possible non-response bias.

**Key words:** refrigeration equipment, school nutrition, adequacy of refrigeration

## **Introduction**

Over 31.8 million children are served daily through the National School Lunch Program (NSLP) with fiscal 2011 funding over \$11.1 billion (USDA, 2012c). Public funds for school feeding predate the 1946 National School Lunch Act (NSLA) (Gunderson, 1971) with social consciousness and agricultural markets serving as foundations of the program (Educational Facilities Laboratories, 1969). The World War II draft rejections due to poor health provided the impetus for passage of the NSLA to improve the health and well-being of children (Perrott, 1946; Gunderson). Today, public scrutiny of the NSLP is due to issues about food safety and increased childhood obesity rates (National Academy of Sciences, 2009).

Nutrition requirements in the NSLA were established using three types of lunches: Type A, Type B, and Type C. The NSLA provided funding to states based on the number of school children (not meals) and differences in the state and federal per capita income which gave the states with the lowest per capita income the highest proportion of federal funds (Gunderson, 1971). The total cost for the NSLP in 1947 was \$70 million (USDA, 2012b) and equipment funding was \$10 million or about 14% of the monies available. Apportionment of funds was altered slightly with the first NSLA amended in 1952, which gave higher proportions of funding to the lowest per capita income states and territories. Problems continued with this method of funding because the numbers of meals were not considered in the equation so many districts did not have the resources to support the program throughout the school year (Gunderson; Martin & Oakley, 2008). In 1962, the NSLA was amended to change the basis of funding to include the participation rate and assistance need rate for the state (Library of Congress, 1976).

The 1966 Child Nutrition Act (CNA) authorized the Special Milk Program through 1970, established the School Breakfast Program (SBP) as a pilot, and provided grants to purchase

foodservice equipment (Gunderson, 1971). Further provisions authorized funds for state administrative expenses, expanded eligibility to preschool programs in school systems, and made commodity foods available to other school foodservice programs such as the SBP (Library of Congress, 1976). The provisions of the 1966 CNA strengthened and expanded school meals programs (Martin & Oakley, 2008).

Legislation during the 1970s established national guidelines to determine free and reduced price eligibility and guaranteed funding on a per meal basis (Gunderson, 1971). The Special Food Service Program for Children (SFSPC) was changed to the Child Care Food Program and the Summer Food Service Program for Children in 1975 legislation (Library of Congress, 1976). The expansion of SBP was encouraged by 1978 legislation that provided additional funding and food service equipment to schools initiating breakfast programs (Gunderson).

The early 1980s legislation resulted in major funding cuts and reduced participation in school meal programs (Martin & Oakley, 2008). In 1989, the National Food Service Management Institute (NFSMI) was established although funding was not provided until 1991. NFSMI was charged with conducting activities to improve the quality and general operation of federally assisted child nutrition programs (Martin & Oakley).

The Child Nutrition and WIC Reauthorization Act of 2004 required implementation of a local wellness policy, two health inspections per year and implementation of a food safety program based on Hazard Analysis and Critical Control Points (HACCP). Congress appropriated \$100,000,000 for the purchase of foodservice equipment for NSLP participants through the American Recovery and Reinvestment Act of 2009.

The Healthy and Hunger-Free Kids Act (2010) focused on improving child nutrition programs funded by USDA. As a result of the Healthy and Hunger-Free Kids Act (HHFKA), USDA's Food and Nutrition Service (2012c) issued regulations for the NSLP that included new meal patterns requiring increased variety and additional servings of fruits and vegetables and increased whole grains. Following the release of the regulations in January 2012, school nutrition directors posted comments to a listserv expressing concern about their programs' ability to financially support these changes (USDA/FNS, 2012a). Prior to issuance of the new meal pattern requirements, a position paper issued jointly by the American Dietetic Association, the School Nutrition Association (SNA) and the Society for Nutrition Education (SNE) described the need for new kitchen equipment for schools and the training of school employees in offering healthier foods (ADA, 2010).

Fryett (1996) identified reach-in refrigerators and freezers and walk-in refrigerators and freezers as common types of equipment in the food service industry. Pass-through, roll-in, and under-counter refrigerators and freezers are additional types of refrigeration equipment. Service areas may include refrigerated display cases, deli counters, salad bars, or vending merchandisers. Milk coolers, ice cream cabinets, soft serve ice cream machines, and ice machines are specialty types of refrigeration equipment (Almanza, 2009; Fryett). Blast chillers are designed to quickly reduce the temperature of food (Traulsen, 2011).

Despite the concerns expressed about refrigerated storage equipment, published research about refrigeration equipment in child nutrition is sparse. Krishnamurthy and Sneed (2011) identified cooling equipment available in schools, with approximately 85% of schools having walk-in refrigerators and 84% with walk-in freezers. Slightly over 40% of respondents indicated the presence of reach-in freezers and around 60% reported having reach-in refrigerators. The

Krishnamurthy and Sneed study is the only recent study reporting on refrigeration equipment in schools.

The purpose of this study was to gain insight into the refrigeration availability and perceived adequacy of current refrigerated equipment to meet the new meal pattern requirements. In addition, practices to compensate for inadequate refrigerated storage, barriers to purchasing refrigeration equipment, and resources used to develop refrigeration equipment specifications were investigated. The hypothesis guiding this research was that no significant differences exist between perceived adequacy of refrigerated storage based on school nutrition director characteristics.

## **Methodology**

The Kansas State University Committee for Research Involving Human Subjects approved the research protocols. The mixed methods research methodology included a modified Delphi technique, on-site observation, a pilot study, and a regional survey of school nutrition directors.

### ***Sample***

The target population included 2,501 school nutrition directors in the USDA Food and Nutrition Service's Southwest Region, including the states of Arkansas (254), Louisiana (134), New Mexico (238), Oklahoma (530) and Texas (1345). Email addresses for the directors were obtained from four of the states and one state (Arkansas) sent the survey using their email system. Dillman, Smyth and Christian (2007) identified completed sample sizes needed for populations of 2,000 and 4,000, 5% margin of error, and a 80/20 split to be 219 and 232 respectively. Due to the complexity of the information requested and length of the survey and the review of literature of survey response rates for school nutrition management topics, an



estimated 12% response rate was projected to obtain 300 responses. Due to concerns about incomplete information in the returned surveys, the entire population of 2,501 was included in the sample.

### ***Instrument Development***

After a thorough review of literature, experts in child nutrition programs were identified to serve on a Delphi panel to assist in development of a survey. The panelists were asked to respond electronically to open-ended questions regarding content of the instrument and the survey process. Three rounds allowed the panelists to provide assistance in the development of an instrument, which was then tested by 10 school nutrition directors in Kansas. The state director for child nutrition programs provided suggestions of directors who were from a variety of sizes and types of schools from across the state of Kansas. The 10 school nutrition directors answered the survey prior to onsite visits by the researcher. The researcher elicited feedback on the instrument and the survey process. The reliability of the self-reported data was checked by comparing the reported descriptions and measures of the refrigeration equipment to the actual equipment. The data entered by the directors was verified without discrepancy, indicating high reliability of data provided. The Kansas directors gave feedback about the directions in the survey invitation as well as recommendations for specific questions.

Following further revision of the instrument, Kansas school nutrition directors, excluding those participating in the site observation, piloted the instrument. A response rate of 16% (n=69) was obtained with an average time of 63 minutes to complete the survey. Based on pilot study results, some questions were eliminated from the survey and the order questions were asked was modified.

The final instrument was formatted using an online survey tool. For specific refrigeration information, directors were instructed to select the second school from an alphabetical list of all schools in the district. If there was only one school in the district, that school was used. The questionnaire sections included demographic characteristics of school nutrition director and school; inventory and detailed descriptions of refrigeration equipment in one school; and Likert-type scales to measure adequacy, barriers, resources, and practices related to refrigeration equipment. Characteristics describing the director included sex, years in position, years of school nutrition experience, education level, location of employment, and certification/credentials/memberships. Schools were described by type of school, enrollment, type of food production system, number of lunch entrée choices, total daily meals, management type, percent free and reduced price meals, student participation rate in the NSLP, and program participation.

The barriers investigated included insufficient funding, lack of space in the kitchen, inadequacy of utilities, obtaining approval from district administrators, having sufficient knowledge to write specifications, making time to complete the purchasing process, and state and federal procurement regulations. Resources studied contained manufacturer's representative, representative from local equipment company, specification sheets from company, sample specifications from manufacturer, resources from the National Food Service Management Institute, State agency staff, the School Nutrition Association, cooperative purchasing organization, specifications used previously, foodservice consultant, peers, and personal experience. Maintaining low inventory, adjusting menus, and using high capacity shelving are some of the 14 practices used or recommended by directors to compensate for inadequate refrigeration space. Adequacy of refrigerated storage, barriers to purchasing

refrigeration equipment, resources to develop refrigeration equipment specifications, and practices to compensate for inadequate refrigerated storage were evaluated using a five-point Likert-type scale ranging from strongly disagree (1) to strongly agree (5).

The introductory email described the purpose of the survey and directions to complete an inventory of the refrigeration in the one selected school using the list of refrigeration equipment provided by the researcher. Directors were asked to complete the inventory of refrigeration equipment prior to opening the survey. A URL link to the survey was included in the email message. Three reminders, approximately weekly, were sent to all school nutrition directors to increase response rates. Survey respondents were given an incentive for completing the survey: the opportunity to win a training session to be held in their school district. At the end of the initial survey offering, the response rate was lower than desired. The survey was reopened for an additional 18 days with three additional reminders to increase the response rate.

SPSS® version 20.0 was used to analyze the data. Statistics were calculated for demographic and operational characteristics and types of refrigerated equipment were reported as frequencies. Means and standard deviations were computed for barriers, resources, practices, and adequacy measures. Mean scores of adequacy were compared to director and school characteristics using the independent samples *t* test. Mean scores of adequacy and barrier measures were compared to different variables using analysis of variance (ANOVA) with post hoc analysis. Cronbach's alpha was used to measure internal consistency of scaled items. A probability of  $p < 0.05$  was used for testing significance.

## **Results and Discussion**

Of the 2,501 email addresses of school nutrition directors in the Southwest Region, only 2,392 were deliverable. Response rates by state were 5.7% (Arkansas), 15.3% (Louisiana),

14.1% (New Mexico), 9.1% (Oklahoma), and 10.1% (Texas). Data analysis was conducted on 240 completed surveys, yielding an overall response rate of 10.0%. This response rate compared to other recent studies conducted with school nutrition directors; the Krishnamurthy and Sneed (2011) study reported a 10.0% response rate and the research reported by Stinson, Carr, Nettles, and Johnson (2011) obtained a 9.2% response rate, however it was lower than studies reported by Moliason and Nettles (2010); Rice, Strohbahn, Shelly, Arendt, and Gregoire (2010); and Paez, Arendt, and Strohbahn (2011) which ranged from 22% to 28.9%.

Characteristics of the school nutrition directors are illustrated in Table 4.1. Of the 240 directors, 87.1% were female, which is similar to that reported by Stinson, Carr, Nettles, and Johnson (2011). Over 70% had been in their position 10 years or less, which is higher than the 54.4% reported by Molaison and Nettles and the 65% reported by Stinson et al. Ten years or less experience in school nutrition was reported by 42.5% of the respondents, comparable to the 41.3% reported by Molaison and Nettles and slightly higher than the 36% reported by Stinson et al. College degrees were held by 49.5% of the respondents, less than the 57.5% reported by Stinson et al. Over half of the respondents were from Texas, followed by Oklahoma (19.6%), New Mexico (12.1%), Louisiana (8.3%), and Arkansas (5.8%).

Schools were described by the type of school, enrollment, meals served, type of food production system, complexity of lunch menu, percent free and reduced price meals, National School Lunch Program student participation rate, and management type (Table 4.2). Pre-K or K-12 schools were reported most frequently (n=73, 30.4%) followed by elementary schools (n=63, 26.3%). Approximately 38% of the schools had an enrollment of 300 students or less. Over 78% of schools used onsite food preparation with some convenience items as their food production system. One entrée choice was offered by almost half of the schools (n=118, 49.2%). The

remainder of the schools offered two entrée choices (n=62, 25.8%) or three or more entrée choices (n=60, 25.0%). Slightly over 13% indicated the child nutrition program was managed by a food management company, more than the 2.7% identified in the School Nutrition Operations Report (School Nutrition Association, 2011). Additional characteristics of the schools are illustrated in Table 4.2.

**Table 4.1. Characteristics of School Nutrition Directors (n=240)**

Characteristic	n	% <sup>a</sup>	Characteristic	n	% <sup>a</sup>
Sex			Location of employment		
Female	209	87.1	Arkansas	14	5.8
Male	31	12.9	Louisiana	20	8.3
Years in Position			New Mexico	29	12.1
10 years or less	169	70.4	Oklahoma	47	19.6
More than 10 years	71	29.6	Texas	130	54.2
Years School Nutrition Experience			Certifications/Credentials <sup>b</sup>		
10 years or less	102	42.5	Other food safety certification	143	59.6
More than 10 years	138	57.5	ServSafe certification	120	50.0
Education Level			Certified Director	34	14.2
High school, some post-secondary	121	50.4	School Nutrition Specialist	30	12.5
College degree	119	49.6	Registered Dietitian	22	9.2
			Certified Dietary Manager	11	4.6
			Certified Chef	8	3.3
			Dietetic Technician Registered	2	0.8
			Memberships <sup>b</sup>		
			School Nutrition Association	92	38.3
			Academy of Nutrition and Dietetics (formerly American Dietetic Association)	15	6.3

<sup>a</sup>Responses may not equal 100% due to non-response to a question or rounding.

<sup>b</sup>Respondent able to choose multiple responses

**Table 4.2. Characteristics of Schools (n=240)**

Characteristic	n	% <sup>a</sup>	Characteristic	n	% <sup>a</sup>
Type of school			Average total daily meals from school		
Pre-K or K – 12	73	30.4	0 – 300	71	29.6
Pre-K or K – 8	33	13.8	301 – 700	87	36.3
Elementary	63	26.3	701 and greater	82	34.3
Middle	22	9.2	Program participation		
High School	32	13.3	School Breakfast Program	219	91.3
Other	17	7.1	After School Snack Program	85	35.4
School enrollment			Fresh Fruit and Vegetable Program	56	23.3
Up to 300	91	37.9	Special Milk Program	12	5.0
301 - 550	74	30.8	Supper Program	6	2.5
Greater than 550	75	31.3	Other programs/services		
Type of food production			A la carte	73	30.4
Onsite preparation, some convenience	189	78.8	Child care (Headstart, CACFP, Pre-K)	34	14.2
Onsite preparation, all scratch cooking	23	9.6	Breakfast in the classroom	25	10.4
Central kitchen	8	3.3	Catering	29	12.1
Purchased preplated meals	6	2.5	Vending by School Nutrition	9	3.8
Satellite kitchen rec food/some prep	5	2.1	Percent Free and Reduced Price Meals		
Satellite kitchen receives food/no prep	5	2.1	Less than 70%	115	47.9
Other	4	1.7	70% and greater	125	52.1
Lunch entrée choices			Student participation rate in NSLP		
1 entrée choice	118	49.2	Less than 85%	111	46.3
2 entrée choices	62	25.8	85% and higher	129	53.7
3 or more entrée choices	60	25.0	Management Type		
			Self-operated	208	86.7
			Food management company	32	13.3

<sup>a</sup>Responses may not equal 100% due to non-response to a question or rounding.

Milk boxes were the most frequently reported refrigeration equipment (n=212, 88.3%), followed by walk-in freezers (75.0%) and reach-in refrigerators (73.8%). Walk-in refrigerators were reported in 71.7% of the schools and reach-in freezers in 39.2% of schools. In comparing results to a previous study (Krishnamurthy & Sneed, 2011), the percent of schools with walk-in freezers and walk-in refrigerators were higher and the percent of reach-in refrigerators were lower. It would appear that the number of reach-in refrigerators decrease as the number of walk-ins increase. Blast chillers were reported in only 0.8% of the schools, much lower than the 8% reported by Krishnamurthy and Sneed.

**Table 4.3. Availability of Refrigeration Equipment (n=240)**

Type of Equipment	Frequency	Percent <sup>a</sup>
Milk box	212	88.3
Walk-in Freezer	180	75.0
Reach-in Refrigerator	177	73.8
Walk-in Refrigerator	172	71.7
Reach-in Freezer	94	39.2
Pass-through or Roll-in Refrigerator	72	30.0
Refrigerated serving line equipment	71	29.6
Ice cream cabinet or yogurt machine	61	25.4
Pass-through or Roll-in Freezer	9	3.8
Under-counter Refrigerator	8	3.3
Under-counter Freezer	3	1.3
Blast chiller	2	0.8

<sup>a</sup>Totals do not equal 100% because respondent could choose multiple answers.

Many schools reported more than one of particular types of refrigeration equipment. Of the 180 schools with walk-in freezers, 17 reported having more than one walk-in freezer and of the 212 schools with milk boxes, 70 schools reported having multiple milk coolers in the school. The size of the equipment also varied. The most common reach-in refrigerator was the double-section (n=87) and the most common size milk cooler was the 16 case (n=89).



Over 40% of directors identified refrigeration equipment when asked what type of equipment would be purchased based on greatest need. This was followed by cooking equipment (n=80, 33.3%). In the *2012 Back to School Trends Report*, refrigerators or freezers (47.8%) were second to ovens, warmers or broilers (52.5%) when directors were asked what items they have purchased or were considering purchasing (SNA, 2012).

**Table 4.4. Equipment to be Purchased based on Greatest Need (n=240)**

Equipment type	Frequency	Percent <sup>a</sup>
Refrigeration equipment	97	40.4
Cooking equipment	80	33.3
Service equipment	43	17.9
Sanitation equipment	20	8.3

<sup>a</sup>Number may not equal 100 due to rounding.

Directors were asked to determine barriers to purchasing refrigeration equipment in their school nutrition program using a five-point Likert-type scale (1=strongly disagree, 5=strongly agree). None of the items had a mean score higher than 3.5 on the five-point scale. This indicated that there were no barriers with a strong presence throughout the school nutrition programs participating in the study. Respondents rated lack of space in the kitchen (3.5±1.3) and insufficient funding (3.5±1.3) highest. Having sufficient knowledge to write specifications (2.4±1.1) and making time to complete the purchasing process (2.3±1.1) were rated lowest of the barriers to purchasing.

When asked about practices to compensate for inadequate refrigerated storage, the respondents rated maintaining low inventory first (3.7±1.0), followed by decreasing the number of items purchased (3.3±1.1), scheduling more frequent deliveries of refrigerated items (3.3±1.1), and using high capacity shelving (3.3±1.1) as shown in Table 4.6. Ratings were based on a five-point Likert-type scale. Although respondents indicated they were likely to schedule

**Table 4.5. Barriers to Purchasing Refrigeration Equipment (n=240)**

Factor	Mean±SD	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	$\alpha=0.705$	←———— n (%) —————→				
Lack of space in the kitchen	3.5±1.3	29 (12.1)	25 (10.4)	55 (22.9)	63 (26.3)	68 (28.3)
Insufficient funding	3.5±1.3	29 (12.1)	25 (10.4)	55(22.9)	63 (26.3)	68 (28.3)
Inadequacy of utilities	2.9±1.2	35 (14.3)	48 (20.0)	85 (35.4)	45 (18.8)	27 (11.3)
Obtaining approval from district administrators	2.7±1.2	46 (19.2)	60 (25.0)	74 (30.8)	41 (17.1)	19(7.9)
State and federal procurement regulations	2.5±1.0	53 (22.1)	54(22.5)	103 (42.9)	26 (10.8)	4 (1.7)
Having sufficient knowledge to write specifications	2.4±1.1	64 (26.7)	55(22.9)	85 (35.4)	32 (13.3)	4 (1.7)
Making time to complete the purchasing process	2.3±1.1	69 (28.7)	68 (28.3)	73 (30.4)	26 (10.8)	4 (1.7)

Scale values ranged from Strongly disagree (1) to Strongly agree (5).

SD=Standard Deviation

more frequent deliveries, they strongly indicated they were not likely to pay extra fees or higher prices for more frequent deliveries (2.1±1.1). Respondents indicated they were least likely to rent or lease offsite refrigeration space (1.9±1.1).

Directors primarily used personal experience (3.8±1.0) and specification sheets from a company (3.7±0.9) in developing specifications for refrigeration equipment (Table 4.7). Considering that over 70% of the respondents had 10 years or less in their position, it is not clear how initial experience in specification development is obtained. External resources from organizations such as the National Food Service Management Institute, the School Nutrition Association, the State agency, and cooperative purchasing organizations are not utilized as much as internal resources such as personal experience, peers, and specifications previously used in the district. Foodservice consultants (3.0±1.1) were least likely to be considered in specification development.

Directors were asked to rank the adequacy of freezer (frozen food) and refrigeration (chilled food) storage space in the selected school and the adequacy of refrigerated storage in the school district to meet requirements of the new meal patterns. Over 35% of directors indicated that refrigerated storage (including frozen and chilled food storage) in the school was not adequate to meet new requirements. Thirty-five percent of directors indicated they strongly disagreed or disagreed with the statement that current freezer space in the school is adequate to store and serve the additional fruit and vegetable requirements in the new meal pattern. Over 39% of directors strongly disagreed or disagreed with the statement that current refrigeration space in the school is adequate. The adequacy of refrigeration capacity for the school nutrition program (all schools) provided comparable results, 40.4% of directors strongly disagreed or

**Table 4.6. Practices to Compensate for Inadequate Refrigerated Storage (n=240)**

Type of Practice	Mean±SD	Definitely not likely to use	Not likely to use	Neutral	Likely to use	Definitely likely to use
	$\alpha=0.814$	←----- n (%) -----→				
Maintain low inventory	3.7±1.0	9(3.8)	20(8.3)	54(22.5)	114(47.5)	43(17.9)
Decrease the number of items purchased	3.3±1.1	17(7.1)	33(13.8)	68(28.3)	98(40.8)	24(10.0)
More frequent deliveries of refrigerated items	3.3±1.1	17(7.1)	42(17.5)	60(25.0)	91(37.9)	30(12.5)
Use high capacity shelving	3.3±1.1	16(6.7)	37(15.4)	64(26.7)	103(42.9)	20(8.3)
Make more items from scratch	3.2±1.0	16(6.7)	39(16.3)	87(36.3)	80(33.3)	18(7.5)
Plan just-in-time deliveries of refrigerated items	3.1±1.1	23(9.6)	53(22.1)	67(27.9)	74(30.8)	23(9.6)
Adjust the menu to reduce refrigerated items	3.1±1.1	19(7.9)	65(27.1)	62(25.8)	71(29.6)	23(9.6)
Use local producers or farm-to-school program	3.0±1.1	29(12.1)	44(18.3)	85(35.4)	61(25.4)	21(8.8)
Investigate cooperative bidding to offset costs	3.0±1.1	28(11.7)	43(17.9)	87(36.3)	64(26.7)	18(7.5)
Change from refrigerated to shelf-stable items	2.6±1.1	43(17.9)	63(26.3)	86(35.8)	40(16.7)	8(3.3)
Add walk-in refrigerator/freezer at warehouse	2.4±1.2	74(30.8)	58(24.2)	60(25.0)	39(16.3)	9(3.8)
Lease refrigeration equipment for onsite	2.1±1.1	92(38.3)	72(30.0)	49(20.4)	19(7.9)	8(3.3)
Pay more frequent deliveries	2.1±1.1	91(37.9)	73(30.4)	52(21.7)	16(6.7)	8(3.3)
Rent or lease refrigeration space offsite	1.9±1.1	111(46.3)	68(28.3)	38(15.8)	15(6.3)	8(3.3)

Scale values range from Definitely Not Likely to Use (1) to Definitely Likely to Use (5).

SD=Standard Deviation

**Table 4.7. Resources to Use in Development of Refrigeration Specifications (n=240)**

Resource	Mean±SD	Definitely not likely to use	Not likely to use	Neutral	Likely to use	Definitely likely to use
	$\alpha=0.88$	← n (%) →				
Personal experience	3.8±1.0	11 (4.6)	7 (2.9)	58 (24.2)	119 (49.6)	45 (18.8)
Specification sheets from company	3.7±0.9	8(3.3)	12 (5.0)	66 (27.5)	122 (50.8)	32 (13.3)
Sample specifications from manufacturer	3.6±0.9	6(2.5)	16 (6.7)	76 (31.7)	109 (45.4)	33(13.8)
Specifications used previously in my district	3.5±1.0	16 (6.7)	18 (7.5)	68 (28.3)	105 (43.8)	33 (13.8)
Representative from local equipment company	3.5±1.0	10 (4.2)	26 (10.8)	73 (30.4)	101 (42.1)	30 (12.5)
Manufacturer’s representative	3.4±1.0	9 (3.8)	23 (9.6)	90 (37.5)	89 (37.1)	29 (12.1)
Peers	3.4±1.0	17 (7.1)	26 (10.8)	79 (32.9)	92 (38.3)	26 (10.8)
Resources from National Food Svc. Mgt. Inst.	3.3±1.0	11 (4.6)	33 (13.8)	90 (37.5)	79 (32.9)	27 (11.3)
Resources from School Nutrition Association	3.2±1.1	20 (8.3)	32 (13.3)	83 (34.6)	85 (35.4)	20 (8.3)
Resources from State agency staff	3.2±1.0	20 (8.3)	31 (12.9)	94 (39.2)	75 (31.3)	20 (8.3)
Cooperative purchasing organization	3.2±1.1	28 (11.7)	33 (13.8)	76 (31.7)	80 (33.3)	23 (9.6)
Foodservice consultant	3.0±1.1	31 (12.9)	40 (16.7)	82 (34.2)	68 (28.3)	19 (7.9)

Scale values ranged from Strongly disagree (1) to Strongly agree (5).

SD=Standard Deviation

disagreed with the statement that in general, the refrigeration capacity for their school nutrition program is adequate (Table 4.8).

Perceived adequacy of school refrigerated space was compared to characteristics of school nutrition directors. Independent sample *t* tests were conducted for years of school nutrition experience, years in position, sex, and education level. The perceived adequacy of current freezer storage space and perceived adequacy of current refrigeration (chilled food) storage space at the school level differed significantly between school nutrition directors with less than 10 years' experience and those with 10 or more years' experience. More experienced directors rated adequacy of freezer storage higher than their less experienced counterparts but rated adequacy of refrigeration storage (chilled food) lower than those less experienced. A statistically significant difference ( $p \leq 0.05$ ) was found in the perceived adequacy of current refrigeration storage space by years in position of the school nutrition director (Table 4.9). Directors who had held their position for 10 years or more rated refrigerated storage adequacy higher than their less experienced counterparts. Perceived adequacy did not differ significantly by sex or education level.

Perceived adequacy of current freezer and refrigeration storage space was compared to characteristics of schools. Independent sample *t* tests and ANOVA tests were conducted to compare complexity of menu, number of meals, management type, percent free and reduced price meals, student participation rates, school enrollment, and type of food production system to perceived adequacy. No significant differences were identified.

**Table 4.8. Overall Adequacy of Refrigerated Storage at School and School District (n=240)**

Factor	Mean±SD	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	$\alpha=0.85$	← n (%) →				
In comparing the adequacy of refrigeration (chilled food) storage space in the selected school to the adequacy of refrigeration storage in the district as a whole, they are about the same.	3.3±1.2	23(9.6)	42(17.5)	54(22.5)	81(33.8)	40(16.7)
In comparing the adequacy of freezer (frozen food) storage space in the selected school to the adequacy of refrigeration storage in the district as a whole, they are about the same.	3.3±1.2	27(11.3)	40(16.7)	55(22.9)	82(34.2)	36(15.0)
Current freezer (frozen food) storage space in the selected school is adequate to store and serve the additional fruit and vegetable requirements in the new meal pattern.	3.2±1.4	37(15.4)	47(19.6)	31(12.9)	80(33.3)	45(18.8)
Current refrigeration (chilled food) storage space in the selected school is adequate to store and serve the additional fruit and vegetable requirements in the new meal pattern.	3.1±1.3	35(14.6)	59(24.6)	29(12.1)	78(32.5)	39(16.3)
Refrigeration storage in the selected school is more adequate than most schools in the district.	3.0±1.2	36(15.0)	43(17.9)	81(33.8)	52(21.7)	28(11.7)
In general, the refrigeration capacity for the school nutrition program (considering all schools) is adequate.	3.2±1.4	25 (10.4)	72 (30.0)	26 (10.8)	73 (30.4)	39 (16.3)

Scale values range from Strongly Disagree (1) to Strongly Agree (5).

SD=Standard Deviation

**Table 4.9. Comparison of Adequacy of School Refrigeration and School Nutrition Director Characteristics**

Factor (Items) Adequacy of Refrigerated Storage at Selected School	Mean ± SD for Years School Nutrition Experience		Mean ± SD for Years in Positions		Mean ± SD for Sex		Mean ± SD for Education Level	
	<10 Years(n=102)	≥10 Years (n=138)	<10 Years in Position (n=169)	≥10 Years in Position (n=71)	Female (n=209)	Male (n=31)	No College Degree (n=121)	College Degree (n=119)
Current freezer (frozen food) storage space in the selected school is adequate to store and serve the additional fruit and vegetable requirements in the new meal pattern.	3.2±1.3*	3.3±1.4*	3.1±1.3	3.4±1.4	3.2±1.4	3.4±1.2	3.4±1.4	3.0±1.3
Current refrigeration (chilled food) storage space at the selected school is adequate to store and serve the additional fruit and vegetable requirements in the new meal pattern.	3.1±1.2*	3.1±1.4*	3.0±1.3*	3.3±1.4*	3.1±1.4	3.2±1.2	3.3±1.4	2.9±1.3

Scale values range from Strongly Disagree (1) to Strongly Agree (5).

SD = Standard Deviation

\* p<0.05



**Table 4.10. Comparison of Adequacy of School Refrigeration and School Characteristics**

Factor (Items)	Mean ± SD for Complexity of Menu		Mean ± SD for Number of Meals		Mean ± SD for Management Type		Mean ± SD for Free & Reduced Price Meals		Mean ± SD for Student Participation Rate	
	1 entrée (n=118)	2 or more entrees (n=122)	≤300 meals (n=71)	>300 meals (n=169)	Self (n=208)	Company (n=32)	<70% Free & Reduced Price Meals (n=115)	≥70% Free & Reduced Price Meals (n=125)	<85% Student Participation Rate (n=111)	≥85% Student Participation Rate (n=129)
Adequacy of Refrigerated Storage										
Current freezer (frozen food) storage space is adequate	3.2±1.4	3.2±1.4	3.3±1.3	3.2±1.4	3.2±1.4	3.2±1.4	3.3±1.4	3.1±1.4	3.2±1.4	3.2±1.3
Current refrigeration (chilled food) storage space is adequate	3.1±1.3	3.1±1.4	3.2±1.3	3.1±1.4	3.3±1.2	3.2±1.3	3.2±1.3	3.3±1.2	3.2±1.3	3.3±1.2

Scale values range from Strongly Disagree (1) to Strongly Agree (5).

SD = Standard Deviation

\* p<0.05

**Table 4.10. Comparison of Adequacy of School Refrigeration and School Characteristics (continued)**

Factor (Items)	Mean ± SD for School Enrollment		Mean ± SD for Food Production System	
	≤300 students (n=91)	>300 students (n=149)	Onsite, some convenience (n=189)	All other (n=51)
Adequacy of Refrigerated Storage				
Current freezer (frozen food) storage space is adequate	3.2±1.4	3.2±1.4	3.2±1.4	3.1±1.4
Current refrigeration (chilled food) storage space is adequate	3.1±1.3	3.1±1.4	3.1±1.3	3.1±1.4

Scale values range from Strongly Disagree (1) to Strongly Agree (5).

SD = Standard Deviation

\* p<0.05

## **Applications to Child Nutrition Professionals**

Over 35% of school nutrition directors perceived the refrigerated storage space to be inadequate to meet the new meal pattern requirements. This result must be addressed in order to continue to provide safe and nutritious meals in the NSLP. Training for school nutrition staff in practices to compensate for inadequate storage is one way to deal with the problem. Inadequate refrigerated storage and the potential unsafe storage of food is of concern because of the potential harm to students. The practices to compensate for inadequate storage identified in this study may be used in the local schools if refrigerated storage is inadequate. Maintaining low inventory and decreasing the number of items purchased allows improved circulation of air and maintenance of safe temperatures in refrigerated storage. School nutrition professionals may use the results of this study to support their requests for funding to purchase refrigeration equipment.

Refrigeration equipment was chosen most often as the type of equipment to be purchased according to need. Almost 40% of directors indicated a concern with adequacy of refrigerated (chilled food) storage space and 35% indicated perceived inadequacy of the freezer storage space. As the new meal patterns are implemented during the 2012 school year, policymakers and stakeholders in school nutrition programs should be responsive to the potential need for additional refrigeration in schools to safely serve nutritious meals in an efficient manner.

The perceived inadequacy of refrigerated storage space by more experienced directors is less than that of less experienced directors. Less experienced directors may look to their more experienced counterparts for mentoring and suggestions for building their program. Additional training on the use and purchase of equipment may be needed.

The barriers to purchasing refrigeration identified in this study may be used by school nutrition directors to evaluate their own barriers and develop strategies for overcoming barriers

to obtain adequate refrigeration storage. Lack of space in the kitchen and inadequacy of utilities have implications for foodservice consultants who design kitchens, as well as administrators in schools responsible for buildings. This information can provide facts helpful to directors in approaching school administrators about keeping school nutrition directors involved in the facility planning process. Discussing total refrigeration capacity rather than just pieces of equipment planned for a new kitchen can provide credibility for the director's involvement in planning. Resources identified in this study may be used by school nutrition directors to develop refrigeration equipment specifications. Resources available from the National Food Service Management Institute, the School Nutrition Association, and the state agency did not appear to be utilized by many directors.

### *Limitations*

Several limitations apply to this study. The response rate of the online survey was 10.0%, similar to a recent school foodservice survey by Krishnamurthy and Sneed (2011) but lower than other school nutrition studies. The low response rate may be attributed to the complexity of the online survey, the time required to complete the survey and the time period the survey was administered. Dillman (2007) discussed limited computer access and complexity of the online survey possibly contributing to low response rates. Since email is commonly used by state agencies to communicate with school nutrition directors, access did not seem to be a problem but answering the survey was time consuming. The burden on the respondent was high since directors had to inventory and collect information about the refrigerated equipment in a selected school, requiring special efforts if their office was not located in that school. Email messages were received from potential respondents regarding the length of the survey at a time when the end-of-school-year activities were requiring attention. A state director indicated that

the mild winter meant that “snow days” reserved in the school calendar were not used and schools dismissed students earlier than usual. Although the total population of school nutrition directors in the Southwest Region was sampled, the generalization of findings to the population may be difficult. Survey participants were volunteers and may have been more interested in refrigeration equipment issues than the general population, possibly resulting in non-response bias.

### ***Recommendations***

It is evident that refrigeration equipment is necessary to serve safe and nutritious foods in the NSLP. School nutrition directors with inadequate refrigeration space should train school nutrition staff in the practices to compensate for inadequate refrigerated storage. Certain purchasing practices may be beneficial when additional refrigeration equipment is not available.

The barriers to purchasing refrigeration equipment must be addressed when inadequate refrigerated storage exists. School nutrition directors need to identify the existing barriers to purchasing refrigeration equipment and consider ways to reduce or eliminate the barriers. Foodservice consultants can design school kitchens that meet the needs of the school nutrition program but changes in regulations, number of meals served, and menus can quickly impact storage needs; therefore directors should be prepared to address changing needs.

Training in development of refrigeration equipment specifications should be conducted to assist school nutrition directors without experience in specification development. Directors should seek resources that are available from all sources. School nutrition directors developing specifications for equipment who use representatives from local equipment companies or manufacturers should review procurement policies to verify that assisting with specification development is not rendering the company ineligible to bid on the equipment (USDA/FNS,

2009). Directors should investigate the resources available from external organizations that often provide complimentary resources and communicate their need for assistance in writing specifications.

Future research is needed to determine actual refrigeration space available in school nutrition programs and factors influencing the amount of refrigeration space available. Since school nutrition programs have many variables (i.e., types of schools, menus, food production systems, numbers of meals served), the future study of similar programs may assist researchers in identifying specific guidelines for similar school nutrition programs. The development of a decision model for purchasing refrigeration equipment is needed to assist school nutrition directors.

## References

Almanza, B. (2009). *Equipment purchasing and facility design for school nutrition programs*.

Retrieved from <http://nfsmi.org/documentlibraryfiles/PDF/20090312115009.pdf>

American Dietetic Association, School Nutrition Association, & Society for Nutrition

Education. (2010). Comprehensive School Nutrition Services. *Journal of the*

*American Dietetic Association, 110*, 1738-1748.

American Recovery and Reinvestment Act. (2009). Public Law 111-5. (February 17, 2009).

120Stat. 115. Retrieved from <http://www.gpo.gov/fdsys/pkg/PLAW-111publ5/pdf/>

PLAW-111publ5.pdf

Child Nutrition and WIC Reauthorization Act. (2004). Public Law 108-265. (June 30, 2004).

118 STAT. 729. Retrieved from <http://www.fns.usda.gov/cnd/Governance/>

Legislation/Historical/PL\_108-265.pdf

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2009). Internet, mail, and mixed-mode

surveys (3<sup>rd</sup> ed.). Hoboken, NJ: John Wiley & Sons, Inc.

Education Facilities Laboratories. (1968). *20 Million for lunch*. New York: Author.

Fryett, D. K. (1996). *An introduction to the foodservice industry*. Chicago, IL: North

American Association of Food Equipment Manufacturers.

Gunderson, G. W. (1971). *The National School Lunch Program: Background and*

*Development*. Washington, DC: U. S. Government Printing Office.

Healthy and Hunger-Free Kids Act. (2010). Public Law 111-296 (December 13, 2010) 124

Statute3183. Retrieved from <http://www.gpo.gov/fdsys/pkg/PLAW-111publ296/pdf/>

/PLAW-111publ296.pdf

- Krishnamurthy, K. & Sneed, J. (2011). Cooling practices used in school foodservice. *Food Protection Trends*, 31(12), 828-833.
- Library of Congress. Congressional Research Service. (1976). Legislative history of the child feeding programs. Retrieved from <http://www.lexisnexis.com.er.lib.k-state.edu/congcomp/getdoc?CRDC-ID=CRS-1976-EPW-0023>
- Martin, M. J. & Oakley, C. B. (Eds.). (2008). *Managing child nutrition programs: Leadership for excellence (2<sup>nd</sup> ed.)*. Sudbury, MA: Jones and Bartlett Publishers.
- Molaison, E. F. & Nettles, M. F. (2010). Special food and nutrition needs in school nutrition programs. *Journal of Child Nutrition*, 34(1).
- National Academy of Sciences, Institute of Medicine. (2009). *School meals: Building blocks for healthy children report brief*. Retrieved from <http://www.iom.edu/~media/Files/Report%20Files/2009/School-Meals/School%20Meals%202009%20%20Report%20Brief.pdf>
- Paez, P., Arendt, S., & Strohbahn, C. (2011). Training: An opportunity for people with disabilities in school foodservice operations. *Journal of Child Nutrition*, 35(1).
- Perrott, G. St. J. (1946). Selective Service rejection statistics and some of their implications. *American Journal of Public Health*, 36, 336-342.
- Rice, B. W., Strohbahn, C., Shelly, M. C., Arendt, S., & Gregoire, M. (2010). Comparison of cooperative and noncooperative purchasing in school nutrition programs. *Journal of Child Nutrition*, 34(2).
- School Nutrition Association. (2011). *School Nutrition Operations Report 2011*. National Harbor, MD: Author.
- School Nutrition Association. (2012). *2012 Back to School Trends Report*. National Harbor, MD: Author.



- Stinson, W. B., Carr, D., Nettles, M. F., & Johnson, J. T. (2011). Food safety programs based on HACCP principles in school nutrition programs: Implementation status and factors related to implementation. *Journal of Child Nutrition, 35*(1).
- Traulsen. (2011). Blast chiller. Retrieved from <https://my.hobartcorp.com/resourcecenter/ProductDocumentation/TR35799%20rbc200.pdf>
- U.S. Department of Agriculture, Food and Nutrition Service. (2009). Equipment Specifications for the 2009 Equipment Assistance Grants for School Food Authorities. (Policy Memo SP 24-2009). Retrieved from [http://www.fns.usda.gov/cnd/Governance/Policy-Memos/2009/SP\\_24-2009\\_os.pdf](http://www.fns.usda.gov/cnd/Governance/Policy-Memos/2009/SP_24-2009_os.pdf)
- U.S. Department of Agriculture, Food and Nutrition Service. (2012a). Mealtalk. Retrieved from <http://healthymeals.nal.usda.gov/get-connected/mealtalk>
- U.S. Department of Agriculture, Food and Nutrition Service. (2012b). National School Lunch Program fact sheet. Retrieved from <http://www.fns.usda.gov/cnd/lunch/AboutLunch/NSLPFactSheet.pdf>
- U.S. Department of Agriculture, Food and Nutrition Service. (2012c). School meals programs Retrieved from <http://www.fns.usda.gov/cnd/>

# **Chapter 5 - A Study of Refrigeration Equipment Capacity and Preliminary Decision Model for School Nutrition Programs in the USDA Southwest Region**

## **Abstract**

Serving safe and nutritious school lunches to over 31 million children each school day presents challenges to school nutrition directors. Refrigeration equipment plays an important role in the safety and efficiency of providing these meals yet little is known about the equipment capacity of existing school programs. The purpose of this study was to determine the amount of space refrigerated equipment space by type, examine differences in refrigeration capacity by school characteristics, and determine factors that may predict capacity.

A modified Delphi technique, site observations, pilot study, and electronic survey were utilized in the research design. School nutrition directors in the USDA/FNS Southwest Region (N=2501) served as the population. An online survey was conducted to identify an inventory of a school's refrigeration equipment and refrigerated storage capacity, perceived adequacy of refrigerated storage, school characteristics, and school nutrition director demographics. Data analysis included descriptive statistics, independent sample t-tests, ANOVA, and regression.

Walk-in freezers and walk-in refrigerators provided over 95% of refrigerated storage. Approximately 54% of this was frozen food storage versus chilled food storage. The mean average cubic feet of refrigeration per school was  $1423 \pm 1152$  with the cubic feet per meal being  $3.37 \pm 3.29$ . Over one-third of school nutrition directors perceived refrigerated storage to be inadequate to meet the new meal pattern requirements. Significant differences in cubic feet of refrigerated storage by type of school and perceived adequacy were identified. School enrollment was a predictor of total cubic feet of refrigerated storage.

This study provides empirical data on refrigerated storage capacity by school and by meal that may be used as a benchmarking reference for school nutrition directors. Methods identified in this study may be implemented by local school nutrition directors to maximize refrigerated storage in their schools. Researchers can replicate this study in other USDA regions and focus on school nutrition programs with similar food production systems, size, type of school, and enrollment. The regional nature of the survey and low response rate limit generalization of study results.

## Introduction

Each school day approximately 31.8 million students are served meals through the National School Lunch Program (NSLP) in over 100,000 facilities (USDA, 2012a). In 2011 the NSLP was funded for \$11.1 billion by the U.S. Department of Agriculture (USDA) Food and Nutrition Service (FNS) (USDA). The National School Lunch Act (NSLA) of 1946 marked the formal birth of the NSLP and focused on the health of U.S. children and consumption of domestic agricultural commodities (Gunderson, 1971).

Equipment used for these programs has been critical to their success. Sublette (1976) described the basic equipment in schools during the 1930s and 1940s as “a stove, double boiler, large kettle with top, a large baking pan, and tea kettle.” Electricity was not available to many rural areas in the 1940s, lack of refrigeration was a problem, and it was common for parent teacher groups to renovate existing space into kitchens and provide equipment to assist in preparation of school meals (Sublette). Identifying the need, the NSLA in 1946 allocated \$10 million for school foodservice equipment purchases, to be apportioned to states based on per capita income (Gunderson, 1971), and as a result equipment for school kitchens became more advanced in the 1950s. USDA’s publication *A Guide for Planning and Equipping School Lunchrooms* (1956) provided equipment recommendations based on number of meals served for ranges, ovens, steam-jacketed kettle, slicers, cutters, walk-in and reach-in refrigerators, and frozen food storage cabinet.

Specific funding for school foodservice equipment was noticeably absent from NSLP legislation until the Child Nutrition Act of 1966 provided grants-in-aid to purchase foodservice equipment (Martin & Oakley, 2008; Ralston, Newman, Clauson, Guthrie & Buzby, 2008). And in 2009, the American Recovery and Reinvestment Act (ARRA) of 2009 appropriated \$100

million for school foodservice equipment. The ARRA funds were spent in a short period of time and Wanda Shockey, state director in Arkansas (personal communication, October 7, 2011) indicated requests for equipment purchases to be over 10 times in excess of funds available in her state.

In 2010 Congress passed legislation focused on improvement of nutrition in the NSLP meals (Healthy, Hunger-Free Kids Act, 2010). Implementation of the legislation was specified in the Final Rule “Nutrition Standards in the National School Lunch and School Breakfast Programs” issued January 13, 2012 (Federal Register, 2012). Meal patterns in the NSLP were changed to specify the types and increase the required amounts of fruits, vegetables, and whole grains to be served. Preparing additional food items is expected to impact the type and amount of food produced in school nutrition programs, thereby affecting refrigerated storage space. School nutrition directors expressed concern about the adequacy of refrigerated storage space in meeting the new meal patterns. New storage and/or equipment needs ranked seventh in the top challenges identified by school nutrition directors (School Nutrition Association, 2012b).

Guidelines for the amount of refrigerated storage needed by schools are found in the literature but are not consistent in required space or units of measure. Walk-in refrigeration guidelines are reported in square feet and reach-in refrigeration capacity in cubic feet (Fryett, 1996). Estimates of refrigeration space needs are obtainable from very few sources and the most recent source is based on an earlier document that is over 15 years of age (Almanza, 2009), though the few recommendations available have increased over the years. An early reference from USDA suggested one fourth to one third cubic feet per meal served in school (USDA, 1956). Fryett (1996) provided a rule of thumb estimate for walk-in refrigeration of one-half cubic foot of usable refrigerated storage space per meal served. Almanza (2009) recommended

that there should be approximately one square foot of refrigerator/freezer shelf space for each student meal. USDA guidelines focused on a combination of reach-in and walk-in refrigeration space when total refrigeration capacity exceeds 60 cubic feet (USDA, 1956). In 1968, Educational Facilities Laboratories, Inc. estimated 120 square feet of refrigerated storage floor space was needed to serve 200 meals in one service period (shift). Fryett (1996) discussed different numbers of walk-ins and square feet required for different sizes and types of foodservice operations (i.e. fast food, restaurant, institution). Birchfield (1988) and Fryett recommended that small institutions have 180-240 square feet of refrigerated storage provided by two walk-ins. *The New Design Handbook for School Food Service* (Silberberg, 1997) reported refrigeration/freezers guidelines in square feet based on the number of meals served per day. Empirical research as the basis for recommendations could not be located and actual refrigeration capacity in schools participating in the NSLP was not available.

Because there are many diverse recommendations in dissimilar measures, the purpose of this research was to identify the refrigeration capacity by type of equipment for schools in the USDA/FNS Southwest Region and determine if there were differences in capacity by school characteristics. Factors related to refrigeration capacity were examined to assist in development of a preliminary decision model to determine refrigeration equipment needs in school nutrition programs.

The hypothesis guiding this study was there will be no significant relationship between cubic feet of refrigerated capacity and school characteristics. School characteristics included school enrollment, daily meals, percent free and reduced price meals, and participation rate.

## **Methods**

The Kansas State University Committee for Research Involving Human Subjects (IRB) approved the research protocol (See Appendix A.). The research design included a Delphi panel, onsite observations, a pilot study, and an online survey.

### ***Sample***

School nutrition (SN) directors in the USDA Food and Nutrition Service Southwest Region served as the population for the study. This included the states of Arkansas, Louisiana, New Mexico, Oklahoma, and Texas. The Southwest Region is one of seven regions administering the National School Lunch Program and represents approximately 15% of the total meals provided through the NSLP (2012b). Email addresses for the school nutrition directors were obtained through the state agency administering the school nutrition program. The total available population was 2,501 school nutrition directors. This included 254 directors from Arkansas, 134 from Louisiana, 238 from New Mexico, 530 from Oklahoma, and 1,345 from Texas.

### ***Instrument Development***

After a review of literature the survey instrument was developed employing a modified Delphi technique. A three-round electronic process was used to obtain feedback on question content and format from 12 Delphi panelists who had experience in Child Nutrition Programs (See Appendix B.). Using the Delphi panel, the initial instrument was drafted. Then, 10 school nutrition directors in Kansas who were recommended by the State Director completed the online survey. During a site visit by the researcher, they provided feedback on the instrument and research process and the researcher checked the accuracy of information supplied about

refrigeration equipment by observation and measurement. The survey instrument was revised and pilot tested using an electronic survey with all school nutrition directors in Kansas, except those who participated in the earlier review. Additional modifications to the instrument were made based on pilot test results.

The instrument included sections on school demographics, school nutrition director characteristics, and an inventory which asked directors to describe the refrigerated equipment in a selected school. School demographics included type of school, student enrollment, percent free and reduced price meals, participation rate, average daily meals, type of food production, programs offered, and number of entrees offered at lunch. School nutrition director characteristics were described through level of educational attainment, certifications/memberships, sex, years' in position, and years of experience in school nutrition. Because of the complexity of the survey school nutrition directors were asked to gather specific information on all refrigeration equipment in one school in their district prior to opening the survey. The selected school was the second school on an alphabetical list of schools in the district (if only one school in the district, that school was used). The refrigeration equipment inventory list provided to the directors gave specific examples of equipment descriptions as illustrated in Figure 5.1. The inventory list was in the exact order as the related questions on the survey for the convenience of the respondents and allowed them to quickly complete the inventory section and reduce dropouts.

### ***Refrigerated equipment***

Refrigerated equipment is defined as equipment that is used to store chilled food or frozen food. Refrigeration equipment for chilled food included walk-in refrigerator, reach-in



**Figure 5.1. Refrigeration Equipment Inventory List with Examples**

1. Number and dimensions of **walk-in refrigerators**. Example: 1 walk-in 10' wide by 12' long by 8' high. Be sure to include **height!**
2. Number and dimensions of **walk-in freezers**. Example: 10' x 12' x 10'. Be sure to include **height!**
3. Number and dimensions of **reach-in refrigerators**. Examples: 2 single-door, 1 two-door, and 2 triple-door
4. Number and dimensions of **reach-in freezers**. Examples: 1 triple-door, 3 single-door; 25 cu ft home-type freezer
5. Number and type of **pass-through or roll-in refrigerators (not walk-ins)**. Examples: 2 single-door pass-thru refrigerators; 1 single door roll-in refrigerator
6. Number and type of **pass-through or roll-in freezers (not walk-ins)**. Examples: 2 single-door pass-thru freezers; 1 single door roll-in freezer
7. Number and size of **milk boxes**. Examples: 2 milk boxes, 16 case; 1 milk box, 8 case capacity
8. Number and type of **under-counter refrigerators**. Examples: 2 refrigerators
9. Number and type of **under-counter freezers**. Examples: 2 freezers
10. Number and type of **ice cream cabinet or yogurt machines**. Examples: 14.8 cu ft ice cream box; 1 3-spout yogurt machine
11. Number and type of **refrigerated serving line equipment**. Examples: 1 display refrigerator, 15 cu ft; 1 deli counter, about 3' by 2'; 2 refrigerated salad bars, 6' x 3' surface
12. Number and type of **any other refrigerated equipment**. Examples: 2 blast chillers, undercounter type, 3 pan; 1 blast chiller, full-size door; 3 refrigerated drawers, about 2'x3'; 1 sandwich prep refrigerators, 12 pan capacity

refrigerator, pass-through or roll-in refrigerator, milk box, under-counter refrigerator, and refrigerated serving line equipment. The types of freezers for frozen food storage included walk-in freezer, reach-in freezer, pass-through or roll-in freezer, and under-counter freezer.

Respondents had the opportunity to provide descriptions of any additional equipment such as blast chillers or drawer refrigeration.

### ***Cubic feet of refrigerated storage***

Respondents were asked to describe refrigerated equipment in the selected school in a manner that allowed the researcher to determine the number of cubic feet of refrigerated storage. The width, length, and height of walk-ins were calculated in cubic feet. The type (refrigerator or

freezer) and size (1-, 2-, or 3-section) of reach-in, pass-through, and roll-in equipment determined the number of cubic feet for each piece of equipment. Three different major brands of each type of refrigerated equipment were used to obtain the number of cubic feet of storage. The average number of cubic feet provided by the brands for each piece of equipment was used to calculate total cubic feet available. For example, the three specification sheets for reach-in one section refrigerators indicated 19, 24, and 20 cubic feet. Therefore, an average of 21 cubic feet was used by the researcher to calculate cubic feet for a one section reach-in refrigerator. Although the purchase of non-commercial equipment is not recommended for school foodservice (Almanza, 2009), the cubic feet for home-type refrigerated equipment was obtained since respondents included these items in their inventory of refrigerated equipment. Refer to Appendix G for the average number of cubic feet of storage calculated for each piece of refrigerated equipment and the sources of information. After the cubic feet for each piece of equipment was calculated, total refrigeration space for every school was then calculated using data provided by the director.

### ***Demographic and operational variables***

The school characteristics obtained were type of school; school enrollment; type of food production; complexity of lunch menu; average daily meals; percent free and reduced price meals; student participation rate; number of deliveries, and programs and services offered. Characteristics of the school nutrition director included sex, educational attainment; certifications/credentials, memberships; years in position; and years of school nutrition experience.

### ***Survey Distribution***

An online survey tool was used to deliver the electronic messages with the embedded survey link to the school nutrition directors in the four states providing email addresses. One state used their own email system to deliver the electronic message to directors. The survey was available for approximately three and one-half weeks initially and three weekly reminders were sent. At the close of the initial survey offering, response rates were lower than desired. The survey was extended for an additional 12 days with three reminders to increase the number of responses.

### ***Data Analysis***

SPSS® version 20.0 was used to analyze the data. Statistics were calculated for demographic and operational characteristics and types of refrigerated equipment and reported as frequencies. Mahalanobis' distance was calculated to identify outliers. Means and standard deviations were computed for director and school characteristics. Independent sample *t* tests and ANOVA were conducted to examine differences in cubic feet per meal and independent variables. Multiple regression was conducted to identify predictors of refrigerated capacity. The probability of  $p < 0.05$  was used for testing significance.

### **Results and Discussion**

Of the 2,501 email addresses of school nutrition directors in the Southwest Region, only 2,392 were deliverable. The survey was completed by 240 (10.0%) of the respondents. Data were reviewed for accuracy and completeness. Detailed descriptions that allowed calculation of cubic feet of refrigerated storage by type of equipment were not provided by 117 respondents. Fifty-six respondents with walk-in freezers were eliminated because the height of the walk-in was missing. Therefore, complete information on equipment was obtained from 123

respondents. Before data analysis, multivariate outliers were identified using Mahalanobis' distance measure. Seven outliers were identified and examined individually to investigate possible reasons. Due to the development of a preliminary model and the limitations of the survey because of the low response rate and regional nature of the research, the seven outliers were deleted. Data analysis for the preliminary model was completed using only 116 surveys yielding an overall response rate of 4.8%, which is lower than other studies conducted with a similar population (Moliason & Nettles, 2010; Rice, Strohbehn, Shelly, Arendt, & Gregoire, 2010); and Paez, Arendt, & Strohbehn, 2011).

Characteristics of school nutrition directors are illustrated in Table 5.1. Of the 116 directors, 84.5% were female, similar to that reported by Stinson, Carr, Nettles, and Johnson (2011). Over 70% had been in their position 10 years or less, which is higher than the 65% reported by Stinson et al. and the 54.4% reported by Molaison and Nettles (2010). Ten years or less school nutrition experience was reported by 43.1% of the directors, similar to the 41.3% reported by Molaison and Nettles and slightly higher than the 36% reported by Stinson et al. College degrees were held by 46.6% of the respondents, less than the 57.5% reported by Stinson et al. Almost half of the respondents were from Texas (48.3%), followed by Oklahoma (21.6%), New Mexico (13.8%), Louisiana (9.5%), and Arkansas (6.9%).

Schools were described by the type of school, enrollment, type of food production, complexity of lunch menu, daily meals served, percent free and reduced price meals, and student participation rate in NSLP (Table 5.2). Pre-K or K-12 schools were reported most frequently (n=37, 31.9%) followed by elementary schools (n=33, 28.4%) and high schools (n=19, 16.4%). Approximately 42% of the schools had an enrollment of 300 students or less. Over 87% of schools used onsite food preparation as their food production method. One entrée choice was

offered by almost half of the schools (n=56, 48.3%). Two entrée choices were available at over 26% of the schools (n=31, 26.7%) and three or more entrée choices were available at 25% of the schools. Over 28% of the schools served 300 meals or less (n=33, 28.4%) and 32.8% of the schools served from 301 to 500 meals per day. Most of the school nutrition programs were self-managed (n=100, 86.2%).

**Table 5.1. Characteristics of School Nutrition Directors (n=116)**

Characteristic	n	% <sup>a</sup>
<b>Sex</b>		
Female	98	84.5
Male	18	15.5
<b>Years in Position</b>		
10 years or less	84	72.4
More than 10 years	32	27.6
<b>Years School Nutrition Experience</b>		
10 years or less	50	43.1
More than 10 years	66	56.9
<b>Education</b>		
High school, some post-secondary	62	53.4
College degree	54	46.6
<b>Location of employment</b>		
Arkansas	8	6.9
Louisiana	11	9.5
New Mexico	16	13.8
Oklahoma	25	21.6
Texas	56	48.3

<sup>a</sup> Responses may not equal 100% due to rounding.

Less than half of the schools had free and reduce price meals below 67% (n=54, 46.6%).

Nationally 66.7% of students received free and reduce price meals (USDA, 2012). Over 55% of the schools had a student participation rate of 85% or higher. Additional characteristics of schools are reported in Table 5.2.

**Table 5.2. Characteristics of Schools (n=116)**

Characteristic	n	Percent <sup>a</sup>
Type of school		
Pre-K or K – 12	37	31.9
Pre-K or K – 8	15	12.9
Elementary	33	28.4
Middle	12	10.3
High School	19	16.4
School enrollment		
Up to 300 (Low)	49	42.2
301-500 (Medium)	30	25.9
>500 (High)	37	31.9
Type of food production		
Onsite preparation	101	87.1
Central kitchen	4	3.4
Satellite or preplated meals	11	9.5
Lunch entrée choices		
1 entrée choice	56	48.3
2 entrée choices	31	26.7
3 or more entrée choices	29	25.0
Average total daily meals from school		
Up to 300	33	28.4
301 – 500	38	32.8
>500	45	38.8
Type of food management		
Self-operated	100	86.2
Food management company	16	13.8
Percent Free and Reduced Price Meals		
Less than 67%	54	46.6
67% and greater	62	53.4
Student participation rate in NSLP		
Less than 85%	52	44.8
85% and higher	64	55.2

<sup>a</sup>Responses may not equal 100% due to rounding.

Respondents identified the refrigeration equipment available in the selected school (Table 5.3). Milk coolers were the most frequently reported type of refrigeration equipment (n=106,

91.4%), followed by reach-in refrigerators (n=85, 73.3%) and walk-in freezers (n=80, 69.0%). Some schools had multiple pieces of refrigeration equipment; there were 153 milk coolers in 106 schools and 138 reach-in refrigerators in 85 schools. Krishnamurthy and Sneed (2011) reported very different numbers; reach-in refrigerators were found in 59.9% of schools (compared to 73.3% in this study) and walk-in freezers in 84.1% of schools (compared to 69.0% in this study).

For each type of refrigerated equipment, the total storage capacity for all schools was calculated in cubic feet. Results are reported in Table 5.3. Although walk-in freezers were the third most frequent in availability, they had the greatest number of cubic feet by type of equipment. Over 91% of the refrigerated storage capacity in the selected schools is from walk-in freezers and walk-in refrigerators.

Although milk coolers are found most frequently in the schools, the contribution is only 2.0% of the total refrigerated storage space (Table 5.3). Milk coolers placed at the point of service allow milk storage in advance of meal service periods and eliminates the need for staff to leave the service line to restock milk during meal service. Keeping milk under refrigeration during service contributes to the acceptability of the milk to students and positively impacts labor productivity (Warfel & Cremer, 2000).

The total cubic feet of storage space for chilled foods and for frozen foods is reported in Table 5.4 as is the average per school and average by meal served. Refrigeration equipment for chilled foods included walk-in refrigerators, reach-in refrigerators, milk boxes, pass-through or roll-in refrigerators, and under-counter refrigerators. Freezer equipment for frozen foods included walk-in freezer, reach-in freezer, pass-through or roll-in freezer, and under-counter freezer. Over 54% of the refrigerated storage space is for frozen food. Warfel and Cremer (2000) indicated older food preparation facilities had more refrigerated storage for chilled foods

**Table 5.3. Frequency of Type of Equipment, Total Cubic Feet Capacity, and Numbers of Equipment by Type of Refrigerated Equipment (n=116)**

Type of Equipment	Frequency (School)	Percent	Total Cubic Feet Capacity	Percent of Total Cubic Feet	Number of Equipment
Milk Cooler (Box)	106	91.4	3,376	2.0	153
Reach-in Refrigerator	85	73.3	6,156	3.7	138
Walk-in Freezer	80	69.0	86,772	52.6	86
Walk-in Refrigerator	73	62.9	63,797	38.6	74
Reach-in Freezer	47	40.5	3,151	1.9	93
Pass-through or Roll-in Refrigerator	30	25.9	1,735	1.1	57
Pass-through or Roll-in Freezer	3	2.6	115	0.07	3
Under-counter Refrigerator	2	1.7	11	0.01	2

than for frozen foods but increased availability and usage of convenience foods has changed the proportions. Almanza (2009, page 235) recommended school operations have twice as much space for chilled food as frozen food even though newer schools have more freezer space than refrigerator space. The average cubic feet of total refrigerated storage space per school is  $1423 \pm 1152$ . The average cubic feet per meal of refrigerated storage is  $3.37 \pm 3.29$ .

Recommendations in the literature were 0.6 cubic foot per lunch with additional space for other types of meals served (Almanza, 2009, page 236).

Perceived adequacy of refrigerated storage was examined using questions based on a five-point Likert-type scale (Table 5.5). Responses disagreeing or strongly disagreeing with the adequacy statement were categorized as rating refrigerated storage as inadequate. Responses agreeing or strongly agreeing with the adequacy statement were categorized as rating refrigerated storage as adequate. Chilled food storage at the selected school was rated inadequate by over 39% of directors. Frozen food storage at the selected school was considered



**Table 5.4. Total Refrigerated Capacity in Cubic Feet, Average Cubic Feet of Refrigerated Storage per School and Average Cubic Feet per Meal by Chilled, Frozen, and Total Refrigerated Storage (n=116)**

Type of Refrigerated Equipment	Capacity (Total cubic feet for all schools)	Average cubic feet per school	Average cubic feet per meal
Refrigeration equipment (chilled food)	75,075	647±537	1.56±1.55
Freezer equipment (frozen food)	90,038	775±697	1.82±1.90
Total refrigerated equipment	165,113	1423±1152	3.37±3.29

inadequate by over 36% of directors. When asked to rate the refrigeration capacity for the school nutrition program considering all schools, over 45% of directors rated district-wide storage as inadequate.

**Table 5.5. Perceived Adequacy of Refrigerated Storage at School and School District by Chilled and Frozen Storage at School and Refrigeration Capacity for School District (n=116)**

Factor	Inadequate <sup>a</sup>	Neutral <sup>b</sup>	Adequate <sup>c</sup>
	←———— n —————→ (%) <sup>d</sup>		
Chilled food storage space at the selected school	46 (39.7)	12 (10.3)	58 (50.0)
Frozen food storage space at the selected school	42 (36.2)	17 (14.7)	57 (40.1)
Refrigeration capacity for the school nutrition program (considering all schools)	53 (45.7)	10 (8.6)	50 (43.1)

<sup>a</sup>Based on scale values of strongly disagree (1) and disagree (2).

<sup>b</sup>Based on scale value of neutral (3).

<sup>c</sup>Based on scale values of agree (4) and strongly agree (5).

<sup>d</sup>Responses may not equal 100% due to non-responses to a question or rounding.

ANOVA tests were conducted to compare independent variables (percent free and reduced price meals, participation rate in the NSLP, complexity of lunch menu, and type of management) and the total cubic feet of refrigerated storage. The results indicated that the cubic feet of chilled food storage ( $F=2.50, p < 0.05$ ) and total cubic feet of refrigerated storage ( $F=2.40, p < 0.05$ ) were significantly different among types of schools but results were not significant for

frozen food storage (Table 5.6). LSD post hoc analysis showed significant differences ( $p < 0.05$ ) in cubic feet of refrigerated storage between K-8 schools and all other types of schools. The K-8 schools had significantly fewer cubic feet of refrigerated storage than other types of schools.

**Table 5.6. ANOVA Analysis of Cubic Feet of Refrigerated Storage based on Type of School (n=116)**

Refrigerated Storage Space	Overall Mean±SD	Pre-K, K - 12 school (n=37)	K - 8 school (n=15)	Elementary school (n=33)	Middle school (n=12)	High school (n=19)	F	p
Chilled Food	647±537	783±561	330±351	717±501	657±480	505±613	2.50	0.05*
Frozen Food	775±697	841±687	307±331	883±650	841±718	788±739	2.07	0.09
Total cubic feet	1423±1152	1625±1162 <sup>x</sup>	638±678 <sup>y</sup>	1600±1099 <sup>x</sup>	1499±1098 <sup>x</sup>	1292±1364 <sup>x</sup>	2.40	0.05*

SD = Standard Deviation

<sup>x, y</sup>Means with different superscripts differ significantly using the LSD post hoc test ( $p < 0.05$ )

\* $p < 0.05$

Results of the one-way ANOVA test (Table 5.7) indicated the cubic feet of chilled food storage space per meal were significantly different among different levels of perceived adequacy ( $F=3.88, p <0.05$ ). As perceived adequacy improved, the average number of cubic feet of chilled food storage increased. LSD post hoc analysis showed significant differences in cubic feet of chilled food refrigerated storage between low perceived adequacy and high perceived adequacy groups ( $p <0.05$ ). Frozen food storage was significantly different among the levels of perceived adequacy ( $F=3.4, p <0.05$ ). LSD post hoc analysis showed significant differences in cubic feet of chilled and frozen food refrigerated storage per meal between low perceived adequacy and neutral perceived adequacy groups and the high perceived adequacy group ( $p <0.05$ ). The results indicate differences among the adequacy groups, but chilled food storage and frozen food storage do not have similar significant differences. Chilled food storage for neutral adequacy is not significantly different from either low or high adequacy groups. Frozen food storage for neutral adequacy is significantly lower from the high perceived adequacy group.

A multiple regression analysis was conducted to test the relationships among the number of cubic feet of refrigerated storage (dependent variable) and total meals, school enrollment, percent free and reduced price meals, and participation rate (independent variables). The results of the regression indicated the model explained 24% of the variance ( $r^2 = .24$ ). However total meals, percent free and reduced status, and participant rate were not significant. School enrollment ( $\beta=0.364, p <0.01$ ) was a significant predictor of cubic feet of storage (Table 5.8).

**Table 5.7. ANOVA Analyses of Cubic Feet of Refrigerated Storage based on Perceived Adequacy (n=116)**

Refrigerated storage space	Mean±SD	Low	Neutral	High	F	p
		(n=46)	(n=12)	(n=58)		
Chilled food storage cubic feet	647±537	482±539 <sup>x</sup>	698±584 <sup>x</sup>	768±499 <sup>y</sup>	3.88	0.02*
		(n=42)	(n=17)	(n=57)		
Frozen food storage cubic feet	775±697	613±645 <sup>x</sup>	611±605 <sup>x</sup>	943±730 <sup>y</sup>	3.40	0.04*

SD = Standard Deviation

<sup>x, y</sup>Means with different superscripts differ significantly using the LSD post hoc test ( $p < 0.05$ )

\* $p < 0.05$

**Table 5.8. Multiple Regression on Total Meals, School Enrollment, Percent Free and Reduced Price Status, and Participation Rate Predicting Cubic Feet of Storage (n=116)**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	37111591.673	4	9277897.918	8.917	0.000 ***
Residual	115487144.862	111	1040424.728		
Total	152598736.54	115			

#### Standardized Coefficients

Model <sup>a</sup>	Beta	t	Sig.
(Constant)		.941	0.35
Total meals	.177	1.810	0.07
School enrollment	.364	3.319	0.001 **
Percent free & reduced	-.116	-1.118	0.27
Participation rate	.050	.465	0.64

<sup>a</sup> $R^2 = .24$

\*\*\* $p < 0.001$

\*\* $p < 0.01$

### Discussion

Data analyses were completed using 116 responses, which is an overall response rate of 4.8%. The vast majority of directors were female (84.5%) and had been in their position 10 years or less (72.4%). Approximately 56% of respondents had more than 10 years' school nutrition experience. College degrees were held by 46.6% of respondents.

Schools serving grades Pre-K or K through 12 represented approximately 32% of the respondents, closely followed by elementary schools at 28.4%. Over 42% of schools had student enrollment of 300 or fewer students and 31.9% of schools had over 500 students enrolled. Over 87% of schools used onsite food preparation. Complexity of menu was gauged by the number of lunch entrée choices. Over 48% of schools offered just one entrée; another 26.7% offered two entrée choices. More than 38% of the schools served over 500 meals per day.

Refrigeration equipment found most often in schools was milk coolers, followed by reach-in refrigerators, walk-in freezers, and walk-in refrigerators. Walk-in freezers and refrigerators accounted for over 91% of total cubic feet of refrigerated storage. Over 54% of the refrigerated storage space was for frozen food. Average total refrigerated storage space per school was  $1423 \pm 1152$  and average cubic feet per meal was  $3.37 \pm 3.29$ .

Examination of differences in cubic feet based on school characteristics show significant differences for type of school enrollment, daily meals, and adequacy. The K-8 schools had significantly fewer cubic feet of refrigerated storage than other types of schools. Low enrollment schools had significantly fewer cubic feet of refrigerated storage than medium or high enrollment schools. Schools serving less than 300 meals had significantly fewer cubic feet of refrigerated storage than those serving more meals.

The hypothesis stated there will be no significant relationship between cubic feet refrigerated capacity and school characteristics and was partially supported. A multiple regression indicated significance in the relationship. The school characteristic of student enrollment was significant; daily meals, percent free and reduced status, and participation rate were not significant.

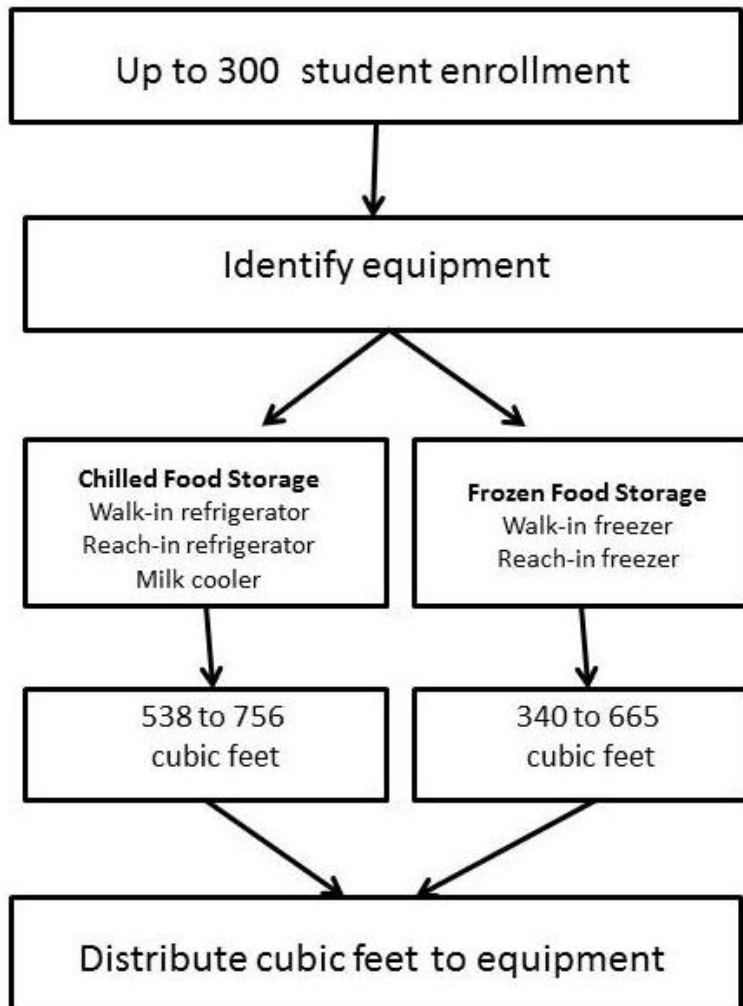
### *Preliminary decision model*

Results of the literature review and the research were incorporated into a preliminary decision model for determining refrigeration equipment needs in school nutrition programs. Educational Facilities Laboratories, Inc. (1968) indicated that frequency of delivery, food purchasing practices, and the location of the school influenced the appropriate size of refrigerated storage space. Fryett (1996) used the type of operation as a factor for determining the number of walk-ins and square feet needed without differentiating between frozen and chilled storage. Almanza (2009) identified the type of food production, type of menu and variety, number of meal programs offered, types of recipes and forms of ingredients, frequency of food deliveries, and the volume of preparation based on number of customers as factors influencing the amount of refrigerated space. The number of meals was used by Educational Facilities Laboratories, Inc., Fryett, and Almanza in determining refrigerated storage needs. The results of this study indicated differences in chilled food storage and frozen food storage, suggesting the two types of storage be considered separately. School enrollment was found to be significant in predicting the total refrigerated storage space and there were significant differences among the three levels of school enrollment. Preliminary decision models were developed based on three levels of enrollment. The types of equipment found most frequently in school nutrition programs in this study were used in the model. Chilled food storage and frozen food storage capacity ranges were established using data from schools perceived to have neutral to adequate storage in each enrollment size. The preliminary models were checked using data provided by Kansas schools. For the three levels of school enrollment, the low and medium enrollment group means fell within the ranges in the models. The high enrollment group from Kansas had cubic feet lower than the range provided in the preliminary model. The preliminary decision models

need to be studied further. The preliminary decision model forms a foundation for future research that could be used in purchasing or determining needs for refrigeration equipment in school nutrition programs.

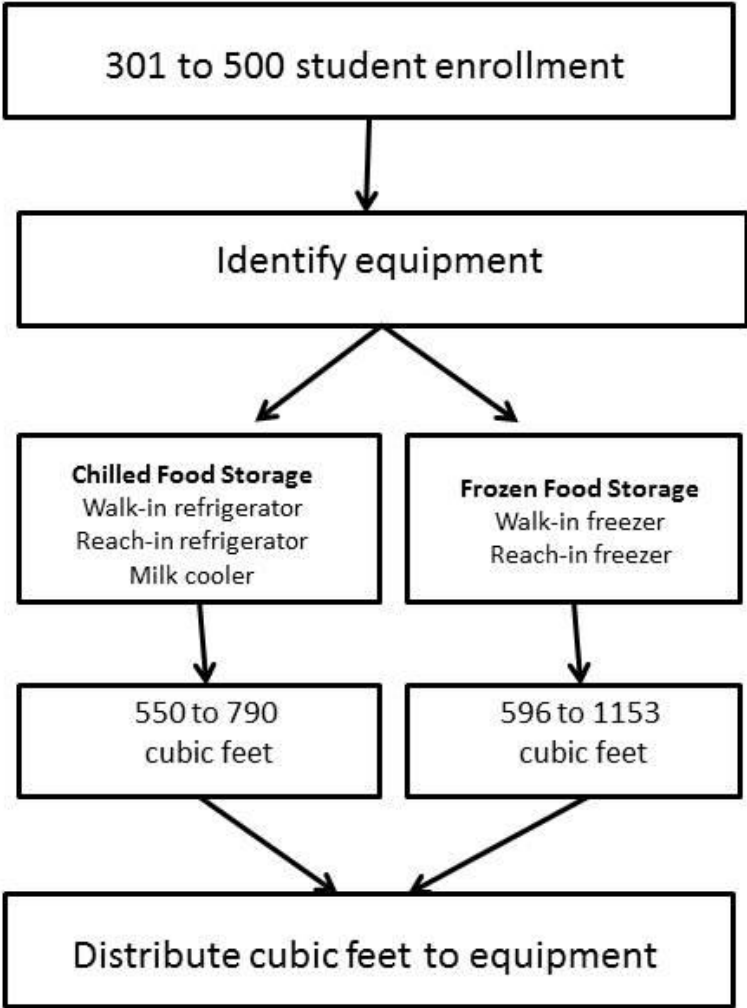


Figure 5.2. Preliminary Decision Model for Enrollment to 300 Students\*



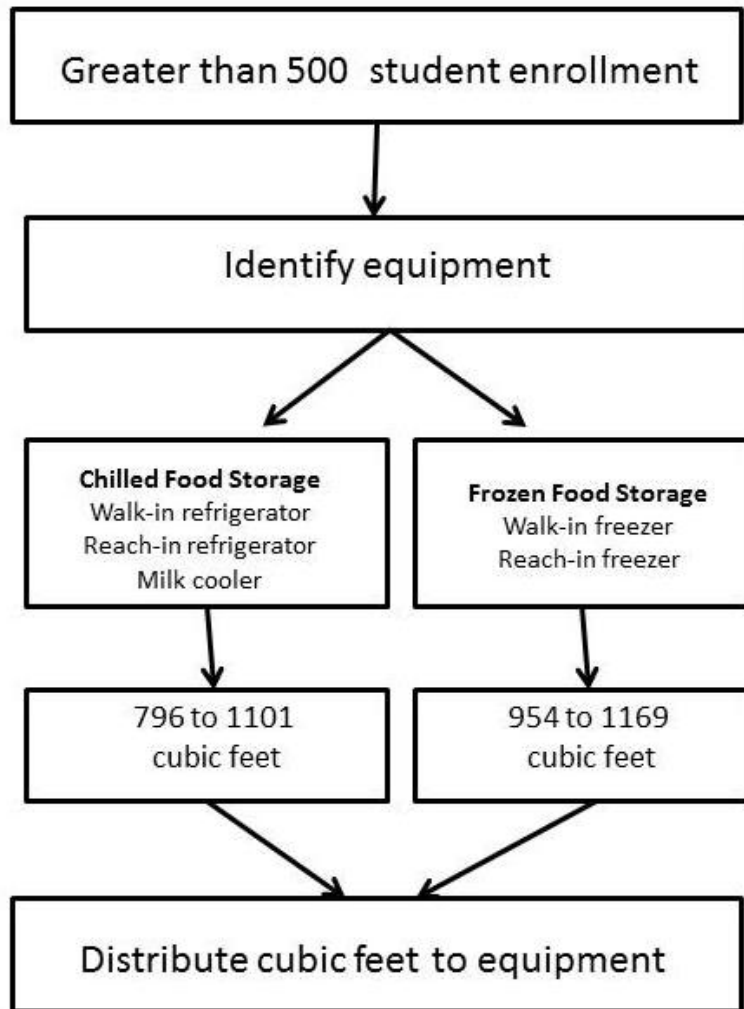
\* Model is based on limited data and needs further research prior to using as a determinant for refrigeration capacity.

Figure 5.3. Preliminary Decision Model for Enrollment 301 to 500 Students\*



\* Model is based on limited data and needs further research prior to using as a determinant for refrigeration capacity.

**Figure 5.4. Preliminary Decision Model for Enrollment Greater than 500 Students\***



\* Model is based on limited data and needs further research prior to using as a determinant for refrigeration capacity.

### *Limitations*

A number of limitations apply to this study. The first is the low response rate which might be because the survey was administered at the end of the school year and during the planning to meet the new meal patterns. One state director indicated that many schools were able to close sooner than usual since the mild winter meant “snow days” were not used and

schools were out for the summer earlier. Directors employed on a 9- or 10-month contract may have been leaving school for the summer or distracted by the end of school year activities and responsibilities at the time the survey was distributed.

The survey was complex in that school nutrition directors were asked to inventory the refrigerated equipment of a selected school, including measurements of walk-in refrigerators and freezers. The low response rate might have been due to the time and effort required to gather information, and then the time to enter the refrigeration equipment inventory information and answer other questions. Of the 180 responses indicating the presence of a walk-in freezer, 56 omitted the height measurement. Without width, length, and height, cubic feet could not be calculated, thus eliminating 56 responses due to incomplete information. Omissions in equipment descriptions occurred in almost 50% of the responses, further reducing the response rate.

Online surveys are typically more cost-effective than mail surveys and offer the ability to transfer data without manual data entry, thus increasing time efficiencies (Shin, Johnson, & Rao, 2012). Computer access can be an issue with electronic surveys but this sample had communication with state agency staff as part of their participation in the NSLP. Dillman, Smyth, and Christian (2009) cited security and confidentiality concerns as an issue for electronic surveys. Surveys that cannot be accessed multiple times present a problem for some respondents and may cause reduced response rates (Dillman, et al). Concern was expressed by respondents because this survey could not be accessed multiple times and respondents could not go back and check their responses.

Non-response bias may be a problem. School nutrition directors were provided instructions and an inventory list of refrigeration equipment in the invitation message in an

attempt to increase response rate. Multiple reminders were sent to non-respondents to try to control non-response and the survey offering was extended to allow more time for responses. It is possible that the perceived adequacy and the refrigeration storage capacity of those who did not respond may be very different from that of the respondents. Respondents may have been more interested in refrigeration equipment than non-respondents.

The high standard deviations of the mean cubic feet found in this study indicate the data is widely dispersed about the mean. Because means were utilized in the model development, caution must be exercised in using the models to identify cubic feet of refrigerated storage needed.

The study was conducted in a specific geographic region of the U.S. and focused on school nutrition programs. The results cannot be generalized to all of the U.S. or to other segments of the foodservice industry. The limitations of this study must be considered in interpreting results.

## **Conclusions and Applications**

The amount of refrigerated storage in schools varies greatly, even when using a standardized measure such as cubic feet per meal. Guidelines for refrigerated equipment needs are presented in many units of measure, including square feet, usable square feet, cubic feet, and by listing the number of pieces of refrigerated equipment. A common unit of measure to express refrigerated equipment capacity is needed. This researcher proposed cubic feet to be the common measure for refrigerated storage space because the foodservice equipment industry commonly uses cubic feet in specifications for freestanding refrigeration equipment such as reach-in refrigerators and freezers. However, kitchen designers use square feet when designing

kitchen layouts. Specifications for refrigeration equipment should include an expected range of cubic feet.

School nutrition directors may use the method of calculating refrigerated storage cubic feet provided in this research to conduct an audit of the space available in their schools. Benchmarking school data within a district may provide valuable operational documents to help resolve these issues and the results of this study provide the numbers from the Southwest Region as a basis for comparison to local storage capacities. Determining the cubic feet of refrigerated storage needed in schools is a complex issue worthy of future study. Inadequate refrigeration space has the potential to negatively impact the safety and nutritive value of school meals.

One concern is that in this study frozen food storage represents over half of the total refrigerated storage, however new meal patterns are expected to increase the need for chilled food storage. This means that existing proportions of chilled and frozen food storage need to change.

Existing guidelines for refrigerated storage (Fryett, 1996; Almanza, 2009) are much lower than the actual storage space reported by study respondents. Further study is needed to determine if guidelines need to be adjusted or if results of this study are an aberration. Predicting refrigerated storage needs involves more factors than those in this study so future studies are needed to determine if the preliminary model can predict future needs.

## References

- Almanza, B. (2009). *Equipment purchasing and facility design for school nutrition programs*. Retrieved from <http://nfsmi.org/documentlibraryfiles/PDF/20090312115009.pdf>
- American Recovery and Reinvestment Act. (2009). Public Law 111-5. (February 17, 2009). 120Stat. 115. Retrieved from <http://www.gpo.gov/fdsys/pkg/PLAW-111publ5/pdf/PLAW-111publ5.pdf>
- Birchfield, J. C. (1988). *Design and layout of foodservice facilities*. New York: Van Nostrand Reinhold.
- Child Nutrition and WIC Reauthorization Act. (2004). Public Law 108-265. (June 30, 2004). 118 STAT. 729. Retrieved from [http://www.fns.usda.gov/cnd/Governance/Legislation/Historical/PL\\_108-265.pdf](http://www.fns.usda.gov/cnd/Governance/Legislation/Historical/PL_108-265.pdf)
- Dillman, D. A., Smyth, J. D., & Christian, L. M. (2009). *Internet, mail, and mixed-mode surveys* (3<sup>rd</sup> ed.). Hoboken, NJ: John Wiley & Sons, Inc.
- Education Facilities Laboratories. (1968). *20 Million for lunch*. New York: Author.
- Federal Register. (January 13, 2011). *7CFR parts 210 and 220*. 76:9, p. 2494.
- Fryett, D. K. (1996). *An introduction to the foodservice industry*. Chicago, IL: North American Association of Food Equipment Manufacturers.
- Gunderson, G. W. (1971). *The National School Lunch Program: Background and Development*. Washington, DC: Government Printing Office.
- Healthy and Hunger-Free Kids Act. (2010). Public Law 111-296 (December 13, 2010) 124 Statute3183. Retrieved from <http://www.gpo.gov/fdsys/pkg/PLAW-111publ296/pdf/PLAW-111publ296.pdf>

- Krishnamurthy, K. & Sneed, J. (2011). Cooling practices used in school foodservice. *Food Protection Trends* 31(12) 828-833.
- Martin, M. J. & Oakley, C. B. (Eds.). (2008). *Managing child nutrition programs: Leadership for excellence (2<sup>nd</sup> ed.)*. Sudbury, MA: Jones and Bartlett Publishers.
- Molaison, E. F. & Nettles, M. F. (2010). Special food and nutrition needs in school nutrition programs. *Journal of Child Nutrition*, 34(1).
- Paez, P., Arendt, S., & Strohbahn, C. (2011). Training: An opportunity for people with disabilities in school foodservice operations. *Journal of Child Nutrition*, 35(1).
- Ralston, K., Newman, C., Clauson, A., Guthrie, J., & Buzby, J. (2008). *The National School Lunch Program: Background, trends, and issues*. Economic Research Report Number 61. USDA Economic Research Service.
- Rice, B. W., Strohbahn, C., Shelly, M. C., Arendt, S., & Gregoire, M. (2010). Comparison of cooperative and noncooperative purchasing in school nutrition programs. *Journal of Child Nutrition*, 34(2).
- School Nutrition Association. (2012). *2012 Back to School Trends Report*. National Harbor, MD: Author.
- Shin, E., Johnson, T. P., & Rao, K. (2012). Survey mode effects on data quality: Comparison of web and mail modes in a U.S. national panel survey. *Social Sciences Computer Review* 30, 212-228. doi: 10: 1177/0894439311404508
- Silberberg, S. C. (1997). *The New Design Handbook*. University, MS: National Food Service Management Institute.



- Stinson, W. B., Carr, D., Nettles, M. F., & Johnson, J. T. (2011). Food safety programs based on HACCP principles in school nutrition programs: Implementation status and factors related to implementation. *Journal of Child Nutrition, 35*(1).
- Sublette, L. (1976). *I Remember School Lunch*. Martin, TN: S & S Book Company.
- U.S. Department of Agriculture, Agricultural Marketing Service. (1956). *A guide for planning and equipping school lunchrooms* (Program Aid 292). Washington, DC: Government Printing Office.
- U.S. Department of Agriculture, Food and Nutrition Service. (2012a). National School Lunch Program fact sheet. Retrieved from <http://www.fns.usda.gov/cnd/lunch/AboutLunch/NSLPFactSheet.pdf>
- U.S. Department of Agriculture, Food and Nutrition Service. (2012b). USDA Food and Nutrition Service Regional Offices. Retrieved from <http://www.fns.usda.gov/cga/Contacts/RegionContacts.htm>

## **Chapter 6 - Summary and Conclusions**

This final chapter includes the major findings of the study and evaluation of the research objectives and hypotheses stated in Chapter 1. Practical implications for school nutrition directors are discussed along with study limitations and future research.

### **Summary of Study**

School nutrition programs must meet increasing expectations and new meal pattern requirements with few additional resources. New meal patterns implemented in the 2012 school year require an increased variety and additional servings of fruits and vegetables. It is anticipated that additional resources in the form of funding and in refrigeration equipment will be needed. Guidelines for capacity needs of refrigeration equipment were developed over 15 years ago and this researcher could not locate empirical data to support the published guidelines. Estimated refrigerated storage parameters did not separate frozen food and chilled food storage space. This information is critical for school nutrition directors to make informed decisions to successfully manage school nutrition programs and to keep food safe.

Therefore, the purpose of this research was to gain insight into the refrigeration availability and adequacy of school district in the USDA/FNS Southwest Region and to develop resources to assist directors of school nutrition programs in determining equipment needs. A series of research questions and hypotheses served as the basis of the research.

A total of 240 school nutrition directors completed the survey, yielding an overall response rate of 10.0%. The vast majority (87.1%) of directors were female and over 70% had been in their position 10 years or less. Pre-K and K to 12 schools (30.4%) were the most common type of school followed by elementary schools (26.3%). Onsite food preparation with

the use of some convenience items was utilized by over 78% of the respondents. Complexity of the lunch menu was evaluated by the number of entrees served; over 49% of the respondents offered one entrée and almost 26% offered two entrée choices. Approximately 30% of the respondents served 300 or fewer meals each day. Almost 53% of schools had participation rates greater than or equal to 85%. Over 86% of the schools were self-operated versus operated by a food management company.

## **Summary of Major Findings**

### ***Research question 1: What type of refrigeration equipment is used in schools in the USDA/FNS Southwest Region?***

Of the 240 respondents, over 88% (n=212) have milk coolers (boxes). Walk-in freezers were present in 75% (n=180) of schools and reach-in refrigerators in almost 74% (n=177). Most schools had walk in refrigerators (n=172, 71.7%), but very few schools had pass-through or roll-in freezers, under-counter refrigerators and freezers. Only two schools (0.8%) had blast chillers. When asked what equipment would be purchased based on greatest need, over 40% (n=97) responded refrigeration equipment.

### ***Research question 2: What are the barriers to purchasing refrigeration equipment in school nutrition programs?***

On a five-point Likert-type scale, directors rated the barriers of lack of space in the kitchen (3.5±1.3) and insufficient funding (3.5±1.3) of most concern; however, scores indicated that there were no strong barriers. Barriers rated lowest by the school nutrition directors were having sufficient knowledge to write specifications (2.4±1.1) and making time to complete the purchasing process (2.3±1.1).

***Research question 3: What management practices are used or recommended by directors to compensate for inadequate refrigerated storage space in school nutrition programs?***

School nutrition directors identified maintaining low inventory (3.7±1.0) as the practice most likely to be used or recommended to compensate for inadequate refrigerated storage. Decreasing the number of items purchased (3.3±1.1), scheduling more frequent deliveries of refrigerated items (3.3±1.1), and using high capacity shelving (3.3±1.1) also are likely to be used or recommended. Practices least likely to be used include renting or leasing refrigeration space offsite (1.9±1.1), paying extra fees or higher prices for more frequent deliveries (2.1±1.1), and leasing refrigeration equipment to be brought onsite (2.1±1.1).

***Research question 4: What resources are directors likely to use in developing specifications for refrigeration equipment?***

Directors were most likely to use personal experience (3.8±1.0) and specification sheets from a company (3.7±0.9) in developing specifications for refrigeration equipment. Over 70% of directors had 10 years or less in their position so it is not clear how experience in developing specifications was obtained. Internal resources such as personal experience, peers, and specifications previously used in the district were more likely to be used than external resources such as the School Nutrition Association, the National Food Service Management Institute, and cooperative purchasing organizations. Foodservice consultants (3.0±1.1) were least likely to be used in specification development.

***Research question 5: What are perceptions of school nutrition directors regarding adequacy of refrigerated storage in meeting new meal patterns?***

Over 40% of directors strongly disagreed or disagreed with the statement that in general, the refrigeration capacity in their school nutrition program (all schools) was adequate to meet the

new meal pattern requirements. Over 39% indicated disagreement with the statement that chilled food storage in the selected school was adequate to meet new meal pattern requirements. A similar number (35%) disagreed or strongly disagreed that current freezer space in the school is adequate to meet the 2012 meal pattern requirements.

***Research question 6: How does perceived adequacy of refrigerated equipment differ based on characteristics of school nutrition directors?***

Independent sample t tests were conducted to compare years of school nutrition experience, years in position, sex, and education level of directors to perceived adequacy of refrigerated space. The perceived adequacy of current freezer storage space and perceived adequacy of current refrigeration (chilled food) storage space at the school level differed significantly between school nutrition directors with less than 10 years experience and those with 10 or more years experience in school nutrition. More experienced directors rated adequacy of freezer storage higher than their less experienced counterparts but rated adequacy of refrigeration storage (chilled food) lower than those less experienced. A statistically significant difference ( $p \leq 0.05$ ) was found in the perceived adequacy of current refrigeration storage space by years in position of the school nutrition director. Directors who had held their position for 10 years or more rated refrigerated storage adequacy higher than their less experienced counterparts. Perceived adequacy did not differ significantly by sex or education level of director or by school characteristics.

***Hypothesis 1: There is no significant difference in perceived adequacy of refrigerated storage based on years' school nutrition experience of the director. Rejected.***

***Hypothesis 2: There is no significant difference in perceived adequacy of refrigerated storage based on years' in position of the school nutrition director. Failed to reject.***

***Hypothesis 3:*** *There is no significant difference in perceived adequacy of refrigerated storage based on sex of the school nutrition director. Failed to reject.*

***Hypothesis 4:*** *There is no significant difference in perceived adequacy of refrigerated storage based on education level of the school nutrition director. Failed to reject.*

***Research question 7: What is the refrigeration capacity by type of refrigeration equipment available in schools in the USDA/FNS Southwest Region?***

Responses to capacity questions are limited to 116 (4.8%) since detailed information about equipment was not provided by all 240 respondents. Over 91% of total refrigerated storage in school nutrition programs was provided by walk-in freezers and walk-in refrigerators. Although milk coolers were found in over 91% of schools, they contributed only 2.0% of the total capacity of refrigerated storage. The freezer equipment (walk-in freezer and all other frozen food storage equipment) provided 55% of the total refrigerated storage. Ranges of cubic feet of total refrigerated storage in schools varied greatly, with an average cubic feet per school of  $1423 \pm 1152$ . The average cubic feet of refrigerated storage per meal was  $3.37 \pm 3.29$ .

***Research question 8: Are there differences in refrigerated equipment capacity by type of school and perceived adequacy?***

Results indicate that K-8 schools have significantly fewer cubic feet of refrigerated storage than other types of schools (Pre-K or K-12, elementary, middle, and high schools). The refrigerated equipment capacity differed significantly based on perceived adequacy of refrigerated storage, with the capacity increasing as the perceived adequacy of the director improved.

***Research question 9: What factors predict the refrigeration capacity of school nutrition programs in the USDA/FNS Southwest Region?***

***Hypothesis 5:*** There is no significant relationship between number of meals, school enrollment, percent free and reduced meals, and student participation rate and refrigerated capacity.

***Partially rejected.***

Results of a multiple regression analysis to test the relationships between the number of cubic feet of refrigerated storage (dependent variable) and total meals, school enrollment, percent free and reduced price meals, and participation rate (independent variables) indicate significance. Total meals, percent free and reduced status, and participant rate were not significant. School enrollment was the only significant predictor of refrigeration capacity.

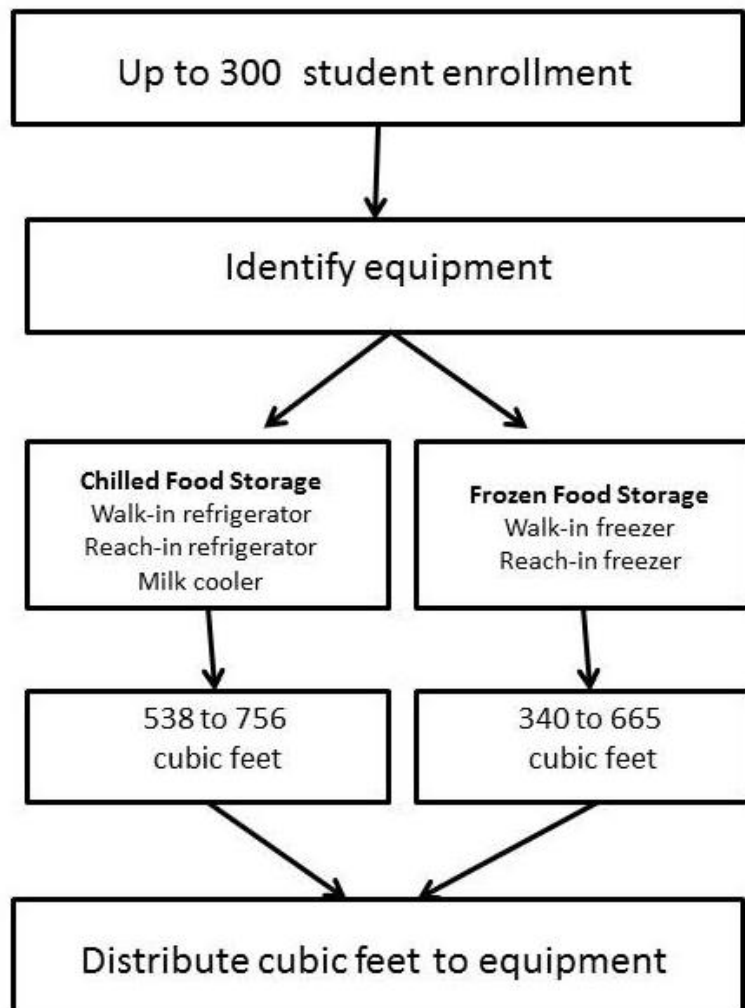
***Preliminary decision model***

Results of the literature review and the research were incorporated into a preliminary decision model for determining refrigeration equipment needs in school nutrition programs. Educational Facilities Laboratories, Inc. (1968) indicated that frequency of delivery, food purchasing practices, and the location of the school influenced the appropriate size of refrigerated storage space. Fryett (1996) used the type of operation as a factor for determining the number of walk-ins and square feet needed without differentiating between frozen and chilled storage. Almanza (2009) identified the type of food production, type of menu and variety, number of meal programs offered, types of recipes and forms of ingredients, frequency of food deliveries, and the volume of preparation based on number of customers as factors influencing the amount of refrigerated space. The number of meals was used by Educational Facilities Laboratories, Inc., Fryett, and Almanza in determining refrigerated storage needs. The results of this study indicated differences in chilled food storage and frozen food storage, suggesting the two types of storage be considered separately. School enrollment was found to be

significant in predicting the total refrigerated storage space and there were significant differences among the three levels of school enrollment. Preliminary decision models were developed based on three levels of enrollment. The types of equipment found most frequently in school nutrition programs in this study were used in the model. Chilled food storage and frozen food storage capacity ranges were established using data from schools perceived to have neutral to adequate storage in each enrollment size. The preliminary decision models were checked using data provided by Kansas schools. For the three levels of school enrollment, the low and medium enrollment group means fell within the ranges of cubic feet in the models. The high enrollment group from Kansas had mean cubic feet lower than the range provided in the preliminary model. The preliminary decision models need to be studied further. The preliminary decision model forms a foundation for future research that could be used in purchasing or determining needs for refrigeration equipment in school nutrition programs.

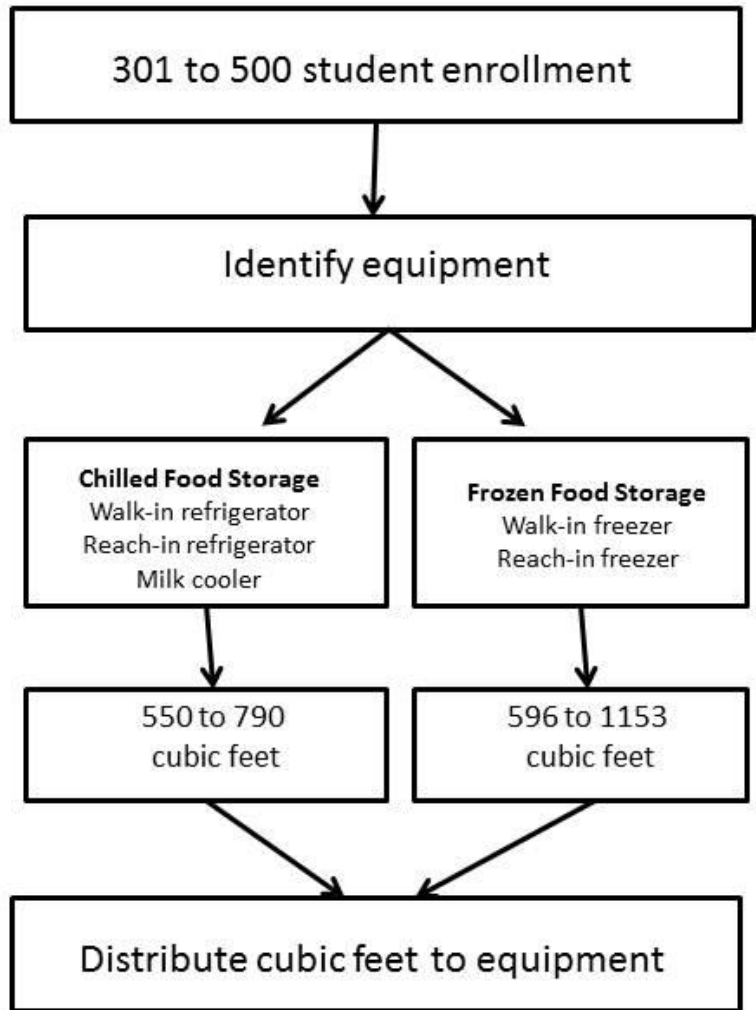


Figure 6.1. Preliminary Decision Model for Enrollment to 300 Students\*



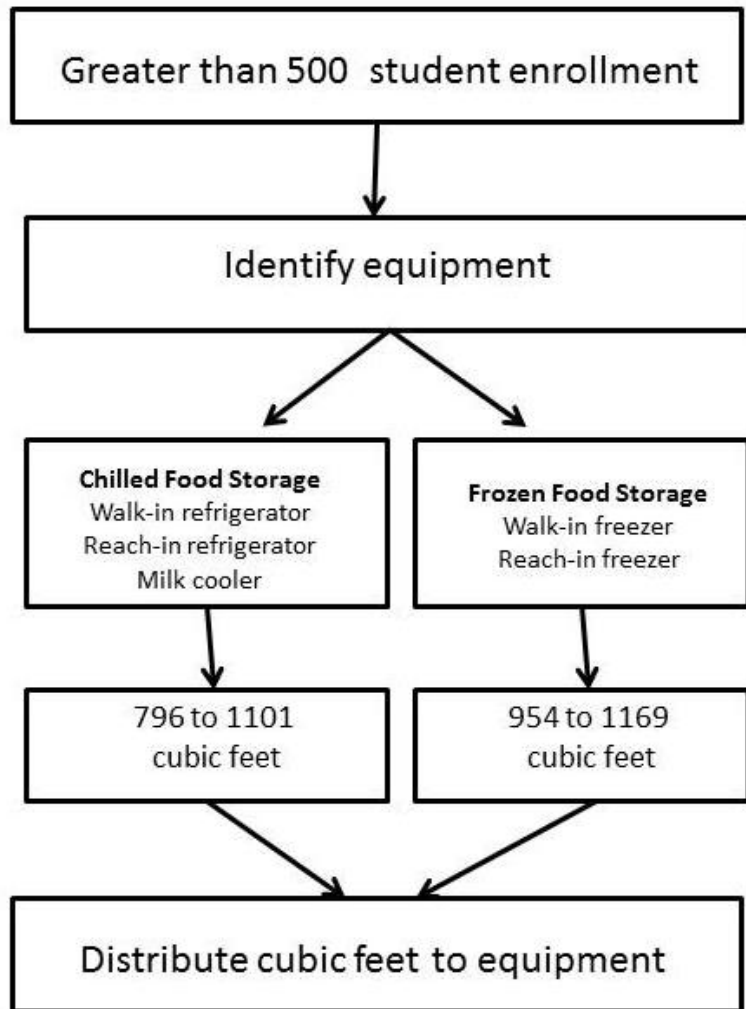
\* Model is based on limited data and needs further research prior to using as a determinant for refrigeration capacity.

Figure 6.2. Preliminary Decision Model for Enrollment 301 to 500 Students\*



\* Model is based on limited data and needs further research prior to using as a determinant for refrigeration capacity.

**Figure 6.3. Preliminary Decision Model for Enrollment Greater than 500 Students\***



\* Model is based on limited data and needs further research prior to using as a determinant for refrigeration capacity.

### **Study Limitations**

Several limitations are present in this study. The response rate was 10.0% but similar to a recent school foodservice survey by Krishnamurthy and Sneed (2011). The low response rate may be attributed to the complexity of the survey, the length, and the time of year the survey was administered. Directors had to collect measurements of certain refrigerated equipment in a

school, requiring special efforts if their office was not located in the school. Email messages were received from potential respondents regarding the length of the survey when end-of-school-year activities were priorities. A state director indicated that the mild winter meant that “snow days” reserved in the school calendar were not used and schools dismissed students earlier than usual. Although the total population of school nutrition directors in the Southwest Region was sampled, the generalization of findings to the population may be difficult due to the low response rate.

The burden on the respondent was high. School nutrition directors were asked to inventory the refrigerated equipment of a selected school and record the length, width, and height measurements of walk-in refrigerators and freezers. The lack of detailed information to allow calculation of cubic feet of refrigerated storage further reduced the response rate and may have been due in part to the time and effort required to gather information and to enter the refrigeration equipment inventory information. Of the 240 who answered all questions, only 123 provided enough detailed information to allow calculation of total cubic feet of refrigerated space. Data review further reduced the sample to 116 responses (4.8%). Of the 180 responses indicating the presence of a walk-in freezer, 56 omitted the height measurement and omissions in equipment descriptions occurred in almost 50% of the responses. The high standard deviations of the mean cubic feet found in this study indicate the data is widely dispersed about the mean. Because means were utilized in the model development, caution must be exercised in using the models to identify cubic feet of refrigerated storage needed.

Online surveys are typically more cost-effective than mail surveys and offer the ability to transfer data without manual data entry, thus increasing time efficiencies (Shin, Johnson, & Rao, 2012). Email does not carry the money and time costs incurred when printing paper surveys and

purchasing postage stamps and envelopes. Electronic surveys are typically answered in fewer days than mail surveys (Cobanoglu, Warde, & Moreo, 2001). Computer access can be an issue with electronic surveys but this sample had communication with state agency staff as part of their participation in the NSLP. Dillman, Smyth, and Christian (2009) cited security and confidentiality concerns as an issue for electronic surveys. The survey system used in the study did not allow respondents to return at a later date. Surveys that cannot be accessed multiple times present a problem for some respondents and may cause reduced response rates (Dillman, et al). Concerns about the inability to return to the survey and go back to earlier questions were expressed by some participants in this study. Regardless of the limitations of online surveys, the benefits of low cost, reduced manual data entry, and fast, direct communication led the researcher to use this survey method.

Another limitation is the definition of adequacy. Since adequate refrigerated space had not been defined prior to this study, the researcher had to rely on the general review of literature, Delphi panelists, and the onsite directors' feedback in crafting the adequacy questions. The study did not address adequacy of refrigerated storage prior to new meal patterns. Factors causing the perceived inadequacy were not addressed in this study. Future studies may investigate the age of equipment, location of equipment, budget, and other factors that may contribute to inadequacy.

Non-response bias is a concern in this study. Although efforts were made to improve response rates, it is possible that perceived adequacy and the refrigerated storage capacity of those who did not respond may differ from that of respondents. Non-respondents may have been less interested in refrigeration equipment than respondents.

Due to limitations, interpretation of results must be approached with caution. The response rate was low with non-response bias a possibility. The study was conducted in a specific geographic region of the U.S. and focused on school nutrition programs. The results cannot be generalized to all of the USDA/FNS regions or to other segments of the foodservice industry.

## **Future Research**

Recommendations for future research are listed below.

1. Test the preliminary decision model in a nationwide study with small, medium, and large schools using onsite food production systems.
2. Complete research on additional factors influencing refrigerated storage space.
3. Identify refrigerated storage capacity in cubic feet planned by designers of new school foodservice facilities.
4. Investigate differences in factors influencing chilled food storage versus frozen food storage.
5. Identify refrigeration equipment costs to assist in budgeting of refrigeration equipment for schools.
6. Develop a training program for school nutrition directors to include practices to compensate for inadequate storage, and methods to store food safely and efficiently.
7. Develop and test a spreadsheet tool to allow calculation of cubic feet of refrigerated storage using simple entry of refrigerated equipment inventory descriptions.

## **Conclusions**

The results of this regional study show that refrigerated storage is a concern for school nutrition directors. New meal patterns requiring increased amounts of fruits and vegetables must be met in a manner that allows safe and nutritious food to be served. As the new meal patterns

are implemented, school nutrition stakeholders and policymakers should be responsive to refrigeration equipment needs.

Since purchasing additional refrigeration equipment may not be a solution, training on practices to compensate for inadequate storage is implicated. Practices identified in this study can be implemented in local schools. Existing refrigeration storage should be examined to determine if space is being used in an efficient and effective manner.

The refrigeration equipment industry has an opportunity to address these concerns through education and the sale of new equipment. Refrigeration equipment was the type of equipment identified most often when directors were asked which type of equipment they would purchase based on need.

Empirical data on existing refrigerated storage can be used as a reference by child nutrition directors and stakeholders. School nutrition directors might wish to identify the refrigeration capacity of all schools within their district. The refrigeration capacity measured by cubic feet per meal could be an operational indicator for schools within a district. A tool to assist school nutrition directors in calculating cubic feet of refrigerated space could be valuable. A spreadsheet application that automatically takes the detailed description of the refrigeration equipment and calculates cubic feet would be a timesaver for school nutrition directors and eliminate calculation errors. This application could also be used by kitchen planners.

Guidelines for refrigeration capacity in schools in the literature do not use standard measures. The number of certain types of equipment, square feet, cubic feet, cubic feet of usable space, and linear feet of shelf space are examples of measures of refrigeration storage space. Square feet measures are used for walk-in refrigeration and cubic feet measures are used for all

other types of refrigeration. In order to analyze refrigerated storage a common unit of measure must be used.

Refrigerated storage needs can be met by walk-in refrigeration and/or other types of refrigeration, as illustrated by results of this study. The preliminary decision models need further examination. Further research is needed to identify factors that impact refrigerated storage. Architects and foodservice design consultants must be included in research to determine the refrigeration capacity planned for new facilities.



## References

- Almanza, B. (2009). *Equipment purchasing and facility design for school nutrition programs*. Retrieved from <http://nfsmi.org/documentlibraryfiles/PDF/20090312115009.pdf>
- Cobanoglu, C., Warde, B., & Moreo, P. J. (2001). A comparison of mail, fax and web-based survey methods. *International Journal of Market Research*, 43(4), 441-452.
- Dillman, D. A., Smyth, J. D., & Christian, L. M. (2009). *Internet, mail, and mixed-mode surveys* (3<sup>rd</sup> ed.). Hoboken, NJ: John Wiley & Sons, Inc.
- Education Facilities Laboratories. (1968). *20 Million for lunch*. New York: Author.
- Fryett, D. K. (1996). *An introduction to the foodservice industry*. Chicago, IL: North American Association of Food Equipment Manufacturers.
- Krishnamurthy, K. & Sneed, J. (2011). Cooling practices used in school foodservice. *Food Protection Trends* 31(12) 828-833.
- Shin, E., Johnson, T. P., & Rao, K. (2012). Survey mode effects on data quality: Comparison of web and mail modes in a U.S. national panel survey. *Social Sciences Computer Review* 30, 212-228. doi: 10: 1177/0894439311404508

## **Appendix A- IRB Approval Letter**

TO: Elizabeth Barrett  
HMD  
107 Justin

Proposal Number: 6156

FROM: Rick Scheidt, Chair  
Committee on Research Involving Human Subjects

DATE: February 27, 2012

RE: Proposal Entitled, "Analysis of Refrigeration Equipment Needs in School Nutrition Programs in the USDA/FNS Southwest Region"

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is EXEMPT from further IRB review. This exemption applies only to the proposal - as written - and currently on file with the IRB. Any change potentially affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the Federal Policy for the Protection of Human Subjects, 45 CFR §46.101, paragraph b, category: 2, subsection: ii.

Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that research is exempt does not imply that investigators have no ethical responsibilities to subjects in such research; it means only that the regulatory requirements related to IRB review, informed consent, and assurance of compliance do not apply to the research.

Any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.

## **Appendix B – Questions Developed to Guide Delphi Panel**

## Appendix B.1. Delphi Panel Round 1 Questions

### AXIO SURVEY

#### Refrigeration Equipment in School Nutrition Programs

##### Survey Description

This instrument is designed to elicit information for a survey regarding refrigeration equipment, equipment budgeting, and best practices in school nutrition programs participating in the National School Lunch Program (NSLP). Refrigeration equipment refers to freezers, refrigerators and other cold temperature equipment such as milk coolers and refrigerated serving counters. My goal in using the Delphi panel is to create a survey based on your collective ideas and information gleaned from the literature. The review of literature and information you provide will be used to develop the survey. Express your thoughts using bullet points or phrases. There also is space at the end of the survey for additional comments. NOTE: This study has been approved by the Institutional Review Board of Kansas State University.

##### Opening Instructions

This instrument is designed to obtain your feedback on specific topics related to refrigeration equipment in school nutrition programs. The objectives are provided for your convenience as a reference as you answer and review questions and provide feedback.

##### RESEARCH OBJECTIVES:

- 1) Identify the refrigeration capacity available in schools participating in the NSLP in the USDA/FNS Southwest Region.
- 2) Ascertain foodservice equipment budgeting practices in school districts in the USDA/FNS Southwest Region.
- 3) Describe best practices related to the purchase and use of refrigeration equipment in the NSLP in the USDA/FNS Southwest Region.
- 4) Determine if there is adequate refrigeration space to meet the new NSLP meal patterns released in 2012.
- 5) Develop a preliminary decision model for purchasing refrigeration equipment in school nutrition programs.

The research questions guiding this research in the USDA/FNS Southwest Region are as follows:

- 1) What type of refrigeration equipment is used in schools?
- 2) Are there differences in refrigeration equipment capacity by student enrollment, free and reduced price status, type of food production system, type of school, budget amount, and number of meals served?
- 3) What is the refrigeration capacity by type of refrigeration equipment available in schools in schools in the Southwest Region?
- 4) What management practices are used by directors to compensate for inadequate refrigeration space in school nutrition programs?
- 5) What are budgeting practices for equipment purchases in schools?
- 6) What are best practices used for purchasing refrigeration equipment in school districts?

Questions in Round 1 will be open-ended.

Page 1

---

Question 1 \*\* required \*\*

---

What demographic and descriptive information about school nutrition programs is needed to meet study objectives?

Question 2 \*\* required \*\*

---

When you think about describing school districts what demographic terms (or other terms used with school nutrition) come to mind?

Question 3 \*\* required \*\*

---

List the types of food production systems found in school nutrition programs.

Question 4 \*\* required \*\*

---

When you think about individual schools what descriptive terms (demographics or other terms used in school nutrition) come to mind?

Question 5 \*\* required \*\*

---

The researcher will ask for the number of schools in the district and the number of schools participating in each USDA food program. What other valuable information describing the district should be obtained?

Question 6 \*\* required \*\*

---

Describe information about food deliveries and warehousing that would be important in answering research questions and developing a decision model about refrigeration equipment.

Question 7 \*\* required \*\*

---

What questions should be asked about capital equipment budgeting?

Question 8 \*\* required \*\*

---

Describe how to ask a question that leads the director to identify the type and number of pieces of equipment purchased by the district in the past three years.

Question 9 \*\* required \*\*

---

Describe how the following question can be worded to identify the item most needed instead of an expensive piece of equipment that is desired but not necessarily needed.

If budget allowed, what is the first piece of new equipment you would purchase and why?

Question 10 \*\* required \*\*

---

When refrigeration capacity (including chilled and frozen items) is not ideal, how can directors adapt for this lack of space?

Question 11 \*\* required \*\*

---

List the types of refrigeration equipment found in school nutrition programs.

Question 12 \*\* required \*\*

---

There is great interest in determining if refrigeration space in school nutrition programs is adequate to implement the new meal patterns. What suggestions do you have for asking this question?

Question 13 \*\* required \*\*

---

The school nutrition director will be asked to select one school in their district and answer more specific questions about refrigeration equipment. If there is only one school in the district, information will be provided about that one school. If there is more than one school the director will look at an alphabetical list of schools in their district and select the second school on the list.

What school specific information should be obtained?

Question 14 \*\* required \*\*

---

The school nutrition director will be asked to give the number and cubic feet of each type of refrigeration equipment in the selected school. It is anticipated that the number of each type of refrigeration equipment will be easily obtained. The cubic feet or other size description of the equipment may not be known. Share your ideas of how this information can be obtained when using an electronic survey.

Question 15 \*\* required \*\*

---

School nutrition directors will be asked to rate the adequacy of the refrigerated storage at the selected school. If refrigeration space is a problem, what ideas do you have to make efficient use of existing refrigeration space and what measures can be taken to adapt for inadequate refrigeration?

Question 16 \*\* required \*\*

---

School nutrition directors responding to the survey may provide their email address and enter a drawing to receive a free 4-hour (maximum) inservice training session for their school nutrition program. Can you provide additional ideas for improving the survey response rate?

Question 17

---

Please provide additional comments in the space provided.

Closing Message: Thank you for your time and expertise! The second correspondence for the panel is planned for March 14, 2012.



## Appendix B.2. Delphi Panel Round 2 Questions

### Survey Description:

This survey is drafted from feedback provided in Round 1 and the review of literature. Review each question and provide comments in the space provided. Indicate for each question if it is acceptable as presented or provide ideas for changes.

### Opening Instructions:

This survey will be open from Wednesday March 14, 2012 until midnight on Monday March 19, 2012. To begin the survey press NEXT.

### Question 1

My school district is:

- Public/independent school district
- Private school district
- Residential child care institution
- Charter school district
- Other:

Further comments about your response:

### Question 2

This school district is considered to be:

- Urban
- Suburban
- Rural
- Other:

Further comments about your response:

### Question 3

The school nutrition program in this district is:

- Self-operated
- Operated by a food management company

Further comments about your response:

Question 4

---

There are \_\_\_\_ schools in my district (please give **ONLY** a numerical value such as 9, not nine).

Question 5

---

School district student enrollment is \_\_\_\_\_ (please give **ONLY** a numeric value such as 2507).

Question 6

---

School district percent free and reduced price meals is \_\_\_\_\_ %.

Question 7

---

School district participation rate in the National School Lunch Program is \_\_\_\_\_ %.

Question 8

---

The average daily number of meals served in the district (all types) is \_\_\_\_\_.

Question 9

---

	Yes	No
9.1 My school district participates in the School Breakfast Program.	<input type="radio"/>	<input type="radio"/>
9.2 My school district participates in the Fresh Fruit and Vegetable Program.	<input type="radio"/>	<input type="radio"/>
9.3 My school district participates in the Special Milk Program.	<input type="radio"/>	<input type="radio"/>
9.4 My school district participates in the After School Snack Program.	<input type="radio"/>	<input type="radio"/>
9.5 My school district participates in the Supper Program.	<input type="radio"/>	<input type="radio"/>
9.6 My school nutrition program offers a la carte items.	<input type="radio"/>	<input type="radio"/>
9.7 My school nutrition program operates the vending machines in the district.	<input type="radio"/>	<input type="radio"/>
9.8 All school campuses are closed campuses.	<input type="radio"/>	<input type="radio"/>

Question 10

---

Do you have comments on the previous question? Anything to add to the question?

Question 11

---

The questions about warehousing are branched--if the answer is YES, the director will be asked about frequency of delivery to schools. If the answer is NO, the director will go to the next warehousing question.

Canned/dry goods are centrally warehoused in this district.

- Yes
- No

Further comments about your response:

Question 12

---

Milk and/or dairy products are centrally warehoused in this district.

- Yes
- No

Further comments about your response:

Question 13

---

Bread products are centrally warehoused in this district.

- Yes
- No

Further comments about your response:

Question 14

---

Frozen foods are centrally warehoused in this district.

- Yes
- No

Further comments about your response:

Question 15

Refrigerated foods are centrally warehoused in this district.

- Yes
- No

Further comments about your response:

Question 16

Supplies, disposable, and/or small equipment is centrally warehoused in this district.

- Yes
- No

Further comments about your response:

Question 17

1 - Strongly Agree | 2 - Somewhat Agree | 3 - Agree  
4 - Somewhat Disagree | 5 - Strongly Disagree

	1	2	3	4	5
17.1 My district/school nutrition program has a formal capital equipment budget process.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.2 My district/school nutrition program maintains a depreciation schedule for foodservice equipment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.3 As school nutrition director, I participate in capital equipment budgeting for my department.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.4 My district/school nutrition program purchases new foodservice equipment ONLY when old equipment breaks down.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.5 In general, the refrigeration capacity for the school nutrition program (considering all schools) is adequate.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.6 My district/school nutrition program includes equipment replacement and/or equipment purchase in the annual budget each year.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.7 At least one school in my district purchased equipment through funds available through the American Recovery and Reinvestment Act of 2009.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.8 Equipment for my district has been purchased through equipment grants such as the Fresh Fruit and Vegetable Program or private grants.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.9 My state agency allows funds to be held in a reserve from one year to the next for the purpose of equipment purchases and/or facilities improvement.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 18

Do you have suggestions for changing the previous question?

Question 19

Assume that budget is not an issue. If you could purchase one type of equipment, what would you purchase based on the **greatest need**?

- Cooking equipment such as range, steamer, or combooven
- Refrigeration equipment such as walk-in or reach-in refrigerators/freezers, refrigerated serving line equipment, or blast chiller
- Sanitation equipment such as dishwasher
- Service equipment such as serving line
- Other:

Further comments about your response:

Question 20

Identify the barriers to purchasing refrigeration equipment in your school nutrition program.

1 - Strongly Agree | 2 - Agree | 3 - Neutral | 4 - Disagree  
5 - Strongly Disagree

	1	2	3	4	5
20.1 Insufficient funding is a barrier to purchasing refrigeration equipment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20.2 Lack of space in the kitchen is a barrier to purchasing refrigeration equipment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20.3 Inadequacy of utilities is a barrier to purchasing refrigeration equipment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20.4 Obtaining approval from district administrators is a barrier to purchasing refrigeration equipment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20.5 Being unsure of requirements and/or specifications is a barrier to purchasing refrigeration equipment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20.6 Making time to complete the purchasing process is a barrier to purchasing refrigeration equipment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20.7 State and Federal procurement regulations are a barrier to purchasing refrigeration equipment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 21

---

Do you have suggestions for improving the previous question?

Question 22

---

Identify resources you would use to develop specifications for refrigeration equipment.

1 - Definitely would use | 2 - Might use | 3 - Neutral  
4 - Probably would not use | 5 - Definitely would not use

	1	2	3	4	5
22.1 Manufacturer's representative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22.2 Representative from local equipment company	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22.3 Cut sheets from company	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22.4 Sample specifications from manufacturer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22.5 Resources from the National Food Service Management Institute	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22.6 Resources from state agency staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22.7 Resources from School Nutrition Association	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22.8 Cooperative purchasing organization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22.9 Specifications used previously in my district	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 23

---

Do you have suggestions for improving the previous question?

Question 24

---

Identify the number and type of refrigeration equipment purchased for your **district** over the past three years. Refrigeration equipment types include 1) reach-in refrigerator, 2) reach-in freezer, 3) walk-in refrigerator, 4) walk-in freezer, 5) milk box/cooler, ice cream or yogurt machine, 6) serving/display refrigeration, 7) blast chiller, and 8) other. If no refrigeration equipment has been purchased, please indicate "none" in the space provided.

Question 25

Identify the practices you use or would use to compensate for inadequate refrigeration space in school nutrition programs. Remember that "refrigeration" refers to frozen and refrigerated storage.

1 - Very likely to use | 2 - Might use | 3 - Neutral  
4 - Probably would not use | 5 - Definitely would not use

	1	2	3	4	5
25.1 Maintain low inventory.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25.2 Decrease the number of items purchased (such as buying only one size or quality of an entree item).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25.3 Adjust the menu to reduce the number of refrigerated and frozen items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25.4 Schedule more frequent deliveries of refrigerated items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25.5 Plan just-in-time deliveries of refrigerated items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25.6 Use local producers or farm-to-school program to allow more frequent deliveries with quick turnaround times.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25.7 Use high capacity shelving for getting the most out of existing refrigeration.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25.8 Rent or lease refrigeration space offsite.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25.9 Pay extra fees or higher prices for more frequent deliveries.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25.10 Make more items from scratch so existing refrigeration can be used for ready-to-serve items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25.11 Investigate cooperative bidding to offset costs of more frequent deliveries.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25.12 Lease refrigeration equipment to be brought onsite.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 26

Do you have suggestions for changing the previous question?

Question 27

---

The next questions will be specific to one school in your district. If your district has only one school, that is the school that will be used. If you have more than one school in your district, choose the second school from an alphabetical list of the schools in your district and answer the questions specifically for the selected school.

The selected school is a

- K-12 school
- Elementary school
- Middle school
- High school
- Other:

Further comments about your response:

Question 28

---

Enrollment at the selected school is \_\_\_\_\_ (please give number such as 540).

Question 29

---

The percent free and reduced price meals at the selected school is \_\_\_\_\_%.

Question 30

---

The participation rate in the National School Lunch Program at the selected school is \_\_\_\_\_%.

Question 31

---

The average daily number of meals (all types) served at the selected school is \_\_\_\_\_.



Question 32

Select the answer that best describes the type of food production at the selected school.

- Onsite preparation, all scratch cooking
- Onsite preparation with convenience foods
- Central kitchen facility that serves in school and also send food to other kitchens
- Satellite kitchen receiving food from central kitchen, some onsite preparation
- Satellite kitchen receiving food from central kitchen, no onsite preparation
- Preplated meals
- Other:

Further comments about your response:

Question 33

1 - Strongly Agree | 2 - Agree | 3 - Neutral | 4 - Disagree  
5 - Strongly Disagree

33.1 Current refrigeration and/or freezer space at the selected school is adequate to store and serve the additional fruit and vegetable requirements in the new meal pattern.

1 2 3 4 5

33.2 In comparing the adequacy of refrigeration storage in the selected school to the adequacy of refrigeration storage in the district as a whole, they are about the same.

33.3 Refrigeration storage in the selected school is less adequate than most schools in the district.

33.4 Refrigeration storage in the selected school is more adequate than most schools in the district.

Question 34

Do you have suggestions for improving the previous question?

Question 35

---

Note to panelists: This question will be branched. If answered yes, the next question asks for dimensions. The followup question would be worded: Give the dimensions of the walk-in refrigerator below. Examples: 1 walk-in refrigerator 6 feet wide by 8 feet long by 8 feet high and

1 walk-in refrigerator 10 feet wide by 12 feet long by 10 feet high.

The selected school has a walk-in refrigerator.

Yes

No

Further comments about your response:

Question 36

---

Note to panelists: This question will be branched. If answered yes, the next question asks for dimensions.

The selected school has a walk-in freezer.

Yes

No

Further comments about your response:

Question 37

---

Note to panelists: This question will be branched. If answered yes, the next question asks for the number and size of the reach-ins. Wording for the followup question:

In the space provided, give the number and type of reach-in refrigerators in the school.

Examples:

2 single door reach-in refrigerators

1 two compartment reach-in refrigerator

3 triple door reach-in refrigerator

The selected school has at least one reach-in refrigerator.

Yes

No

Further comments about your response:

Question 38

---

Note to panelists: This question is branched. If answered yes, the next question will ask for the number and size of the reach-in freezers.

The selected school has at least one reach-in freezer.

- Yes
- No

Further comments about your response:

Question 39

---

Note to panelists: This is a branched question. If answered yes, next question will ask for number and size of pass-through and roll-in refrigerators.

The selected school has at least one pass-through or roll-in refrigerator.

- Yes
- No

Further comments about your response:

Question 40

---

Note to panelists: The following is a branched question. If answered yes, the next questions will ask for the number and size of the under-counter refrigerators and freezers.

The selected school has at least one under-counter refrigerator or freezer.

- Yes
- No

Further comments about your response:

Question 41

---

Note to panelists: The following is a branched question. If answered yes, the next question asks for the number and size of milk box, ice cream cabinet, and yogurt machine.

The selected school has at least one milk box, ice cream cabinet, or yogurt machine.

- Yes
- No

Further comments about your response:

Question 42

---

Note to panelists: The following is a branched question. If answered yes, the next question asks for the number and size of the refrigerated serving line equipment.

The selected school has at least one piece of refrigerated serving line equipment in addition to that previously reported. Examples of refrigerated serving line equipment are display refrigerator, refrigerated deli counter, refrigerated salad bar.

- Yes
- No

Further comments about your response:

Question 43

---

Choose the answer that best describes the highest educational attainment of the school nutrition director.

- High school diploma or equivalent
- Some college
- Bachelor's degree from college
- Culinary school graduate
- Master's degree from college
- PhD degree from college
- Other:

Further comments about your response:

Question 44

---

Select all answers that describe the school nutrition director.

- ServSafe certification
- Other food safety certification
- Certified chef
- School Nutrition Specialist through School Nutrition Association
- Certified Director through School Nutrition Association
- Certified Dietary Manager
- Dietetic Technician Registered
- Registered Dietitian
- Other:

Further comments about your response:

Question 45

---

The sex of the school nutrition director is:

- Male
- Female

Further comments about your response:

Question 46

---

The school nutrition director has been in the position \_\_\_\_\_ years.

Question 47

---

The school nutrition director has \_\_\_\_\_ years' experience in school nutrition.

- less than 1 year
- 1 up to 5 years
- 5 up to 10 years
- 10 up to 15 years
- 15 up to 20 years
- 20 up to 25 years
- 25 up to 30 years
- 30 years or more

Further comments about your response:

Question 48

---

Please submit additional comments about the information in the survey, anything that is missing, or other comments to the researcher.

## Appendix B.3 Delphi Panel Round 3 Questions

### Refrigeration Equipment in School Nutrition Programs (Round 3)

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#### Survey Description:

This survey is drafted from feedback provided in Rounds 1 and 2 and the review of literature. Please review and provide comments in any comment space or in the final open-ended question.

#### Opening Instructions:

This survey will be open from Friday March 23, 2012 until midnight on Wednesday March 28, 2012. To begin the survey press NEXT.

#### Question 1

---

My school district is:

- Public/independent school district
- Private school district
- Residential child care institution
- Charter school district
- Other:

Further comments about your response:

#### Question 2

---

This area where the school district office is located is:

- the central city of a metropolitan area listed at <http://www.census.gov/population/estimates/metro-city/cency.txt> (urban)
- a metropolitan area but not the central city (suburban)
- is not a metropolitan area (rural)
- Other:

Further comments about your response:

#### Question 3

---

The school nutrition program in this district is:

- Self-operated
- Operated by a food management company

Further comments about your response:

Question 4

---

There are \_\_\_\_ schools in my district (please give **ONLY** a numerical value such as 9, not nine).

Question 5

---

School district student enrollment is \_\_\_\_\_ (please give **ONLY** a numeric value such as 2507).

Question 6

---

School district percent free and reduced price meals is \_\_\_\_\_ %. Please enter **ONLY** numbers, not the % sign.

Question 7

---

School district participation rate in the National School Lunch Program is \_\_\_\_\_ %. Please enter **ONLY** numbers, not the % sign.

Question 8

---

The average daily number of meals served in the district (including breakfast, lunch, snack and supper) is \_\_\_\_\_. Please give **ONLY** a numeric value such as 10,890.



Question 9

---

	Yes	No
9.1 My school district participates in the School Breakfast Program.	<input type="radio"/>	<input type="radio"/>
9.2 My school district participates in the Fresh Fruit and Vegetable Program.	<input type="radio"/>	<input type="radio"/>
9.3 My school district participates in the Special Milk Program.	<input type="radio"/>	<input type="radio"/>
9.4 My school district participates in the After School Snack Program (as part of NSLP).	<input type="radio"/>	<input type="radio"/>
9.5 My school district participates in the Supper Program.	<input type="radio"/>	<input type="radio"/>
9.6 My school nutrition program offers a la carte items.	<input type="radio"/>	<input type="radio"/>
9.7 My school nutrition program operates reimbursable meal vending machines.	<input type="radio"/>	<input type="radio"/>
9.8 My school nutrition program operates vending machines in the district.	<input type="radio"/>	<input type="radio"/>
9.9 Contractors operate vending machines in the school district.	<input type="radio"/>	<input type="radio"/>
9.10 All school campuses are closed campuses.	<input type="radio"/>	<input type="radio"/>

Question 10

---

Canned/dry goods are centrally warehoused in this district.

- No
- Yes with daily deliveries to the schools
- Yes with twice weekly deliveries to the schools
- Yes with once a week deliveries to the schools
- Yes with once every 2 weeks deliveries to the schools
- Yes with once a month deliveries to the schools
- Other:

Question 11

---

Milk and/or dairy products are centrally warehoused in this district.

- No
- Yes with daily deliveries to the schools
- Yes with twice weekly deliveries to the schools
- Yes with once a week deliveries to the schools
- Yes with once every 2 weeks deliveries to the schools
- Yes with once a month deliveries to the schools
- Other:

Question 12

---

Bread products are centrally warehoused in this district.

- No
- Yes with daily deliveries to the schools
- Yes with twice weekly deliveries to the schools
- Yes with once a week deliveries to the schools
- Yes with once every 2 weeks deliveries to the schools
- Yes with once a month deliveries to the schools
- Other:

Question 13

---

Frozen foods are centrally warehoused in this district.

- No
- Yes with daily deliveries to the schools
- Yes with twice weekly deliveries to the schools
- Yes with once a week deliveries to the schools
- Yes with once every 2 weeks deliveries to the schools
- Yes with once a month deliveries to the schools
- Other:

Question 14

---

Refrigerated foods are centrally warehoused in this district.

- No
- Yes with daily deliveries to the schools
- Yes with twice weekly deliveries to the schools
- Yes with once a week deliveries to the schools
- Yes with once every 2 weeks deliveries to the schools
- Yes with once a month deliveries to the schools
- Other:

Question 15

Supplies, disposables, and/or small equipment are centrally warehoused in this district.

- No
- Yes with daily deliveries to the schools
- Yes with twice weekly deliveries to the schools
- Yes with once a week deliveries to the schools
- Yes with once every 2 weeks deliveries to the schools
- Yes with once a month deliveries to the schools
- Other:

Question 16

1 - Strongly Agree | 2 - Agree | 3 - Neutral | 4 - Disagree  
5 - Strongly Disagree | 6 - Unknown/unable to judge

	1	2	3	4	5	6
16.1 My district/school nutrition program has a formal capital equipment budget process.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.2 My district/school nutrition program maintains a depreciation schedule for foodservice equipment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.3 As school nutrition director, I participate in capital equipment budgeting for my department.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.4 My district/school nutrition program purchases new foodservice equipment ONLY when old equipment breaks down.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.5 In general, the refrigeration capacity for the school nutrition program (considering all schools) is adequate.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.6 My district/school nutrition program includes equipment replacement and/or equipment purchase in the annual budget each year.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.7 At least one school in my district purchased equipment through funds available through the American Recovery and Reinvestment Act of 2009.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.8 At least one school in my district has acquired equipment through the Fresh Fruit and Vegetable Program or private grants (excluding the American Recovery and Reinvestment Act of 2009).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.9 My state agency allows funds (exceeding the 3 month fund balance) to be held for the purpose of equipment purchases.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 17

Assume that budget is not an issue. If you could purchase one type of equipment, what would you purchase based on the **greatest need**?

- Cooking equipment such as range, steamer, or combo oven
- Refrigeration equipment such as walk-in or reach-in refrigerators/freezers, refrigerated serving line equipment, or blast chiller
- Sanitation equipment such as dishwasher
- Service equipment such as serving line
- Other:

Further comments about your response:

Question 18

Identify the barriers to purchasing refrigeration equipment in your school nutrition program.

1 - Strongly Agree | 2 - Agree | 3 - Neutral | 4 - Disagree  
5 - Strongly Disagree

	1	2	3	4	5
18.1 Insufficient funding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.2 Lack of space in the kitchen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.3 Inadequacy of utilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.4 Obtaining approval from district administrators	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.5 Having sufficient knowledge to write specifications	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.6 Making time to complete the purchasing process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.7 State and Federal procurement regulations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 19

---

Identify resources you would use to develop specifications for refrigeration equipment.

1 - Definitely would use | 2 - Might use | 3 - Neutral  
4 - Probably would not use | 5 - Definitely would not use

	1	2	3	4	5
19.1 Manufacturer's representative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.2 Representative from local equipment company	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.3 Specification sheets from company	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.4 Sample specifications from manufacturer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.5 Resources from the National Food Service Management Institute	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.6 Resources from State agency staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.7 Resources from School Nutrition Association	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.8 Cooperative purchasing organization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.9 Specifications used previously in my district	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.10 Foodservice consultant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 20

---

Identify the number and type of refrigeration equipment purchased for your **district** over the past three years. Refrigeration equipment types include 1) reach-in refrigerator, 2) reach-in freezer, 3) walk-in refrigerator, 4) walk-in freezer, 5) milk box/cooler, ice cream or yogurt machine, 6) serving/display refrigeration, 7) blast chiller, and 8) other. If no refrigeration equipment has been purchased, please indicate "none" in the space provided.

Question 21

Identify the practices you use or would use to compensate for inadequate refrigeration space in school nutrition programs. Remember that "refrigeration" refers to frozen and refrigerated storage.

1 - Very likely to use | 2 - Might use | 3 - Neutral  
4 - Probably would not use | 5 - Definitely would not use

	1	2	3	4	5
21.1 Maintain low inventory.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.2 Decrease the number of items purchased (such as buying only one size or quality of an entree item).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.3 Adjust the menu to reduce the number of refrigerated and frozen items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.4 Schedule more frequent deliveries of refrigerated items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.5 Plan just-in-time deliveries of refrigerated items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.6 Use local producers or farm-to-school program to allow more frequent deliveries with quick turnaround times.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.7 Use high capacity shelving for getting the most out of existing refrigeration.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.8 Rent or lease refrigeration space offsite.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.9 Pay extra fees or higher prices for more frequent deliveries.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.10 Make more items from scratch so existing refrigeration can be used for ready-to-serve items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.11 Investigate cooperative bidding to offset costs of more frequent deliveries.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.12 Lease refrigeration equipment to be brought onsite.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.13 Add walk-in refrigerator/freezer at warehouse.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 22

---

The next questions will be specific to one school in your district. If your district has only one school, that is the school that will be used. If you have more than one school in your district, choose the second school from an alphabetical list of the schools in your district and answer the questions specifically for the selected school.

The selected school is a

- K-12 school
- Elementary school
- Middle school
- High school
- Other:

Further comments about your response:

Question 23

---

Enrollment at the selected school is \_\_\_\_\_ (please give number such as 540).

Question 24

---

The percent free and reduced price meals at the selected school is \_\_\_\_\_%. Please give only numerical value and do not include % sign.

Question 25

---

The participation rate in the National School Lunch Program at the selected school is \_\_\_\_\_%. Please give a numeric value and do not include the % sign.

Question 26

---

The average daily number of meals (including breakfast, lunch, snack, and supper) served at the selected school is \_\_\_\_\_. Please enter a numeric value only, such as 1200.

Question 27

---

Select the answer that best describes the type of food production at the selected school.

- Onsite preparation, all scratch cooking
- Onsite preparation with some convenience foods
- Central kitchen that sends food to other kitchens and does not serve students in the facility
- Central kitchen facility that serves in school and also sends food to other kitchens
- Satellite kitchen receiving food from central kitchen, some onsite preparation
- Satellite kitchen receiving food from central kitchen, no onsite preparation
- Purchased preplated meals
- Other:

Further comments about your response:

Question 28

---

Indicate all programs offered in the selected school and describe other programs or services not listed in the comment section.

- School Breakfast Program
- Fresh Fruit and Vegetable Program
- Special Milk Program
- After School Snack Program
- Supper Program
- A la carte
- Vending (operated by School Nutrition Program)
- Breakfast in the classroom
- Catering
- Other:

Further comments about your response:



Question 29

---

1 - Strongly Agree | 2 - Agree | 3 - Neutral | 4 - Disagree  
5 - Strongly Disagree

	1	2	3	4	5
29.1 Current refrigeration and/or freezer space at the selected school is adequate to store and serve the additional fruit and vegetable requirements in the new meal pattern.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
29.2 In comparing the adequacy of refrigeration storage in the selected school to the adequacy of refrigeration storage in the district as a whole, they are about the same.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
29.3 Refrigeration storage in the selected school is less adequate than most schools in the district.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
29.4 Refrigeration storage in the selected school is more adequate than most schools in the district.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 30

---

The selected school has a walk-in refrigerator.

- Yes; give number and dimensions below. Example: 1 walk-in dimensions 10' wide by 12' long by 10' high
- No

Further comments about your response:

Question 31

---

The selected school has a walk-in freezer.

- Yes; give number and dimensions below. Example: 1 walk-in dimensions 10' wide by 12' long by 10' high
- No

Further comments about your response:

Question 32

---

The selected school has at least one reach-in refrigerator.

Yes. Give the number and type below. Examples: 2 single-door; 1 two-door, and 2 triple-door

No

Further comments about your response:

Question 33

---

The selected school has at least one reach-in freezer.

Yes. Give the number and type below. Examples: 2 single-door; 1 two-door, and 2 triple-door

No

Further comments about your response:

Question 34

---

The selected school has at least one pass-through or roll-in refrigerator and/or freezer.

Yes. Give the number and type below. Examples: 2 single-door pass thru refrigerators; 1 double-door roll-in freezer

No

Further comments about your response:

Question 35

---

The selected school has at least one under-counter refrigerator or freezer.

Yes. Give the number and type below. Examples: 2 freezers; 3 refrigerators

No

Further comments about your response:

Question 36

---

The selected school has at least one milk box.

- Yes. Give the number and capacity below. Example: 1 milk box, 16 case capacity..
- No

Further comments about your response:

Question 37

---

The selected school has at least one ice cream cabinet or yogurt machine.

- Yes. Give the number and type below. Examples: 14.8 cu ft ice cr box; 1 3-spout yogurt machine
- No

Further comments about your response:

Question 38

---

The selected school has at least one piece of refrigerated serving line equipment in addition to that previously reported. Examples of refrigerated serving line equipment are display refrigerator, refrigerated deli counter, refrigerated salad bar.

- Yes. Give the number and descriptions below. Examples: 1 display refrigerator, 15 cu ft; 1 deli counter, about 3' by 2'; 2 refrigerated salad bars, 6' x 3' surface
- No

Further comments about your response:

Question 39

Choose the answer that best describes the highest educational attainment of the school nutrition director.

- High school diploma or equivalent
- Some college
- Culinary school training
- Associate degree from college
- Bachelor's degree from college
- Culinary school graduate (including Bachelor's degree)
- Master's degree from college
- PhD degree from college
- Other:

Further comments about your response:

Question 40

Select all answers that describe the school nutrition director certifications.

- ServSafe certification
- Other food safety certification
- Certified chef
- School Nutrition Specialist through School Nutrition Association
- Certified Director through School Nutrition Association
- Certified Dietary Manager
- Dietetic Technician Registered
- Registered Dietitian
- Other:

Further comments about your response:

Question 41

The sex of the school nutrition director is:

- Female
- Male

Further comments about your response:

Question 42

---

The school nutrition director has been in the position \_\_\_\_\_ years.

Question 43

---

The school nutrition director has \_\_\_\_\_ years' experience in school nutrition.

- less than 1 year
- 1 to 5 years
- 6 to 10 years
- 11 to 15 years
- 16 to 20 years
- 21 to 25 years
- 26 to 30 years
- more than 30 years

Further comments about your response:

Question 44

Please submit additional comments about the information in the survey, anything that is missing, or other comments to the researcher.

---

## **Appendix C – Letter Sent with Survey Instrument**

My name is Virginia Webb and I am a PhD student at Kansas State University. Your help in completing an online survey is needed. To begin: Select the 2nd school on an alphabetical list of schools in your district. If you have only one school, use it.

Collect the following information on the selected school before opening the survey.

- 1) Enrollment, % free and reduced price meals, participation rate, and average daily number of meals;
- 2) Inventory refrigeration equipment at the selected school. See the examples and describe equipment in a like manner.
  - a) Walk-in refrigerators: 1 walk-in 10'Wx12'Lx8'H. Be sure to include height of walk-ins!
  - b) Walk-in freezers: 10x12x10'.
  - c) Reach-in refrigerators: 2 single-door, 2 triple-door
  - d) Reach-in freezers: 1 triple-door, 25 cu ft home-type freezer
  - e) Pass-through or roll-in refrigerators (not walk-ins): 2 single-door pass-thru; 1 single door roll-in
  - f) Pass-through or roll-in freezers (not walk-ins): 2 single-door pass-thru; 1 single door roll-in
  - g) Milk boxes: 2 boxes, 16 case
  - h) Under-counter refrigerators: 2 refrigerators
  - i) Under-counter freezers: 2 freezers
  - j) Ice cream cabinet or yogurt machines: 14.8 cu ft ice cream box; 1 3-spout yogurt
  - k) Refrigerated serving line equipment: 1 display refrigerator, 15 cu ft; 1 deli counter, about 3' by 2'; 2 refrigerated salad bars, 6' x 3' surface
  - l) Any other refrigerated equipment: 2 blast chillers, 3 refrigerated drawers, about 2'x3'; 1 sandwich prep, 12 pan capacity

This project has been reviewed by the KSU IRB, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research subject should be directed to Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 203 Fairchild Hall, KSU, Manhattan, KS 66506, 785-532-3224.

Thank you very much!

Sincerely,

Virginia S. Webb, Graduate Student  
662-202-6673

Betsy Barrett, PhD, RD  
785-532-2208

## **Appendix D – Kansas Onsite Survey Instrument**

### **Refrigeration Equipment in School Nutrition Programs Kansas School Nutrition Directors for Site Observation**

#### Survey Description:

This survey is designed to gather information on refrigeration equipment in school nutrition programs. Please be sure to check the box to enter email address and be eligible for the drawing for a training session at your location! Your email address will be separated from your responses, maintaining your anonymity. Once you open the survey, do not close it until you have finished.

#### Research objectives include:

- 1) Identify the refrigeration capacity available in schools.
- 2) Ascertain foodservice equipment budgeting practices in school districts.
- 3) Describe best practices related to purchase and use of refrigeration equipment in schools.
- 4) Determine if there is adequate refrigeration space to meet the new NSLP meal patterns.
- 5) Develop a preliminary decision model for purchasing refrigeration equipment in school districts.

#### Opening Instructions:

This survey will be open from Thursday March 29, 2012 until midnight on Friday April 6, 2012. To begin the survey press NEXT.



Question 1 \*\* required \*\*

---

My school district's name is:

Question 2 \*\* required \*\*

---

My school district is:

- Public/independent school district
- Private school district
- Residential child care institution
- Charter school district
- Other:

Question 3 \*\* required \*\*

---

This area where the school district office is located is:

- the central city of a metropolitan area listed at <http://www.census.gov/population/estimates/metro-city/cency.txt> (urban)
- a metropolitan area but not the central city (urban/suburban)
- is not a metropolitan area (rural)
- Other:

Question 4 \*\* required \*\*

---

The school nutrition program in this district is:

- Self-operated
- Operated by a food management company

Question 5 \*\* required \*\*

---

There are \_\_\_\_ schools in my district (please give **ONLY** a numerical value such as 9, not nine).

Question 6 \*\* required \*\*

---

School district student enrollment is \_\_\_\_\_ (please give **ONLY** a numeric value such as 2507).

Question 7 \*\* required \*\*

---

School district percent free and reduced price meals is \_\_\_\_\_. Please enter ONLY numbers, not the % sign.

Question 8 \*\* required \*\*

---

School district participation rate in the National School Lunch Program is \_\_\_\_\_. Please enter ONLY numbers, not the % sign.

Question 9 \*\* required \*\*

---

The average daily number of meals served in the district (including breakfast, lunch, snack and supper) is \_\_\_\_\_. Please give ONLY a numeric value such as 10,890.

Question 10 \*\* required \*\*

---

	Yes	No
10.1 My school district participates in the School Breakfast Program.	<input type="radio"/>	<input type="radio"/>
10.2 My school district participates in the Fresh Fruit and Vegetable Program.	<input type="radio"/>	<input type="radio"/>
10.3 My school district participates in the Special Milk Program.	<input type="radio"/>	<input type="radio"/>
10.4 My school district participates in the After School Snack Program (as part of NSLP).	<input type="radio"/>	<input type="radio"/>
10.5 My school district participates in the Supper Program.	<input type="radio"/>	<input type="radio"/>
10.6 My school nutrition program offers a la carte items.	<input type="radio"/>	<input type="radio"/>
10.7 My school nutrition program operates reimbursable meal vending machines.	<input type="radio"/>	<input type="radio"/>
10.8 My school nutrition program operates vending machines in the district.	<input type="radio"/>	<input type="radio"/>
10.9 Contractors operate vending machines in the school district.	<input type="radio"/>	<input type="radio"/>
10.10 All school campuses are closed campuses.	<input type="radio"/>	<input type="radio"/>

Question 11 \*\* required \*\*

---

Canned/dry goods are centrally warehoused in this district.

- No
- Yes with daily deliveries to the schools
- Yes with twice weekly deliveries to the schools
- Yes with once a week deliveries to the schools
- Yes with once every 2 weeks deliveries to the schools
- Yes with once a month deliveries to the schools
- Other:

Question 12 \*\* required \*\*

---

Milk and/or dairy products are centrally warehoused in this district.

- No
- Yes with daily deliveries to the schools
- Yes with twice weekly deliveries to the schools
- Yes with once a week deliveries to the schools
- Yes with once every 2 weeks deliveries to the schools
- Yes with once a month deliveries to the schools
- Other:

Question 13 \*\* required \*\*

---

Bread products are centrally warehoused in this district.

- No
- Yes with daily deliveries to the schools
- Yes with twice weekly deliveries to the schools
- Yes with once a week deliveries to the schools
- Yes with once every 2 weeks deliveries to the schools
- Yes with once a month deliveries to the schools
- Other:

Question 14 \*\* required \*\*

---

Frozen foods are centrally warehoused in this district.

- No
- Yes with daily deliveries to the schools
- Yes with twice weekly deliveries to the schools
- Yes with once a week deliveries to the schools
- Yes with once every 2 weeks deliveries to the schools
- Yes with once a month deliveries to the schools
- Other:

Question 15 \*\* required \*\*

---

Refrigerated foods are centrally warehoused in this district.

- No
- Yes with daily deliveries to the schools
- Yes with twice weekly deliveries to the schools
- Yes with once a week deliveries to the schools
- Yes with once every 2 weeks deliveries to the schools
- Yes with once a month deliveries to the schools
- Other:

Question 16 \*\* required \*\*

---

Supplies, disposables, and/or small equipment are centrally warehoused in this district.

- No
  - Yes with daily deliveries to the schools
  - Yes with twice weekly deliveries to the schools
  - Yes with once a week deliveries to the schools
  - Yes with once every 2 weeks deliveries to the schools
  - Yes with once a month deliveries to the schools
  - Other:
-

Question 17 \*\* required \*\*

Identify financial practices in your school district.

1 - Strongly Agree | 2 - Agree | 3 - Neutral | 4 - Disagree  
5 - Strongly Disagree | 6 - Unknown/unable to judge

	1	2	3	4	5	6
17.1 My district/school nutrition program has a formal capital equipment budget process.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.2 My district/school nutrition program maintains a depreciation schedule for foodservice equipment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.3 As school nutrition director, I participate in capital equipment budgeting for my department.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.4 My district/school nutrition program purchases new foodservice equipment ONLY when old equipment breaks down.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.5 In general, the refrigeration capacity for the school nutrition program (considering all schools) is adequate.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.6 My district/school nutrition program includes equipment replacement and/or equipment purchase in the annual budget each year.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.7 At least one school in my district purchased equipment through funds available through the American Recovery and Reinvestment Act of 2009.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.8 At least one school in my district has acquired equipment through the Fresh Fruit and Vegetable Program or private grants (excluding the American Recovery and Reinvestment Act of 2009).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.9 My state agency allows funds (exceeding the 3 month fund balance) to be held for the purpose of equipment purchases.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 18 \*\* required \*\*

Assume that budget is not an issue. If you could purchase one type of equipment, what would you purchase based on the **greatest need**?

- Cooking equipment such as range, steamer, or combioven
- Refrigeration equipment such as walk-in or reach-in refrigerators/freezers, refrigerated serving line equipment, or blast chiller
- Sanitation equipment such as dishwasher
- Service equipment such as serving line
- Other:

Further comments about your response:

Question 19 \*\* required \*\*

---

Identify the barriers to purchasing refrigeration equipment in your school nutrition program.

1 - Strongly Agree | 2 - Agree | 3 - Neutral | 4 - Disagree  
5 - Strongly Disagree

	1	2	3	4	5
19.1 Insufficient funding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.2 Lack of space in the kitchen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.3 Inadequacy of utilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.4 Obtaining approval from district administrators	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.5 Having sufficient knowledge to write specifications	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.6 Making time to complete the purchasing process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.7 State and Federal procurement regulations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 20

---

Identify additional barriers to purchasing refrigeration equipment not listed in Question 19.

Question 21 \*\* required \*\*

---

Identify resources you would use to develop specifications for refrigeration equipment.

1 - Definitely would use | 2 - Might use | 3 - Neutral  
4 - Probably would not use | 5 - Definitely would not use

	1	2	3	4	5
21.1 Manufacturer's representative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.2 Representative from local equipment company	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.3 Specification sheets from company	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.4 Sample specifications from manufacturer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.5 Resources from the National Food Service Management Institute	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.6 Resources from State agency staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.7 Resources from School Nutrition Association	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.8 Cooperative purchasing organization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.9 Specifications used previously in my district	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21.10 Foodservice consultant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 22

Identify additional resources you would use to develop specifications for refrigeration equipment.

Question 23 \*\* required \*\*

Identify the number and type of refrigeration equipment purchased for your **district** over the past three years. Refrigeration equipment types include 1) reach-in refrigerator, 2) reach-in freezer, 3) walk-in refrigerator, 4) walk-in freezer, 5) milk box/cooler, ice cream or yogurt machine, 6) serving/display refrigeration, 7) blast chiller, and 8) other. If no refrigeration equipment has been purchased, please indicate "none" in the space provided.

Question 24 \*\* required \*\*

Identify the practices you use or would recommend to compensate for inadequate refrigeration space in school nutrition programs. Remember that "refrigeration" refers to frozen and refrigerated storage.

1 - Very likely to use | 2 - Might use | 3 - Neutral  
4 - Probably would not use | 5 - Definitely would not use

	1	2	3	4	5
24.1 Maintain low inventory.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24.2 Decrease the number of items purchased (such as buying only one size or quality of an entree item).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24.3 Adjust the menu to reduce the number of refrigerated and frozen items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24.4 Schedule more frequent deliveries of refrigerated items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24.5 Plan just-in-time deliveries of refrigerated items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24.6 Use local producers or farm-to-school program to allow more frequent deliveries with quick turnaround times.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24.7 Use high capacity shelving for getting the most out of existing refrigeration.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24.8 Rent or lease refrigeration space offsite.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24.9 Pay extra fees or higher prices for more frequent deliveries.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24.10 Make more items from scratch so existing refrigeration can be used for ready-to-serve items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24.11 Investigate cooperative bidding to offset costs of more frequent deliveries.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24.12 Lease refrigeration equipment to be brought onsite.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24.13 Add walk-in refrigerator/freezer at warehouse.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 25

---

Identify additional practices you use or would recommend to compensate for inadequate refrigeration space in school nutrition programs.

Question 26 \*\* required \*\*

---

The next questions will be specific to one school in your district. If your district has only one school, that is the school that will be used. If you have more than one school in your district, choose the second school from an alphabetical list of the schools in your district and answer the questions specifically for the selected school.

The selected school is a

K-12 school

Elementary school

Middle school

High school

Other:

Question 27 \*\* required \*\*

---

Enrollment at the selected school is \_\_\_\_\_ (please give number such as 540).

Question 28 \*\* required \*\*

---

The percent free and reduced price meals at the selected school is \_\_\_\_\_%. Please give only numerical value and do not include % sign.

Question 29 \*\* required \*\*

---

The participation rate in the National School Lunch Program at the selected school is \_\_\_\_\_%. Please give a numeric value and do not include the % sign.

Question 30 \*\* required \*\*

---

The average daily number of meals (including breakfast, lunch, snack, and supper) served at the selected school is \_\_\_\_\_. Please enter a numeric value only, such as 1200.



Question 31 \*\* required \*\*

---

Select the answer that best describes the type of food production at the selected school.

- Onsite preparation, all scratch cooking
- Onsite preparation with some convenience foods
- Central kitchen that sends food to other kitchens and does not serve students in the facility
- Central kitchen facility that serves in school and also sends food to other kitchens
- Satellite kitchen receiving food from central kitchen, some onsite preparation
- Satellite kitchen receiving food from central kitchen, no onsite preparation
- Purchased preplated meals
- Other:

Further comments about your response:

Question 32 \*\* required \*\*

---

Indicate all programs offered in the selected school and describe other programs or services not listed in the comment section.

- School Breakfast Program
- Fresh Fruit and Vegetable Program
- Special Milk Program
- After School Snack Program (as part of NSLP)
- Supper Program
- A la carte
- Vending (operated by School Nutrition Program)
- Breakfast in the classroom
- Catering
- Other:

Question 33 \*\* required \*\*

The lunch menu for the selected school includes:

- 1 entree choice
- 2 entree choices
- 3 entree choices
- 4 entree choices
- 5 or more entree choices

Further comments about your response:

Question 34 \*\* required \*\*

1 - Strongly Agree | 2 - Agree | 3 - Neutral | 4 - Disagree  
5 - Strongly Disagree

34.1 Current refrigeration and/or freezer space at the selected school is adequate to store and serve the additional fruit and vegetable requirements in the new meal pattern.

1   2   3   4   5

34.2 In comparing the adequacy of refrigeration storage in the selected school to the adequacy of refrigeration storage in the district as a whole, they are about the same.

34.3 Refrigeration storage in the selected school is less adequate than most schools in the district.

34.4 Refrigeration storage in the selected school is more adequate than most schools in the district.

Question 35 \*\* required \*\*

Deliveries (by category) to the selected school are made:

- 1 - Five times a week (daily) | 2 - Four times a week  
3 - Three times a week | 4 - Twice a week | 5 - Once a week | 6 - Once every two weeks  
7 - Once a month

	1	2	3	4	5	6	7
35.1 Canned/dry foods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.2 Bread products	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.3 Milk and/or dairy products	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.4 Frozen foods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.5 Refrigerated foods (excluding milk and dairy products already considered in #2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.6 Supplies, disposables, and/or small equipment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 36 \*\* required \*\*

The selected school has a walk-in refrigerator.

- Yes; give number and dimensions below. Example: 1 walk-in dimensions 10' wide by 12' long by 10' high
- a metropolitan area but not the central city (suburban)

Further comments about your response:

Question 37 \*\* required \*\*

The selected school has a walk-in freezer.

- Yes; give number and dimensions below. Example: 1 walk-in dimensions 10' wide by 12' long by 10' high
- No

Further comments about your response:

Question 38 \*\* required \*\*

---

The selected school has at least one reach-in refrigerator.

- Yes. Give the number and type below. Examples: 2 single-door; 1 two-door, and 2 triple-door
- No

Further comments about your response:

Question 39 \*\* required \*\*

---

The selected school has at least one reach-in freezer.

- Yes. Give the number and type below. Examples: 2 single-door; 1 two-door, and 2 triple-door
- No

Further comments about your response:

Question 40 \*\* required \*\*

---

The selected school has at least one pass-through or roll-in refrigerator and/or freezer.

- Yes. Give the number and type below. Examples: 2 single-door pass thru refrigerators; 1 double-door roll-in freezer
- No

Further comments about your response:

Question 41 \*\* required \*\*

---

The selected school has at least one under-counter refrigerator or freezer.

- Yes. Give the number and type below. Examples: 2 freezers; 3 refrigerators
- No

Further comments about your response:

Question 42 \*\* required \*\*

---

The selected school has at least one milk box.

- Yes. Give the number and capacity below. Example: 1 milk box, 16 case capacity..
- No

Further comments about your response:

Question 43 \*\* required \*\*

---

The selected school has at least one ice cream cabinet or yogurt machine.

- Yes. Give the number and type below. Examples: 14.8 cu ft ice cr box; 1 3-spout yogurt machine
- No

Further comments about your response:

Question 44 \*\* required \*\*

---

The selected school has at least one piece of refrigerated serving line equipment in addition to that previously reported. Examples of refrigerated serving line equipment are display refrigerator, refrigerated deli counter, refrigerated salad bar.

- Yes. Give the number and descriptions below. Examples: 1 display refrigerator, 15 cu ft; 1 deli counter, about 3' by 2'; 2 refrigerated salad bars, 6' x 3' surface
- No

Further comments about your response:

Question 45 \*\* required \*\*

---

The selected school has additional refrigerated equipment not listed above.

- Yes. Give the number, descriptions and type below. Examples: 2 blast chillers, undercounter, 3 pan; 1 blast chiller, fullsize door; 3 refrigerated drawers, about 2' x 3'; 1 sandwich/salad prep refrigerator, 12 pan capacity
- No

Further comments about your response:

Question 46 \*\* required \*\*

Choose the answer that best describes the highest educational attainment of the school nutrition director.

- High school diploma or equivalent
- Some college
- Culinary school training
- Associate degree from college
- Bachelor's degree from college
- Culinary school graduate (including Bachelor's degree)
- Master's degree from college
- PhD degree from college
- Other:

Further comments about your response:

Question 47 \*\* required \*\*

Select all answers that describe the school nutrition director certifications.

- ServSafe certification
- Other food safety certification
- Certified chef
- School Nutrition Specialist through School Nutrition Association
- Certified Director through School Nutrition Association
- Certified Dietary Manager
- Dietetic Technician Registered
- Registered Dietitian
- Other:

Further comments about your response:

Question 48 \*\* required \*\*

The sex of the school nutrition director is:

- Female
- Male

Further comments about your response:

Question 49 \*\* required \*\*

---

The school nutrition director has been in the position \_\_\_\_\_ years.

Question 50 \*\* required \*\*

---

The school nutrition director has \_\_\_\_\_ years' experience in school nutrition.

- less than 1 year
- 1 to 5 years
- 6 to 10 years
- 11 to 15 years
- 16 to 20 years
- 21 to 25 years
- 26 to 30 years
- more than 30 years

Further comments about your response:

---

Closing Message

Thank you for your feedback and I look forward to seeing you soon!

## **Appendix E – Kansas Pilot Survey Instrument**



## Survey Description

This survey is designed to gather information on refrigeration equipment in school nutrition programs.

- Your response is **VERY IMPORTANT!**
- Having school information listed in email message will help you quickly complete the survey.
- Refrigeration equipment refers to refrigerated (chilled) equipment and freezer equipment.
- Please be sure to check the box at the end of the survey and enter your email address to be eligible for the drawing for a training session at your location! Your email address will be separated from your responses, maintaining your anonymity.
- Once you open the survey, do not close it until you have finished.

Research objectives include:

- 1) Identify the refrigeration capacity available in schools.
- 2) Ascertain foodservice equipment budgeting practices in school districts.
- 3) Describe best practices related to purchase and use of refrigeration equipment in schools.
- 4) Determine if there is adequate refrigeration space to meet the new NSLP meal patterns.
- 5) Develop a preliminary decision model for purchasing refrigeration equipment in school districts.

## Opening Instructions

This survey will be open from Saturday April 14, 2012 until midnight on Tuesday April 24, 2012. To begin the survey press NEXT.

Question 1 \*\* required \*\*

---

The next questions will be specific to one school in your district. If your district has only one school, that is the school that will be used. If you have more than one school in your district, choose the second school from an alphabetical list of the schools in your district and answer the questions specifically for the selected school.

The selected school is a

- K-12 school
- Elementary school
- Middle school
- High school
- Other:

Question 2 \*\* required \*\*

---

Enrollment at the selected school is \_\_\_\_\_ (please give number such as 540).

Question 3 \*\* required \*\*

---

The percent free and reduced price meals at the selected school is \_\_\_\_\_%. Please give only numerical value and do not include % sign.

Question 4 \*\* required \*\*

---

The participation rate in the National School Lunch Program at the selected school is \_\_\_\_\_%. Please give a numeric value and do not include the % sign.

Question 5 \*\* required \*\*

---

The average daily number of meals (including breakfast, lunch, snack, supper and other) served at the selected school is \_\_\_\_\_. Please enter a numeric value only, such as 1200. If meals are sent to other sites report that number in the next question.

Question 6 \*\* required \*\*

---

The average daily number of meals prepared in this kitchen and sent to other sites is \_\_\_\_\_. Please enter a numeric value only, such as 1200. If none, enter 0.

Question 7 \*\* required \*\*

---

Select the answer that best describes the type of food production at the selected school.

- Onsite preparation, all scratch cooking
- Onsite preparation with some convenience foods
- Central kitchen that sends food to other kitchens and does not serve students in the facility
- Central kitchen facility that serves in school and also sends food to other kitchens
- Satellite kitchen receiving food from central kitchen, some onsite preparation
- Satellite kitchen receiving food from central kitchen, no onsite preparation
- Purchased preplated meals
- Other:

Further comments about your response:

Question 8 \*\* required \*\*

---

Indicate all programs offered in the selected school and describe other programs or services not listed in the comment section.

- School Breakfast Program
- Fresh Fruit and Vegetable Program
- Special Milk Program
- After School Snack Program (as part of NSLP)
- Supper Program
- A la carte
- Vending (operated by School Nutrition Program)
- Breakfast in the classroom
- Catering
- Child Care (Headstart, CACFP, Pre-K, other)
- Other:

Question 9 \*\* required \*\*

---

The lunch menu for the selected school includes:

- 1 entree choice
- 2 entree choices
- 3 entree choices
- 4 entree choices
- 5 or more entree choices

Question 10 \*\* required \*\*

1 - Strongly Agree | 2 - Agree | 3 - Neutral | 4 - Disagree  
5 - Strongly Disagree

10.1 Current refrigeration and/or freezer space at the selected school is adequate to store and serve the additional fruit and vegetable requirements in the new meal pattern.

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10.2 In comparing the adequacy of refrigeration storage in the selected school to the adequacy of refrigeration storage in the district as a whole, they are about the same.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
-----------------------	-----------------------	-----------------------	-----------------------	-----------------------

10.3 Refrigeration storage in the selected school is less adequate than most schools in the district.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
-----------------------	-----------------------	-----------------------	-----------------------	-----------------------

10.4 Refrigeration storage in the selected school is more adequate than most schools in the district.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
-----------------------	-----------------------	-----------------------	-----------------------	-----------------------

Question 11 \*\* required \*\*

Deliveries (by category) to the selected school are made:

1 - Five times a week (daily) | 2 - Four times a week  
3 - Three times a week | 4 - Twice a week | 5 - Once a week | 6 - Once every two weeks  
7 - Once a month

11.1 Canned/dry foods

1	2	3	4	5	6	7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

11.2 Bread products delivered from bread company

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------

11.3 Milk and/or dairy products delivered from dairy company

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------

11.4 Frozen foods

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------

11.5 Refrigerated foods (excluding milk and dairy products already considered in #3)

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------

11.6 Supplies, disposables, and/or small equipment

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------

Question 12 \*\* required \*\*

The selected school has a walk-in refrigerator.

Yes; give number and dimensions below. Example: 1 walk-in dimensions 10' wide by 12' long by 10' high

No

Further comments about your response:

Question 13 \*\* required \*\*

---

The selected school has a walk-in freezer.

- Yes; give number and dimensions below. Example: 1 walk-in dimensions 10' wide by 12' long by 10' high
- No

Further comments about your response:

Question 14 \*\* required \*\*

---

The selected school has at least one reach-in refrigerator.

- Yes. Give the number and type below. Examples: 2 single-door; 1 two-door, and 2 triple-door
- No

Further comments about your response:

Question 15 \*\* required \*\*

---

The selected school has at least one reach-in freezer.

- Yes. Give the number and type below. Examples: 2 single-door; 1 two-door, and 2 triple-door
- No

Further comments about your response:

Question 16 \*\* required \*\*

---

The selected school has at least one pass-through or roll-in refrigerator and/or freezer.

- Yes. Give the number and type below. Examples: 2 single-door pass thru refrigerators; 1 double-door roll-in freezer
- No

Further comments about your response:

Question 17 \*\* required \*\*

---

The selected school has at least one milk box.

- Yes. Give the number and capacity below. Example: 1 milk box, 16 case capacity..
- No

Further comments about your response:

Question 18 \*\* required \*\*

---

The selected school has at least one under-counter refrigerator or freezer.

- Yes. Give the number and type below. Examples: 2 freezers; 3 refrigerators
- No

Further comments about your response:

Question 19 \*\* required \*\*

---

The selected school has at least one ice cream cabinet or yogurt machine.

- Yes. Give the number and type below. Examples: 14.8 cu ft ice cr box; 1 3-spout yogurt machine
- No

Further comments about your response:

Question 20 \*\* required \*\*

---

The selected school has at least one piece of refrigerated serving line equipment in addition to that previously reported. Examples of refrigerated serving line equipment are display refrigerator, refrigerated deli counter, refrigerated salad bar.

- Yes. Give the number and descriptions below. Examples: 1 display refrigerator, 15 cu ft; 1 deli counter, about 3' by 2'; 2 refrigerated salad bars, 6' x 3' surface
- No

Further comments about your response:

Question 21 \*\* required \*\*

---

The selected school has additional refrigerated equipment not listed above.

- Yes. Give the number, descriptions and type below. Examples: 2 blast chillers, undercounter, 3 pan; 1 blast chiller, fullsize door; 3 refrigerated drawers, about 2' x 3'; 1 sandwich/salad prep refrigerator, 12 pan capacity
- No

Further comments about your response:

The next questions refer to your school district.

Question 22 \*\* required \*\*

---

My school district is:

- Public/independent school district
- Private school district
- Residential child care institution
- Charter school district
- Other:

Question 23 \*\* required \*\*

---

This area where the school district office is located has a population:

- over 100,000
- between 25,000 and 100,000
- less than 25,000
- Other:

Question 24 \*\* required \*\*

---

The school nutrition program in this district is:

- Self-operated
- Operated by a food management company

Question 25 \*\* required \*\*

---

There are \_\_\_\_ schools in my district (please give **ONLY** a numerical value such as 9, not nine).

Question 26 \*\* required \*\*

---

School district student enrollment is \_\_\_\_\_ (please give **ONLY** a numeric value such as 2507).

Question 27 \*\* required \*\*

---

School district percent free and reduced price meals is \_\_\_\_\_ %. Please enter **ONLY** numbers, not the % sign.

Question 28 \*\* required \*\*

---

District-wide student participation rate in the National School Lunch Program is \_\_\_\_\_ %. Please enter **ONLY** numbers, not the % sign.

Question 29 \*\* required \*\*

---

The average daily number of meals served in the district (including breakfast, lunch, snack and supper) is \_\_\_\_\_. Please give **ONLY** a numeric value such as 10890.

Question 30 \*\* required \*\*

---

	Yes	No
30.1 My school district participates in the School Breakfast Program.	<input type="radio"/>	<input type="radio"/>
30.2 My school district participates in the Fresh Fruit and Vegetable Program.	<input type="radio"/>	<input type="radio"/>
30.3 My school district participates in the Special Milk Program.	<input type="radio"/>	<input type="radio"/>
30.4 My school district participates in the After School Snack Program (as part of NSLP).	<input type="radio"/>	<input type="radio"/>
30.5 My school district participates in the Supper Program.	<input type="radio"/>	<input type="radio"/>
30.6 My school nutrition program offers a la carte items.	<input type="radio"/>	<input type="radio"/>
30.7 My school nutrition program operates reimbursable meal vending machines.	<input type="radio"/>	<input type="radio"/>
30.8 My school nutrition program operates vending machines in the district.	<input type="radio"/>	<input type="radio"/>
30.9 Contractors operate vending machines in the school district.	<input type="radio"/>	<input type="radio"/>
30.10 All school campuses are closed campuses.	<input type="radio"/>	<input type="radio"/>
30.11 My school nutrition program is a member of a cooperative purchasing organization.	<input type="radio"/>	<input type="radio"/>



Question 31 \*\* required \*\*

Identify financial practices in your school district.

1 - Strongly Agree | 2 - Agree | 3 - Neutral | 4 - Disagree  
5 - Strongly Disagree | 6 - Unknown/unable to judge

	1	2	3	4	5	6
31.1 My district/school nutrition program has a formal capital equipment budget process.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
31.2 My district/school nutrition program maintains a depreciation schedule for foodservice equipment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
31.3 As school nutrition director, I participate in capital equipment budgeting for my department.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
31.4 My district/school nutrition program purchases new foodservice equipment ONLY when old equipment breaks down.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
31.5 In general, the refrigeration capacity for the school nutrition program (considering all schools) is adequate.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
31.6 My district/school nutrition program includes equipment replacement and/or equipment purchase in the annual budget each year.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
31.7 At least one school in my district purchased equipment through funds available through the American Recovery and Reinvestment Act of 2009.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
31.8 At least one school in my district has acquired equipment through the Fresh Fruit and Vegetable Program or private grants (excluding the American Recovery and Reinvestment Act of 2009).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
31.9 Equipment purchases for the school nutrition program are determined based on current year fiscal performance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 32 \*\* required \*\*

Assume that budget is not an issue. If you could purchase one of the following types of equipment, what would you purchase based on the **greatest need**?

- Cooking equipment such as range, steamer, or combioven
- Refrigeration equipment such as walk-in or reach-in refrigerators/freezers, refrigerated serving line equipment, or blast chiller
- Sanitation equipment such as dishwasher
- Service equipment such as serving line

Question 33 \*\* required \*\*

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Identify the barriers to purchasing refrigeration equipment in your school nutrition program.

1 - Strongly Agree | 2 - Agree | 3 - Neutral | 4 - Disagree  
5 - Strongly Disagree

	1	2	3	4	5
33.1 Insufficient funding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33.2 Lack of space in the kitchen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33.3 Inadequacy of utilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33.4 Obtaining approval from district administrators	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33.5 Having sufficient knowledge to write specifications	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33.6 Making time to complete the purchasing process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33.7 State and Federal procurement regulations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 34 \*\* required \*\*

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Identify resources you would use to develop specifications for refrigeration equipment.

1 - Definitely would use | 2 - Might use | 3 - Neutral  
4 - Probably would not use | 5 - Definitely would not use

	1	2	3	4	5
34.1 Manufacturer's representative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34.2 Representative from local equipment company	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34.3 Specification sheets from company	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34.4 Sample specifications from manufacturer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34.5 Resources from the National Food Service Management Institute	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34.6 Resources from State agency staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34.7 Resources from School Nutrition Association	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34.8 Cooperative purchasing organization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34.9 Specifications used previously in my district	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34.10 Foodservice consultant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34.11 Peers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34.12 Personal experience	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 35 \*\* required \*\*

Identify the practices you use or would recommend to compensate for inadequate refrigeration space in school nutrition programs. Remember that "refrigeration" refers to frozen and refrigerated storage.

1 - Very likely to use | 2 - Might use | 3 - Neutral  
4 - Probably would not use | 5 - Definitely would not use

	1	2	3	4	5
35.1 Maintain low inventory.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.2 Decrease the number of items purchased (such as buying only one size or quality of an entree item).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.3 Adjust the menu to reduce the number of refrigerated and frozen items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.4 Schedule more frequent deliveries of refrigerated items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.5 Plan just-in-time deliveries of refrigerated items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.6 Use local producers or farm-to-school program to allow more frequent deliveries with quick turnaround times.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.7 Use high capacity shelving for getting the most out of existing refrigeration.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.8 Rent or lease refrigeration space offsite.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.9 Pay extra fees or higher prices for more frequent deliveries.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.10 Make more items from scratch so existing refrigeration can be used for ready-to-serve items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.11 Investigate cooperative bidding to offset costs of more frequent deliveries.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.12 Lease refrigeration equipment to be brought onsite.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.13 Add walk-in refrigerator/freezer at warehouse.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.14 Change from refrigerated to shelf-stable items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 36 \*\* required \*\*

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Choose the answer that best describes the highest educational attainment of the school nutrition director.

- High school diploma or equivalent
- Some college
- Culinary school training
- Associate degree from college
- Bachelor's degree from college
- Culinary school graduate (including Bachelor's degree)
- Master's degree from college
- PhD degree from college

Question 37 \*\* required \*\*

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Select all answers that describe the school nutrition director certifications and memberships.

- ServSafe certification
- Other food safety certification
- Certified chef
- School Nutrition Specialist through School Nutrition Association
- Certified Director through School Nutrition Association
- Certified Dietary Manager
- Dietetic Technician Registered
- Registered Dietitian
- School Nutrition Association Member
- Academy of Nutrition and Dietetics Member (formerly American Dietetic Association)

Question 38 \*\* required \*\*

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The sex of the school nutrition director is:

- Female
- Male

Question 39 \*\* required \*\*

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The school nutrition director has been in the position \_\_\_\_\_ years. Please answer with a numeric value only such as 9.

Question 40 \*\* required \*\*

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The school nutrition director has \_\_\_\_\_ years' experience in school nutrition.

- less than 1 year
- 1 to 5 years
- 6 to 10 years
- 11 to 15 years
- 16 to 20 years
- 21 to 25 years
- 26 to 30 years
- more than 30 years

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Closing Message

Thank you for your feedback!

## **Appendix F – Southwest Region Survey Instrument**

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## AXIO SURVEY

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### Refrigeration Equipment in School Nutrition Programs (SW Region)

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#### Survey Description

This survey is designed to gather information on refrigeration equipment in school nutrition programs.

- Your response is **VERY IMPORTANT!**
- Having school and district information listed in email message will help you quickly complete the survey.
- Refrigeration equipment refers to refrigerated (chilled) equipment and freezer equipment.
- Please be sure to check the box at the end of the survey and enter your email address to be eligible for the drawing for a training session at your location! Your email address will be separated from your responses, maintaining your anonymity.
- **Once you open the survey, do not close it until you have finished.**

#### Opening Instructions

This survey will be open from Wednesday May 9, 2012 until midnight on Friday June 1, 2012. To begin the survey press NEXT.

Question 1 \*\* required \*\*

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The next questions will be specific to one school in your district. If your district has only one school, that is the school that will be used. If you have more than one school in your district, choose the second school from an alphabetical list of the schools and answer the questions specifically for the selected school.

The selected school is a

- K-12 school
- K-8 school
- Elementary school
- Middle school
- High school
- Other:

Question 2 \*\* required \*\*

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What is the enrollment at the selected school? Please give numerical value such as 540.

Question 3 \*\* required \*\*

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What is the percent free and reduced price meals at the selected school? Please give only numerical value such as 53 and do not include % sign.

Question 4 \*\* required \*\*

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What is the participation rate in the National School Lunch Program at the selected school? Please give a numeric value such as 89 and do not include the % sign.

Question 5 \*\* required \*\*

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What is the average daily number of meals (including breakfast, lunch, snack, supper and other) served at the selected school? Please enter a numeric value only, such as 1200. If meals are sent to other sites report that number in the next question.

Question 6 \*\* required \*\*

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What is the average daily number of meals prepared in this kitchen and sent to other sites? Please enter a numeric value only, such as 1200, in the space below. If none, enter 0.



Question 7 \*\* required \*\*

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Select the answer that best describes the type of food production at the selected school.

- Onsite preparation, all scratch cooking
- Onsite preparation with some convenience foods
- Central kitchen facility that serves in school and also sends food to other kitchens
- Satellite kitchen receiving food from central kitchen, some onsite preparation
- Satellite kitchen receiving food from central kitchen, no onsite preparation
- Purchased preplated meals
- Other:

Further comments about your response:

Question 8 \*\* required \*\*

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Indicate all programs offered in the selected school and describe other programs or services not listed in the comment section.

- National School Lunch Program
- School Breakfast Program
- Fresh Fruit and Vegetable Program
- Special Milk Program
- After School Snack Program (as part of NSLP)
- Supper Program
- A la carte
- Vending (operated by School Nutrition Program)
- Breakfast in the classroom
- Catering
- Child Care (Headstart, CACFP, Pre-K, other)
- Other:

Question 9 \*\* required \*\*

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The lunch menu for the selected school includes:

- 1 entree choice
- 2 entree choices
- 3 entree choices
- 4 entree choices
- 5 or more entree choices

Question 10 \*\* required \*\*

1 - Strongly Disagree | 2 - Disagree | 3 - Neutral | 4 - Agree  
5 - Strongly Agree

	1	2	3	4	5
10.1 Current refrigeration (chilled food) storage space at the selected school is adequate to store and serve the additional fruit and vegetable requirements in the new meal pattern.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10.2 In comparing the adequacy of refrigeration (chilled food) storage in the selected school to the adequacy of refrigeration storage in the district as a whole, they are about the same.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10.3 Current freezer (frozen food) storage space in the selected school is adequate to store and serve the additional fruit and vegetable requirements in the new meal pattern.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10.4 In comparing the adequacy of freezer (frozen food) storage space in the selected school to the adequacy of refrigeration storage in the district as a whole, they are about the same.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10.5 Refrigeration storage in the selected school is more adequate than most schools in the district.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 11 \*\* required \*\*

Deliveries (by category) to the selected school are made:

1 - Never | 2 - Once a month | 3 - Once every two weeks  
4 - Once a week | 5 - Twice a week | 6 - Three times a week | 7 - Four time a week  
8 - Five times a week (daily)

	1	2	3	4	5	6	7	8
11.1 Canned/dry foods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11.2 Bread products delivered from bread company	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11.3 Milk and/or dairy products delivered from dairy company	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11.4 Frozen foods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11.5 Refrigerated foods (excluding milk and dairy products already considered in #3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11.6 Supplies, disposables, and/or small equipment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 12 \*\* required \*\*

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The selected school has a walk-in refrigerator.

- Yes; give number and dimensions below. Example: 1 walk-in dimensions 10' wide by 12' long by 10' high
- No

Further comments about your response:

Question 13 \*\* required \*\*

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The selected school has a walk-in freezer.

- Yes; give number and dimensions below. Example: 1 walk-in dimensions 10' wide by 12' long by 10' high
- No

Further comments about your response:

Question 14 \*\* required \*\*

---

The selected school has at least one reach-in refrigerator.

- Yes. Give the number and type below. Examples: 2 single-door; 1 two-door, and 2 triple-door
- No

Further comments about your response:

Question 15 \*\* required \*\*

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The selected school has at least one reach-in freezer.

- Yes. Give the number and type below. Examples: 2 single-door; 1 two-door, and 2 triple-door
- No

Further comments about your response:

Question 16 \*\* required \*\*

---

The selected school has at least one pass-through or roll-in refrigerator (not a walk-in).

- Yes. Give the number and type below. Examples: 2 single-door pass thru refrigerators; 1 double-door roll-in refrigerator
- No

Further comments about your response:

Question 17 \*\* required \*\*

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The selected school has at least one pass-through or roll-in freezer (not a walk-in).

- Yes. Give the number and type below. Examples: 2 single-door pass thru freezers; 1 double-door roll-in freezer
- No

Further comments about your response:

Question 18 \*\* required \*\*

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The selected school has at least one milk box.

- Yes. Give the number and capacity below. Example: 1 milk box, 16 case capacity..
- No

Further comments about your response:

Question 19 \*\* required \*\*

---

The selected school has at least one under-counter refrigerator.

- Yes. Give the number and type below. Examples: 3 refrigerators, under-counter
- No

Further comments about your response:

Question 20 \*\* required \*\*

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The selected school has at least one under-counter freezer.

- Yes. Give the number and type below. Examples: 2 freezers, under-counter
- No

Further comments about your response:

Question 21 \*\* required \*\*

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The selected school has at least one ice cream cabinet or yogurt machine.

- Yes. Give the number and type below. Examples: 14.8 cu ft ice cr box; 1 3-spout yogurt machine
- No

Further comments about your response:

Question 22 \*\* required \*\*

---

The selected school has at least one piece of refrigerated serving line equipment in addition to that previously reported. Examples of refrigerated serving line equipment are display refrigerator, refrigerated deli counter, refrigerated salad bar.

- Yes. Give the number and descriptions below. Examples: 1 display refrigerator, 15 cu ft; 1 deli counter, about 3' by 2'; 2 refrigerated salad bars, 6' x 3' surface
- No

Further comments about your response:

Question 23 \*\* required \*\*

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The selected school has additional refrigerated equipment not listed above.

- Yes. Give the number, descriptions and type below. Examples: 2 blast chillers, under-counter, 3 pan; 1 blast chiller, fullsize door; 3 refrigerated drawers, about 2' x 3'; 1 sandwich/salad prep refrigerator, 12 pan capacity
- No

Further comments about your response:

The next questions refer to your school district.

Question 24 \*\* required \*\*

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My school district is:

- Public/independent school district
- Private school district (including parochial schools)
- Residential child care institution (including residential juvenile facilities)
- Charter school district
- Other:

Question 25 \*\* required \*\*

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The area where the school district office is located has a population:

- less than 10,000
- 10,000 to 24,999
- 25,000 to 49,999
- 50,000 to 99,999
- 100,000 and greater

Question 26 \*\* required \*\*

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The school nutrition program in this district is:

- Self-operated
- Operated by a food management company

Question 27 \*\* required \*\*

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How many schools are in your district? Please give **ONLY** a numerical value such as 9, not nine.

Question 28 \*\* required \*\*

---

What is the school district student enrollment? Please give **ONLY** a numeric value such as 2507.

Question 29 \*\* required \*\*

---

What is the school district percent free and reduced price meals? Please enter **ONLY** numbers, not the % sign.

Question 30 \*\* required \*\*

---

What is the district-wide student participation rate in the National School Lunch Program? Please enter **ONLY** numbers, not the % sign.

Question 31 \*\* required \*\*

---

What is the average daily number of meals served in the district (including breakfast, lunch, snack and supper)? Please give **ONLY** a numeric value such as 10890.

Question 32 \*\* required \*\*

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	Yes	No
32.1 My school district participates in the School Breakfast Program.	<input type="radio"/>	<input type="radio"/>
32.2 My school district participates in the Fresh Fruit and Vegetable Program.	<input type="radio"/>	<input type="radio"/>
32.3 My school district participates in the Special Milk Program.	<input type="radio"/>	<input type="radio"/>
32.4 My school district participates in the After School Snack Program (as part of NSLP).	<input type="radio"/>	<input type="radio"/>
32.5 My school district participates in the Supper Program.	<input type="radio"/>	<input type="radio"/>
32.6 My school nutrition program offers a la carte items.	<input type="radio"/>	<input type="radio"/>
32.7 My school nutrition program operates reimbursable meal vending machines.	<input type="radio"/>	<input type="radio"/>
32.8 My school nutrition program operates vending machines in the district.	<input type="radio"/>	<input type="radio"/>
32.9 Contractors operate vending machines in the school district.	<input type="radio"/>	<input type="radio"/>
32.10 All school campuses are closed campuses.	<input type="radio"/>	<input type="radio"/>
32.11 My school nutrition program is a member of a cooperative purchasing organization.	<input type="radio"/>	<input type="radio"/>
32.12 At least one school in my district purchased equipment through funds available through the American Recovery and Reinvestment Act of 2009.	<input type="radio"/>	<input type="radio"/>
32.13 At least one school in my district has acquired equipment through the Fresh Fruit and Vegetable Program or private grants (excluding the American Recovery and Reinvestment Act of 2009).	<input type="radio"/>	<input type="radio"/>
32.14 My district has a formal capital equipment budget process.	<input type="radio"/>	<input type="radio"/>
32.15 My school nutrition program has a formal capital equipment budget process separate from the district process.	<input type="radio"/>	<input type="radio"/>
32.16 My district maintains a depreciation schedule for foodservice equipment.	<input type="radio"/>	<input type="radio"/>
32.17 As a school nutrition director, I participate in capital equipment budgeting for my department.	<input type="radio"/>	<input type="radio"/>
32.18 My school nutrition program includes equipment replacement and/or equipment purchase in the annual budget each year.	<input type="radio"/>	<input type="radio"/>

Question 33 \*\* required \*\*

1 - Strongly Disagree | 2 - Disagree | 3 - Neutral | 4 - Agree  
5 - Strongly Agree | 6 - Unknown/unable to judge

	1	2	3	4	5	6
33.1 My district/school nutrition program purchases new foodservice equipment ONLY when old equipment breaks down.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33.2 In general, the refrigeration capacity for the school nutrition program (considering all schools) is adequate.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33.3 Equipment purchases for the school nutrition program are determined based on current year fiscal performance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 34 \*\* required \*\*

Assume that budget is not an issue. If you could purchase one of the following types of equipment, what would you purchase based on the **greatest need**?

- Cooking equipment such as range, steamer, or combooven
- Refrigeration equipment such as walk-in or reach-in refrigerators/freezers, refrigerated serving line equipment, or blast chiller
- Sanitation equipment such as dishwasher
- Service equipment such as serving line

Question 35 \*\* required \*\*

Identify the barriers to purchasing refrigeration equipment in your school nutrition program.

1 - Strongly Disagree | 2 - Disagree | 3 - Neutral | 4 - Agree  
5 - Strongly Agree

	1	2	3	4	5
35.1 Insufficient funding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.2 Lack of space in the kitchen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.3 Inadequacy of utilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.4 Obtaining approval from district administrators	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.5 Having sufficient knowledge to write specifications	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.6 Making time to complete the purchasing process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35.7 State and Federal procurement regulations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Question 36 \*\* required \*\*

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How likely are you to use these resources to develop specifications for refrigeration equipment?

1 - Definitely not likely to use | 2 - Not likely to use  
3 - Neutral | 4 - Likely to use | 5 - Definitely likely to use

	1	2	3	4	5
36.1 Manufacturer's representative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36.2 Representative from local equipment company	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36.3 Specification sheets from company	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36.4 Sample specifications from manufacturer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36.5 Resources from the National Food Service Management Institute	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36.6 Resources from State agency staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36.7 Resources from School Nutrition Association	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36.8 Cooperative purchasing organization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36.9 Specifications used previously in my district	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36.10 Foodservice consultant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36.11 Peers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36.12 Personal experience	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 37 \*\* required \*\*

How likely are you to use or recommend these practices to compensate for inadequate refrigeration space in school nutrition programs? Remember that "refrigeration" refers to frozen and refrigerated storage.

1 - Definitely not likely to use | 2 - Not likely to use  
3 - Neutral | 4 - Likely to use | 5 - Definitely likely to use

	1	2	3	4	5
37.1 Maintain low inventory.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37.2 Decrease the number of items purchased (such as buying only one size or quality of an entree item).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37.3 Adjust the menu to reduce the number of refrigerated and frozen items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37.4 Schedule more frequent deliveries of refrigerated items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37.5 Plan just-in-time deliveries of refrigerated items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37.6 Use local producers or farm-to-school program to allow more frequent deliveries with quick turnaround times.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37.7 Use high capacity shelving for getting the most out of existing refrigeration.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37.8 Rent or lease refrigeration space offsite.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37.9 Pay extra fees or higher prices for more frequent deliveries.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37.10 Make more items from scratch so existing refrigeration can be used for ready-to-serve items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37.11 Investigate cooperative bidding to offset costs of more frequent deliveries.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37.12 Lease refrigeration equipment to be brought onsite.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37.13 Add walk-in refrigerator/freezer at warehouse.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37.14 Change from refrigerated to shelf-stable items.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question 38 \*\* required \*\*

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Choose the answer that best describes the highest educational attainment of the school nutrition director.

- High school diploma or equivalent
- Some college
- Culinary school training
- Associate degree from college
- Bachelor's degree from college
- Culinary school graduate (including Bachelor's degree)
- Master's degree from college
- PhD degree from college

Question 39 \*\* required \*\*

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Select all answers that describe the school nutrition director certifications and memberships.

- ServSafe certification
- Other food safety certification
- Certified chef
- School Nutrition Specialist through School Nutrition Association
- Certified Director through School Nutrition Association
- Certified Dietary Manager
- Dietetic Technician Registered
- Registered Dietitian
- School Nutrition Association Member
- Academy of Nutrition and Dietetics Member (formerly American Dietetic Association)

Question 40 \*\* required \*\*

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The sex of the school nutrition director is:

- Female
- Male

Question 41 \*\* required \*\*

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How many years has the school nutrition director has been in the position? Please answer with a numeric value only such as 9.

Question 42 \*\* required \*\*

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How many years experience in school nutrition (not just this job) does the school nutrition director have?

- less than 1 year
- 1 to 5 years
- 6 to 10 years
- 11 to 15 years
- 16 to 20 years
- 21 to 25 years
- 26 to 30 years
- more than 30 years

Question 43 \*\* required \*\*

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My school district is located in:

- Arkansas
- Louisiana
- New Mexico
- Oklahoma
- Texas

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Closing Message

Thank you for your feedback!

## **Appendix G – Cubic Feet by Type of Refrigeration Equipment**

### Cubic Feet by Type of Refrigeration Equipment

Equipment Description	Cubic Feet	Brands Compared
Reach-in Refrigerator, 1-section	21	Delfield/Manitowoc, Traulsen, True
Reach-in Refrigerator, 2-section	48	
Reach-in Refrigerator, 3-section	73	
Pass-through Refrigerator, 1-section	25	Delfield/Manitowoc, Traulsen, True
Pass-through Refrigerator, 2-section	54	
Pass-through Refrigerator, 3-section	83	
Roll-in Refrigerator, 1-section	36	Delfield/Manitowoc, Traulsen, True
Roll-in Refrigerator, 2-section	74	
Roll-in Refrigerator, 3-section	115	
16 case Milk Cooler	25	Beverage-Air, Shellematic/Delfield
12 case Milk Cooler	19	
8 case Milk Cooler	13	
Under-counter Refrigerator or freezer	5.7	Delfield/Manitowoc
Home-type Refrigerator (if cubic feet not specified)	18	Frigidaire, General Electric, Whirlpool
Reach-in Freezer, 1-section	25	
Reach-in Freezer, 2-section	48	
Reach-in Freezer, 3-section	73	Delfield/Manitowoc, Traulsen, True
Pass-through Freezer, 1-section	25	
Pass-through Freezer, 2-section	54	
Pass-through Freezer, 3-section	83	Delfield/Manitowoc, Traulsen, True
Roll-in Freezer, 1-section	36	
Roll-in Freezer, 2-section	74	
Roll-in Freezer, 3-section	115	Frigidaire, General Electric, Whirlpool
Home-type Freezer, very small (if cubic feet not specified)	7	
Home-type Freezer, small (if cubic feet not specified)	15	
Home-type Freezer, medium (if cubic feet not specified)	21	
Home-type Freezer, large (if cubic feet not specified)	25	

Source:

Beverage-Air. (2012). School milk coolers single access, forced-air. Retrieved from <http://www.Beverage-air.com>

Delfield. (2012a). Self-contained solid door refrigerated roll-in. Retrieved from <http://www.delfield.com>

Delfield. (2012b). Solid door double section dual temp refrigerator/freezer pass-thru units. Retrieved from <http://www.delfield.com>

Delfield. (2012c). Solid door single section dual temp refrigerator/freezer pass-thru units. Retrieved from <http://www.delfield.com>

Delfield. (2012d). Self-contained solid door two-section dual temp refrigerator/freezer pass-thru. Retrieved from <http://www.delfield.com>

Delfield. (2012e). Solid door reach-in freezer. Retrieved from <http://www.delfield.com>

Delfield. (2012f). Solid door reach-in refrigerator. Retrieved from <http://www.delfield.com>

Delfield. (2012g). Undercounter series. Retrieved from <http://www.delfield.com>

Shelleymatic. (2012). Self-contained milk or beverage dispenser with air curtain. Retrieved from [www.delfield.com](http://www.delfield.com)

Traulsen. (2012a). G-series reach-in freezers/self-contained. Retrieved from <http://www.traulsen.com>

Traulsen. (2012b). G-series reach-in refrigerators/self-contained. Retrieved from <http://www.traulsen.com>

Traulsen. (2012c). Roll-in freezer models for 66" high racks/self-contained. Retrieved from <http://www.traulsen.com>

True Food Service Equipment, Inc. (2012a). Reach-in solid swing door refrigerator. Retrieved from <http://www.truemfg.com>

True Food Service Equipment, Inc. (2012b). Reach-in solid swing door freezer. Retrieved from <http://www.truemfg.com>