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RESEARCH ARTICLE

Improvement of Child Care Programs' Health and Safety Policies, and Practices, and Children's Access to Health Care, Linked to Child Care Health Consultation

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Child care health consultation is a partnership between a health professional and a child care program that promotes a healthy and safe child care environment. This partnership involves on-site, internet and telephone consultation, health education, health promotion, and training and technical assistance. The objective of this study was to determine the impact of this partnership on the health and safety of children in 77 child care programs in one state. Data were collected on each child care program's written health and safety policies, children's health records, and staff health and safety behaviors.

The results demonstrate a statistically significant increase in the quality of written health and safety policies and health practices (sanitation/hygiene, nutrition/food service, playground safety and emergency preparedness). These improvements in policies and practices (defined by Alkon et al., 2006, as precursors of child health outcomes) led to improvements in children's access to a medical home, enrollment in health insurance, immunization status, and documented oral, developmental, vision, and hearing screenings.

The US experienced a dramatic and steady increase in the number of young children participating in out-of-home child care beginning in the 1970s (Federal Interagency Forum on Child and Family Statistics, 2010). This expanded use of child care increased young children's risk of illness due to the fact that children in group care are exposed to more pathogens than if they were cared for at home by their families (Churchill & Pickering, 1997; Hurwitz, Gunn, Pinsky & Schonberger, 1991; Aronson & Shope, 2009). Early childhood professionals across the nation dissatisfied with this increased risk of illness, called for improvements in the quality of child care particularly in the area of health and safety. In response to this national call to action, the American Public Health Association (APHA) and the American Academy of Pediatrics (AAP), published the first edition of Caring for Our Children: National Health and Safety Performance Standards;

Guidelines for Out-Of-Home Child Care Programs (CFOC) (AAP, APHA,1992). Two subsequent editions have been published (2002, 2011) with the National Resource Center for Health and Safety in Child Care and Early Education (NRC) as the third author. Among the CFOC standards is the recommendation that every out-of-home child care program have available the services of a Child Care Health Consultant (CCHC). A CCHC is "a licensed health professional with education and experience in child and community health and early care and education, preferably with specialized training in child care health consultation" (AAP, APHA, NRC, 2011).

Pediatric health and early childhood professionals supported the concept of child care health consultation, but an existing work force of trained professionals did not exist. Initial efforts designed to convince state/territory administrators of the importance of this service were mainly based on professional judgment (Dooling & Ulione, 2000; Dunderstadt & Cohen 2004; Evers, 2002; Ulione, 1997) and advocacy (Lucarelli, 2002). Many states were successful in establishing a CCHC role at the state level (mainly utilizing funds from the US Maternal and Child Health Bureau's "Healthy Child Care America Initiative"). However, attempts to establish child care health consultation at the local level were less successful. This lack of success may be attributed to financial constraints, but it could also have been due to the lack of scientific evidence for the efficacy of the role.

In response to the need for scientific evidence, initial investigations into the efficacy of child care health consultation explored areas that could be linked to specific child outcomes such as injury (Ulione & Dooling, 1997; Ulione, 1997), upper respiratory illness (Ulione & Dooling, 1997; Ulione, 1997) and mental health/challenging behaviors (Center for Mental Health Services, 2000; Alkon, Ramler, & MacLennan, 2003). Although value was found in promoting specific areas and activities of child care health consultation, a synthesis of the overall impact of the service was not addressed until Alkon, Fernzweig, To, Wolff, & Mackie (2009) examined the impact of child care health consultation on child care program policies and practices in California. They concluded that "child care health consultation can improve the written health and safety policies and may improve practices in child care centers" (Alkon, et al., 2009).

In an attempt to further explain the process of achieving positive child care health and safety outcomes, Alkon, To, Wolff, Mackie, & Bernzweig (2006) developed a stepwise model (Figure 1) based on a formative evaluation of the CCHC network in California. This model suggested that research must first reveal the impact of CCHC activities on the precursors of child health and safety outcomes before a link could be established to child health and safety outcomes. The precursors in the model, education of the child care staff and CCHCs, consultation between the CCHC and child care staff, development of health and safety policies that are in compliance with national standards, and improvement in child care staff practice, have been examined (Alkon, To, Mackie, Wolff, & Bernzweig, 2010; Alkon, Fernzweig, To, Wolff, & Mackie, 2009; Alkon et al., 2008; Farrer, Alkon, & To, 2007; Crowley & Kulikowich, 2009). However, a void continues to exist concerning evidence that child care health consultation improves child health and safety outcomes.

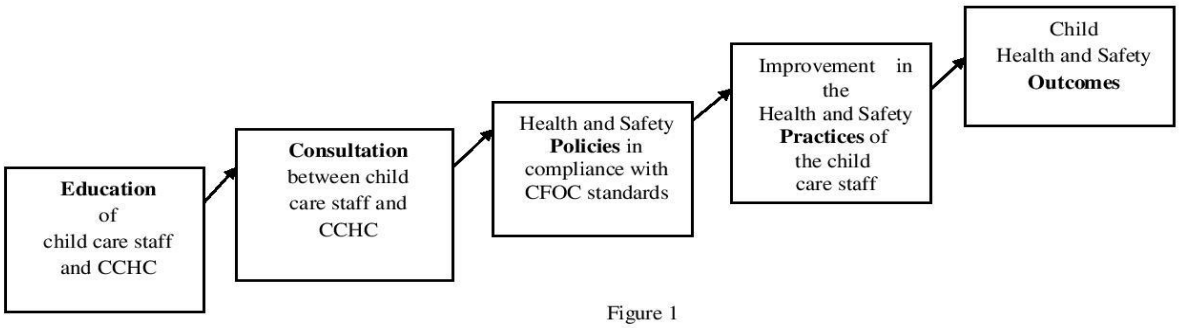

Figure 1

California Child Care Health Program's Stepwise Model of How Health Consultation Improves Children's Health (Alkon, 2006 Personal communication)

CCHC=Child Care Health Consultation

CFOC=Caring for Our Children. National Health and Safety Performance Standards. Guidelines for Early Care and Education Programs. (1992, 2002, 2011)

An understanding of child health and safety outcomes (e.g., access to health care, immunization status, absences due to illness, and medically-attended injury rates) involves an evaluation of both formative (e.g., prevention activities that a CCHC delivers to the child care program such as health and safety trainings and provision of written or electronic resources) and summative (e.g., access to health care, immunization status, absences due to illness, and medically-attended injury) data. Yet, it is difficult to document that a specific preventive health measure taken with respect to a specific health risk actually prevented a specific individual from getting ill or injured. Thus, to determine the impact of child care health consultation prevention activities, the data collected over time must be aggregated at the child care program level (Hegland et al., 2011).

The study reported here addressed the aggregate effect of the prevention activities of CCHCs in North Carolina over two years of intervention. We hypothesized that child care health consultation would be associated with changes in child care program's policies and caregiver practices that were consistent with the CFOC standards, and that these changes would result in an improvement in children's access to preventive health care, immunization status, absences due to illness, and medically-attended injury rates. To control for variability in the quality of care

provided by the child care programs, a control variable, star rating, was added. The Public Health Review Board for the Protection of Human Research Subjects of The University of North Carolina at Chapel Hill approved all aspects of this study.

METHODS

This single group, quasi-experimental, pretest/post-test study was designed to investigate if child care health consultation was associated with improvements in child care policies and practices and in improvements in children's access to preventive health care and reductions in illness and injury.

In 2000, the Quality Enhancement Project for Infants and Toddlers (QEP), supported by the Division of Child Development of the North Carolina Department of Health and Human Services hired 15 CCHCs. The 15 QEP CCHCs provided health and safety consultation services to 23 counties across the state and also served as data collectors for the study. The size of the geographic area and the number of child care programs covered by an individual CCHC varied and ranged from seven rural counties with a total of 162 programs to one urban county with 565 programs. Regardless of the number of available child care programs, each CCHC recruited 25, non-federal programs for the study. The only criterion for involvement in the study was a willingness to participate. The CCHC then assigned an arbitrary number to each program to ensure the confidentiality of each of the child care programs. If there were more than 25 child care programs in a region, the CCHC chose the first 25 programs that agreed to participate in the study. The CCHCs collected baseline data from July 2000 until June 2001. The original 15 QEP CCHCs collected data on 141 child care centers, 113 child care homes, and 10 faith-based programs. Data were collected every six months, plus or minus two weeks between July 2000 and July 2003. Thus, each program had data collected for 24 months. By the time of the fourth follow-up, attrition among the CCHCs reduced their number from 15 to 13, and missed data collection opportunities (e.g., illness of a CCHC, transition of a CCHC, bad weather and/or car trouble) reduced the number of programs with data from all five collection points from 264 to 77 (34 centers, 41 homes and 2 faith-based programs). A total of 2,061 children were enrolled in the 77 eligible programs at baseline. 1,439 (70%) of their on-site health records were reviewed at baseline. By the fourth follow-up, records of 1,344 (60%) of 2,248 classroom enrollees were reviewed. Table 1 provides a summary of the number of children involved by age group at each data collection cycle.

TABLE 1
Children by Age Group and Data Collection Cycle

	Infants/toddlers enrolled	Infants/toddlers reviewed	Preschoolers enrolled	Preschoolers reviewed	School-age enrolled	School-age reviewed	Total enrolled	Total reviewed
Baseline	915	703	771	477	375	259	2061	1439
6 month follow-up	956	674	676	497	311	169	1943	1340
12 month follow-up	721	627	676	490	405	225	1802	1342
18 month follow-up	923	672	821	519	628	268	2372	1459
24 month follow-up	861	576	919	490	468	278	2248	1344
Number of programs= 77								

Instruments

Data collection involved three instruments: the *Daily Encounter Form* (*DEF*), the *Evaluation Summary*, and the *Evaluation Worksheet*. All of the instruments were developed by the project specifically for this study. Following baseline data collection, each CCHC provided health consultation to her 25 programs. At each programs' six month anniversary, data were collected again. Each instrument is described below.

Daily Encounter Form. The DEF, a process evaluation instrument, was designed to document the daily activities and length of time that CCHCs spent working with each child care program on specific child care health and safety topics. Upon completion of any type of consultation, the CCHC recorded the information on the *DEF*. Data collected on CCHC activities included whether the service was consultation (on-site, telephone, and internet/e-mail consultation), health education, training, community development (advocacy), requests for information, administrative tasks, non-child care activities, or direct health services. The *DEF* was necessary to maintain an accounting of the amount of consultation support provided by the CCHC to each child care program on the health and safety topics. This was to eliminate the potential confound that impact was due to differential levels of consultation.

Evaluation Summary. The second instrument had two sections. The first section was designed to collect outcome data on written health and safety policies and the second section involved an observation of the program staff's health practices.

The first section provided the format for recording compliance with national standards on nine health and safety policies selected from CFOC: hand washing, administration of medications, care of mildly ill children, exclusion of ill children, transportation safety, inclusion of children with special needs, cleaning and sanitizing, emergency preparedness, and staff health. Each policy was rated on a four-point scale (0-3). A score of 3 ("excellent") reflected a policy that matched the standard in CFOC. A score of 2 ("adequate") reflected a policy that met NC state licensing regulations but did not meet the CFOC standard. A "poor" score of 1 reflected that a policy existed but was not in compliance with either the national standard or the state licensing regulation. A score of 0 reflected the absence of a written policy.

Upon completion of baseline data collection, the CCHC worked with each program to improve its health and safety policies. As non-regulatory professionals, the CCHCs attempted to influence the policies through the provision of information, resources, and guidance. This involved: training sessions, examples of well-written policies, review of drafts of policies and recommendations. At each of the next data collection points this procedure was repeated.

3	2	1	0	Policy
Excellent	Adequate	Poor	None	
				Hand washing
				Administration of Medications
				Care of Mildly Ill Children
				Exclusion of Ill Children
				Transportation Safety
				Inclusion of Children with Special Needs
				Cleaning and Sanitizing
				Emergency Preparedness
				Staff Health

Figure 2. Evaluation Summary Part One-Policies

The second section of the *Evaluation Summary* reviewed health and safety practices: emergency preparedness, nutrition/food service, playground safety and sanitation/hygiene (Figure 3). The selection of these practices for review was based on *CFOC*. These four health and safety practices were scored on a scale of 0 to 3 based on observable criteria such as "disposable gloves are available". A score of 3 indicated a practice that was always observed, 2 indicated a practice that was observed more than half of the time, 1 indicated a practice that was observed half of the time or less than half of the time, and 0 indicated a practice that was never observed.

Upon completion of baseline data collection, the CCHC worked with each program to improve its health and safety practices. This involved: training sessions, observations, and corrective guidance. At each of the next data collection points this procedure was repeated.

Cronbach's α indicated adequate to high levels of internal consistency for both the health policy and health practices sections of the instrument. These scales were created for the nine health and safety policies combined ($\alpha = 0.92$) as well as for each of the four health or safety practices: sanitation ($\alpha = 0.90$), safe/active play ($\alpha = 0.91$), nutrition ($\alpha = 0.87$), and emergency preparedness ($\alpha = 0.90$).

Scoring reliability for these sections of the *Evaluation Summary* was determined by concurrent scoring of policies and observations of caregiver practices in the same child care programs by two senior QEP staff. The Project CCHCs were trained to 85% reliability by the same two senior QEP staff.

Always	Usually	Sometimes	Never		
				Sanitation	Disposable gloves are available
					Disposable towels are available
					A complete and accurate hand washing protocol is visible during the caregivers' hand washing process
					There is a designated diaper-changing area
					The diaper-changing surface is used only for diaper changes
					An adjacent sink is available for the caregiver(s) to wash hands without leaving the diaper-changing area
					A complete and accurate diapering protocol is visible during the diapering process
					Sanitizing solution for diaper-changing areas and/or eating surfaces is accessible and made fresh daily
					Food preparation and food service area are distinct from diapering areas
					There are separate sinks for food preparation and diapering
					Food is handled safely and stored properly
				Playground	Equipment and furniture are developmentally appropriate for typically developing children and children with special needs
					Playground and play equipment are accessible to children with special needs
					Equipment and furniture are sturdy, stable, and free of hazards
					Surfacing is appropriate for height of equipment and intended activities and is properly maintained Facility is on schedule with any corrective action plan for hazard abatement
					The indoor play area is designed to allow staff to observe and interact with children in all play areas at all times
					The outdoor play area is designed to allow staff to observe and interact with children in all play areas at all times
					The children participate in outdoor activities every day, except in extreme weather that would compromise a child's health
					Swimming pools and wading pools have access controlled exclusively by adults and are maintained and operated safely

(Continue)

Always	Usually	Sometimes	Never		
				Emergency Preparedness	Emergency procedures and evacuation plans are posted in visible locations
					Emergency procedures and evacuation plans include provisions for children with special needs
					Emergency drills are conducted regularly and documented
					Indoor environment is designed to prevent burns, poisonings, falls, and drowning
				Nutrition	Facility is participating in the Child and Adult Care Food Program (CACFP)
					Meal plans meet standards as per CACFP
					The names of children with specific dietary needs and those needs are posted in food preparation and food service areas

Figure 3. Evaluation Summary Health and Safety Practice

Evaluation Worksheet. The third instrument, the *Evaluation Worksheet*, collected outcome data at the child level by summarizing the health and attendance records of enrolled children. The CCHC recorded the number of children enrolled in each program and the number of those children who were reviewed in three age-specific groups: 1) infant/toddlers- aged 0-35 months; 2) preschool children-aged 36-59 months; and 3) school aged-children older than 60 months. These three groups were defined for two reasons. First, infants and toddlers are ill more frequently than older children due to immature immune systems and hand to mouth behaviors (Bartlett et al., 1985; Haskins & Kotch, 1986; Hurwitz, Gunn, Pinsky & Schonberger, 1991; Aronson & Shope, 2009). Second, school-aged children (those participating in the after school programs) are exposed to pathogens from groups of children outside of the study program (e.g., elementary school) (Aronson & Shope, 2009) and may be ill or injured as a result of the time that they spent in school. Twenty-five children's records in each program were randomly selected and reviewed for information on: absences; medically-attended injuries; health screenings; evidence of well-child physical; documentation of medical home[1]; documentation of health insurance coverage; documentation of emergency contact information; record of immunizations; documentation of special health needs and evidence of a medical care plan for children having a special health care need. The selection of these child outcomes for review was based on CFOC.

[1] Medical home is primary health care that is accessible, continuous, comprehensive, family centered, coordinated, compassionate, and culturally effective (Hagen, Shaw & Duncan, 2008).

Emergency Contact on file	Record "yes" if there is a name, address, and telephone number of person to be contacted, choice of health care provider, preferred hospital; any chronic illness and any medication for that illness and any other information that has a direct bearing on assuring safe medical treatment for the child
Well-Child Physical on file	Record "yes" if there complete record of a well-child physical
Well-Child Physical in last year	Record "yes" if there if a well-child physical is recorded within the last year
Child with Special Needs	Record "yes" if there any record of special needs including an IFSP or IEP
Medical Care Plan on file	Record "yes" if there if a child has special needs and if there is a record of a medical care plan
Immunizations up to date	Record "yes" if there is a record of immunizations that is up to date based on recommendations in CFOC
Medical Home on file	Record "yes" if there if a medical home is listed [a medical home primary care that is accessible, continuous, comprehensive, family centered, coordinated, compassionate, and culturally effective (Hagan, Shaw & Duncan, 2008)]
Dental Home on file	Record "yes" if there if a dental home is listed [a dental home is the ongoing relationship between the dentist and the patient, inclusive of all aspects of oral health care delivered in a comprehensive, continuously accessible, coordinated and family centered way (American Academy of Pediatrics, 2003)]
Health Insurance on file	Record "yes" if there is a record that the child has health insurance (i.e., private health insurance, Medicaid, CHIP, CHAMPUS)
Number of Days Absent (Previous 2 months)	For each child, record the number of days absent when the center was open in the previous two months, for whatever reason
Number of Medically Attended Injuries (Previous 2 months)	For each child, record the number of medically injuries in the previous two months

(Continue)

	Screenings: for each screening listed, record the appropriate code					
	N = No	I = screening recorded but no record of outcome	Y = Yes but not positive	P = screening recorded and positive but no record of referral	R = screening recorded and positive, referral is pending.	C = screening recorded, referral complete.
Height and Weight Screening						
Hct or Hgb Screening						
Lead Screening						
Vision Screening						
Hearing Screening						
Speech or Language Screening						
Oral Screening						
Developmental Screening						
Hct- Hematocrit is a blood test that measures the percentage of the volume of whole blood that is made up of red blood cells. Hgb-Hemoglobin is a protein in red blood cells that carries oxygen						

Figure 4. Evaluation Worksheet - Access to Preventive Health Care

Data Analysis

Three covariates were defined and included in all analysis models: 1) the size of the program, 2) the proportion of infants and toddlers (0-35 months) enrolled, and 3) a measure of child care quality, the star-rated licensing level (North Carolina Division of Child Development, Star Rated License, 2003). Size was defined as "small" if a site had fewer than ten enrolled children; all other sizes were categorized as "other". The proportion of enrolled children who were infants and toddlers was divided into 2 groups, "less than or equal to 50%" or "greater than 50%". The five star-rated licensing levels were aggregated into three categories: scores of 1 or 2, a score of 3, and scores of 4 or 5. The star rating is assigned by the state agency that regulates and licenses the state's child care programs. The rating involved an extensive review of records (e.g., environmental health, staff training) and an observational assessment using the Early Childhood Environment Rating Scale: Revised Edition (Harms, Clifford, & Cryer, 1998). A rating of 4 or 5 indicated highest quality care, a rating of 1 or 2 indicated a low quality, and a rating of 3 indicated an acceptable level of quality. A description of the eligible programs at each time point is shown in Table 2.

TABLE 2
Descriptive Data on Eligible Child Care Programs

	Baseline	Follow-up 1	Follow-up 2	Follow-up 3	Follow-up 4
Number of Programs by Size					
Small (<10 children)	42	37	37	34	36
Other (>10 children)	35	40	40	43	41
Number of Enrolled Children at all Programs					
Small (<10 children)	249	217	223	204	202
Other (>10 children)	1812	1726	1751	2168	2046
Total	2061	1943	1974	2372	2248
Percent of Enrolled Children who are Infants/Toddlers					
Small (<10 children)	54%	56%	44%	51%	49%
Other (>10 children)	44%	48%	36%	38%	37%
Number of Programs by NC Star Rating					
Missing*	1	1	1	1	1
1	34	30	28	18	14
2	2	2	2	0	0
3	22	23	24	31	31
4	13	15	16	21	22
5	5	6	6	6	9

**Note:* One program was faith-based and not required by state licensure to have a star rating

The analysis data set consisted of 77 out-of-home child care programs that had data for the baseline visit and all four semi-annual follow-up visits. To check against a bias created as an artifact of site selection, a chi-square test for categorical descriptive variables and t-test for continuous descriptive variables were run comparing the 77 eligible programs to the 187 ineligible programs. The results of this analysis suggested that there was one statistically significant bias in the size of the eligible programs compared to the ineligible programs. Size was controlled for in the analysis. A comparison of the covariates between the 77 sites and the other 187 sites at baseline is shown in Table 3.

TABLE 3
Baseline Covariate Comparison between 77 sites and other 187 sites

		Programs with incomplete data (N= 187)	Programs with complete data* (N= 77)	Total	Chi-Square Test
Did the program have more than 50% infants/toddlers?	No	124	44	168	1.342
	Yes	60	33	93	
	Missing	3	0	3	
	Total	187	77	264	
Was the star rating 1 or 2?	No	102	40	142	0.144
	Yes	65	36	101	
	Total	167	76	243	
Was the star rating 4 or 5?	No	123	58	181	1.034
	Yes	44	18	62	
	Total	167	76	243	
Missing star rating	Total	20	1*	21	
Was total enrollment fewer than 10 children?	No	122	35	157	11.957***
	Yes	63	42	105	
	Missing	2	0	2	
	Total	187	77	264	

**Note*-One program, a faith-based center that is not required by state licensure to have a star-rating.

Rates of injury and rates of absence were also calculated. The rate of injury was calculated as the number of injuries per 100 child days based on weekly incident reports required by the state. The rate of absence was calculated as the average number of absences per child per month. The information on absences was collected from the attendance sheets in each child care program, also required by the state.

Hierarchical Linear Modeling (HLM) (Raudenbush & Bryk, 2002) was used to assess the linear change over time in these outcomes. HLM is widely used in the social, behavioral, and biological sciences to assess stability and change (Raudenbush & Bryk, 2002) when repeated measures are used. In addition to linear change over time, it was also important to assess absolute change between baseline and the final follow-up. This was done using a General Linear Model (ANOVA) to test the difference between each outcome at baseline and at the final follow-up visit.

RESULTS

The CCHCs had a positive impact on the nine written health and safety policies. On a scale from 0-3, the mean of the nine policy scores rose from 0.79 to 2.44 over 24 months ($p<0.001$). Similarly, all four health and safety practice scores increased (see Table 4). The improvement in the mean of each of the four scores was statistically significant ($p < 0.001$).

TABLE 4
Means for Health and Safety Policies and Practices

Domain	Outcome	Baseline	Follow-up 1	Follow-up 2	Follow-up 3	Follow-up 4	t-Test
Policies	Mean of 9 policies	0.79	1.32	1.78	2.20	2.44	20.29***
Practices	Emergency	2.24	2.67	2.82	2.89	2.88	9.35***
	Nutrition	2.57	2.60	2.61	2.78	2.77	3.78***
	Playground	2.26	2.51	2.69	2.79	2.81	10.59***
	Sanitation	2.27	2.64	2.73	2.79	2.89	10.48***

A 2-level hierarchical model with time point as the only model covariate.
Number of Programs= 77, *** $p < .001$

In addition to evaluating nine written health and safety policies and four health and safety practices, health and safety indicators from the children's records were also reviewed. Individual children were not tracked. The records reviewed were selected randomly and the number of records reviewed was based on the size of the program. In child care centers and family child care homes with fewer than 25 children, the CCHCs reviewed all of the children's records. In programs with 25 or more children, at least 25 records were randomly selected and reviewed by the CCHC.

Records of screenings performed in the previous six months for height and weight, hematocrit or hemoglobin, lead level, vision, hearing, speech or language, oral health, and development were coded. With the exception of statistically insignificant declines in recorded lead and hematocrit/hemoglobin screening, the proportion of children with screening information increased. Four specific screening tests demonstrated statistically significant increases:
1) developmental, 2) hearing, 3) oral, and 4) vision. (Table 5)

TABLE 5
Percentage of Children's Records with Indicator of Access to Preventive Health Care

Outcome	Baseline	Follow-up 1	Follow-up 2	Follow-up 3	Follow-up 4	t-Test
Emergency contact information on file	94.95	94.37	97.45	97.27	96.89	1.95+
Immunizations up-to-date	71.55	73.94	75.72	76.81	82.92	3.79**
Health insurance on file	47.77	57.59	65.72	64.71	63.61	4.51**
Medical home on file	90.01	92.11	93.22	94.44	96.96	3.68**
Well child physical in last year	44.27	39.64	40.08	41.84	43.86	0.17
Well child physical on file	84.11	85.40	87.68	85.92	87.18	1.30
Developmental screening	6.84	4.79	8.33	12.89	17.04	3.98**
Hct/Hgb screening	9.02	4.76	5.96	3.47	4.36	-2.27*
Hearing screening	6.40	13.97	17.33	29.17	36.39	8.16**
Height/ weight screening	46.92	40.36	43.21	48.74	48.04	1.21
Lead screening	2.56	1.25	1.22	1.71	1.62	-0.48
Oral screening	9.74	17.76	19.30	33.18	35.30	7.09**
Speech/language screening	2.71	3.44	3.61	4.48	7.02	2.40*
Vision screening	7.33	14.48	18.34	28.25	36.62	7.97**

+ $p < .10$, * $p < .05$, ** $p < .001$

Similarly, as Table 5 shows, the percentage of children with a medical home on record increased from 90.01% to 96.96% ($p < 0.001$). Those with recorded health insurance went up from 47.77% to 63.61% ($p < 0.001$), and those with up-to-date immunizations went from 71.55% to 82.92% ($p < 0.001$). Statistically non-significant increases were noted for children with well-child physicals on file (84.11% to 87.18%) and for those with emergency contact information on file (94.95% to 96.89%). There were not enough children with special needs to calculate reliable statistics for the proportion of all such children who had medical care plans on file.

Finally, the rate of child absences for any reason decreased from 0.88 per child per month at baseline to 0.66 one year later, but rose to 0.93 at 24 months. The rate of medically-reported injury showed no particular pattern, probably because of small numbers, starting at 0.02 per 100 child days at baseline, rising and falling and ending up at 0.03 at 24 months. Neither trend was statistically significant.

DISCUSSION

The data collected by the CCHCs in our study demonstrated that child care health consultation had a positive impact on health and safety policies and practices at the child care program level. The CCHCs also had an impact on indicators of health and access to preventive health care at the child level.

At the program level, the data indicated a positive impact on the quality and completeness of written health and safety policies based on state and national standards. This observation supports the conclusion of Ramler, Nakatsukasa-Ono, Loe, & Harris (2006) that, "child care health consultation appears to have a positive impact on the development and use of standards-

based health and safety policies in ECE (Early Childhood Education) programs". Similarly, we observed in a previous study that having written health and safety policies is associated with a reduction in severe diarrhea in child care centers, suggesting that improvement in written health and safety policies is a precursor to health status improvements in children (Kotch, et al., 1997).

The data also indicated a positive impact on observed health and safety practices at the program level. This observation is similar to the results of studies conducted by Alkon et al., (2002 & 2009), who used trained observers to measure compliance with the National Health and Safety Performance Standards in centers served by CCHCs. Statistically significant improved compliance was noted; however, it is difficult to compare the magnitude of Alkon's et al., (2002) improvements since Alkon et al. (2002) used a three point scale compared to the four point scale used in this study.

The most significant result of this study was the impact of the CCHCs at the child level. The data collected indicated small but important improvements in a child's reported use of medical care homes, health insurance coverage, recommended immunizations, screening tests, and well child physicals in the past year. The link between these indicators and the CCHC was that written health and safety policies require families interested in child care services to conform to the program's established policies. Policies guide, for example, the admission criteria (e.g., immunizations must be up to date) as well as requirements for current, valid, emergency medical information on all of the children (e.g., medical home on file). These two examples, established the link to the work of CCHCs on the written health and safety policies. Therefore, when guided by a CCHC, improvements in policies may be both statistically and practically significant to the children in child care. For example, over time this study demonstrated a steady increase in the percentage of children with up-to-date immunizations. To determine the actual increase, the number of children at baseline and at the fourth follow-up whose records were reviewed, was multiplied by the percentage of records with up-to-date immunizations (1439 X 71.55% and 1344 X 83%) (See Tables 1 and 5). The two resulting numbers subtracted from each other (1115-1029) yields 86 more children with up-to-date immunizations. These 86 children represented a 6% increase. When 6% is multiplied by the approximately 260,480 children in regulated out-of-home child care in NC (North Carolina Division of Child Development, 2011), 15,629 additional children would have been fully immunized, if child care health consultation services were available statewide. This same logic of steady increases over time can be applied to the other indicators of child health and safety: health insurance, medical home on file, screenings (developmental, hearing, oral and vision).

It is also apparent that the CCHC had an influence on the child care staff's health and safety practices. The influence was achieved by training on health and safety topics and by corrective guidance. Written policies and procedures developed in collaboration with the CCHC guided the change in the behaviors of the staff. The statistically significant improvement in staff practice in the areas of sanitation (e.g., hand washing, diaper-changing), playground safety (e.g., observation of all areas, developmentally appropriate equipment), emergency preparedness (e.g., evacuation plans, drills) and nutrition (e.g., nutrition standards) were all directly linked to the health and safety of the children in care.

Unfortunately, the results of the study did not demonstrate a consistent decline in either absences or medically-attended injuries among children in the study programs. The numbers of medically-attended injuries was probably too small to generate stable rates. As for absences, although they declined in the first year, there are numerous reasons why they may have bounced back in the second year. Some of the reasons may have included unpredictable infectious disease

outbreaks in the community, turnover of child care children and staff (and of the CCHCs themselves in some cases), and possible recording errors.

Limitations

Resource constraints precluded our following a comparison group of child care programs without CCHC services. Even if that had been possible, it is likely our funding agency or the programs themselves might have legitimately argued that withholding child care health consultation services would have been unethical. Another limitation was the lack of objective data collectors. Daily activity data and center- and child-level outcome data were collected by the CCHCs themselves, who, although trained to collect the data reliably and accurately, could not have been completely unbiased. Similarly, even though the 77 programs did not differ on important baseline characteristics from the entire sample of 264, it was possible that attrition may have introduced bias into the analyses.

The lack of a statistically significant decline in medically-attended injury (injuries that were examined by a physician) may have been the result of small numbers. The fact that the data were based on injury reports that were generated by the child care staff may have led to underreporting, a process that was noted by the state's regulatory staff (personal communications, 2004). The under-reporting may have been due to the fact that child care programs are penalized by the licensing agency if it is determined that injuries occur frequently.

The lack of statistically significant change in records of child absences may have been due to the fact that the data were collected from records compiled by the child care staff for administrative purposes and not generated by direct observation by the research staff.

Conclusion

The Association of State and Territorial Health Officials is on record as supporting public health agencies' expanding the use of CCHCs (Association of State and Territorial Health Officials, 2004). The data presented in this study provide early evidence that support the recommendation to expand this service. Future studies with larger numbers, comparison groups, and objective data collectors will strengthen the case for greater utilization of this new public health professional.

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