



## Improvement of food safety in school meal service during a long-term intervention period: a strategy based on the knowledge, attitude and practice triad



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### ABSTRACT

The objective of the present study was to evaluate the development of food safety scores in school meal services during the application of a systematic intervention based on the knowledge, attitude and practice triad. A total of 68 public schools were included in the study. School meal services were assessed every three months with a checklist, which resulted in eight evaluations over two years. A program was developed and implemented in all the schools during this period that was comprised of three steps: 1) theoretical training, 2) implementation of action plans *in situ* and 3) weekly visits to motivate food handlers and monitor good practices. These steps were designed to promote changes in the attitudes and practices of food handlers. An ascending linear function was observed for the school meal services' general adequacy percentage over time. Positive developments were also observed regarding buildings and facilities, processes and procedures, distribution of meals, integrated pest management, water control, controls and records, health and safety of employees and equipment and utensils. Our results suggest that the proposed intervention strategy performs well in making school meal services conform to good practices and that strategies in this context should be permanent and continuous.

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## 1. Introduction

Foodborne diseases are considered to be an emerging problem and are currently a subject of major concern for the governments of various countries throughout the world. Affecting both developed and developing countries, every individual in the world is at risk of foodborne disease (WHO, 2008).

Food- and water-borne diseases contribute significantly to mortality due to diarrhea, responsible for 2.2 million deaths every year, mainly children in developing countries (WHO, 2008). However, the magnitude of the problem is believed to be even greater

due to underreporting and the lack of full health monitoring systems, even in developed countries (Seaman & Eves, 2006).

Several factors contribute to the incidence of foodborne disease, including population growth, growth of highly vulnerable population groups, lack of basic sanitation, increased food production and distribution and changes in consumer behavior toward a preference for high-risk foods (Motarjemi & Käferstein, 1999). These factors are associated with human development and society rather than directly associated with food handlers.

Nonetheless, studies report that the inadequate handling of food is considered the main causal mechanism of foodborne disease and is directly related to several outbreak cases (Greig, Todd, Bartleson, & Michaels, 2007; Howes, McEwan, Griffiths, & Harris, 1996). Outbreaks usually involve cases of inadequate cooking temperatures and storage and cross-contamination between raw foods and ready-to-eat foods. In these cases, food handlers are estimated to be responsible for 97% of foodborne outbreaks (Egan et al., 2007).

Thus, strategies should be employed to ensure that food handlers know good practices for food handling and that they use these

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practices in their work environment. The most widely used strategy is training, which is considered to be an important method to increase knowledge and skills (Medeiros, Cavalli, Salay, & Proenca, 2011). However, Ehiri, Morris, and McEwen (1994) reported that Good Hygiene Practice training, which involves only scientific communication, is not an effective strategy for changing practices in the workplace. Rennie (1994) stated that knowledge alone does not result in changes in food hygiene practices. Failure to change behavior following training programs was also observed in other studies, which indicates that knowledge and practice are not always associated (Cook & Casey, 1979; Park, Kwak, & Chang, 2010). This theory may be even more consistent than is observed in the literature, as scientific bias may cause articles that report negative results or intervention failures to remain unpublished (Dirnagl & Lauritzen, 2010; Schooler, 2011).

Therefore, new methods to promote good practices in food service are needed to guarantee the quality of food provided. This assumption becomes even more important in the context of school meal programs because these programs are meant to provide food to children and young people to encourage their growth and biopsychosocial development (Oliveira, Brasil, & Taddei, 2008).

One of the most important public policies of the Brazilian federal government to ensure the health of the population is the provision of school meals, through the NSFP (National School Feeding Program). The program began in 1955 and over the years changes have occurred in its management until it was established, in 1979, as the NSFP. Currently this program provides, through transfer of financial resources, the food supply for all students (from day care centers, elementary schools, high schools and general education for youth and adults) enrolled in public and philanthropic schools in Brazil. Approximately 45.6 million of school meals are served every day in Brazil (Peixinho, 2013).

Brazil's Good Manufacturing Practices (GMP) law does not specifically address school kitchens, ruled by laws applied to general food services. It must be considered that school kitchens are, generally, adapted rooms or similar to home kitchens, resulting in great difficulty in following GMP laws (Oliveira et al., 2008). Thus, this program deserves special attention in relation to food handling and the risks the ready-to-eat food can pose to students' health if food is mishandled.

The objective of the present study was to evaluate trends in sanitation and hygiene conditions within school meal services during the application of a systematic intervention program based on the knowledge, attitude and practice triad.

## 2. Methods

The present study included all public schools ( $n = 68$ ) of a highly developed municipality of São Paulo (Brazil) with a 0.8340 Human Development Index (UNDP, 2000). Schools participating in the study covered all age groups involved in basic education, including kindergarten, preschool, elementary, middle and high schools for young people and adults. A total of 365 food handlers participated in the intervention and were distributed among the school meal services being evaluated.

None of the school meal services had implemented the Hazard Analysis and Critical Control Points (HACCP) program before the intervention.

### 2.1. Checklist and application

A good practice checklist was developed based on current legislation in Brazil, including CVS-18 (São Paulo, 2008), RDC 216 (Brazil, 2004) and CVS-6 (São Paulo, 1999), and on the food standards

present in the *Codex Alimentarius* (2003). The checklist contained ninety-five items divided into eleven thematic areas: area one – receipt, containing six questions; area two – storage, containing seventeen questions; area three – processes and procedures, containing twenty questions; area four – distribution of meals, containing four questions; area five – pest control management, containing two questions; area six – controls and records, containing four questions; area seven – waste management, containing six questions; area eight – health and safety of employees, containing three questions; area nine – water control, containing four questions; area ten – equipment and utensils, containing twelve questions and area eleven – structure and buildings, containing fourteen questions. The checklist questions were given a score of one point for compliant conditions and zero for non-compliant conditions.

Trained nutritionists applied the list to all schools participating in the study, thereby providing a diagnosis of the sanitation and hygiene conditions of the school meal services. This diagnosis stage was identified as time zero ( $t_0$ ) of the intervention.

After applying the checklist, fitness scores were calculated for each thematic area. The scores were calculated as the number of points achieved in the thematic area divided by the maximum number of points possible for that particular area and then converted into a percentage. The same procedure was followed to generate an overall adequacy score. This variable included all scores obtained across the ninety-five items and corresponded to a mean adequacy for all thematic areas.

After discussing the strengths and weaknesses observed in each school meal service, an intervention program was proposed.

This intervention program was monitored by repeated applications of the same checklist used in the diagnostic stage. The checklist was applied every three months, for a total of eight evaluations performed over a two-year period ( $t_0, t_1, t_2, t_3, t_4, t_5, t_6$  and  $t_7$ ). The purpose of this application was to monitor the behavior of the scores of each thematic area and the total scores of school meal services after the intervention program was implemented.

### 2.2. Intervention program

The proposed intervention program provides a new form of intervention to promote good practices in food service as it combines strategies and concepts presented in other studies. The knowledge, attitude and practice triad serves as the central axis of the intervention program (Bas, Ersun, & Kivanc, 2006; Sharif & Al-Malki, 2010) and the program evaluation uses hybrid models (combination of internal and external evaluation) (Bourgeois, Hart, Townsend, & Gagné, 2011); the program also includes scheduled monitoring of good practices (Bader, Blonder, Henriksen, & Strong, 1978) and motivation of food handlers (Seaman, 2010).

Systematization of the intervention model was adapted from Seaman (2010) (Fig. 1).

The intervention consisted of three stages: 1) theoretical training focused on improving knowledge, which was held every six months; 2) good practices evaluation and implementation of *in situ* action plans to correct nonconformities and to align practices, every three months and 3) weekly visits to all school kitchens to monitor action plans and motivate food handlers. The first and second stages were conducted by nutritionists outside of the school meal services (external assessment and intervention) and the third stage was conducted by trained tutors and staff from the municipality (internal assessment and intervention).

A total of five 12-h theoretical trainings were performed. Each training included three breaks for meals. These trainings were conducted in classrooms with a maximum of thirty food handlers

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