

Surveying vendors of street-vended food: a new methodology applied in two Guatemalan cities

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SUMMARY

Lack of reliable data about street vendors, who are difficult to survey, has hampered efforts to improve the safety of street-vended food. A two-phase method for sampling vendors, surveying first in areas of concentrated vending activity identified by local authorities and second in randomly selected areas, was developed and implemented in two Guatemalan cities where street-vended food had been implicated in cholera transmission. In a 4-day survey in Escuintla, 59 vendors (42 from phase 1, 17 from phase 2) were interviewed. They demonstrated good knowledge of food safety and cholera but unsafe practices, implying that more effective, practical training was needed. In a 6-day survey in Guatemala City, 78 vendors (77 from phase 1, 1 from phase 2) were interviewed. Sixty-eight (87%) vendors stored water, usually in wide-mouthed vessels prone to contamination; this led to a field test of a new system for safe water storage. Useful information for public health planning and intervention can be gathered rapidly with this new method for surveying street vendors.

INTRODUCTION

Street vendors and street-vended food are an integral part of urban life. Present in many cities worldwide, street vendors are a particularly important source of convenient, affordable food for the urban poor and working classes in developing countries. Street

vending has a major economic impact in many countries and is a major source of employment. For example, it has been estimated that 320 000 street vendors work in Mexico City, 100 000 in Malaysia, and more than 1 000 000 in China [1]. Although street vendors may be seen as a nuisance by public authorities concerned about transmission of food-borne disease and traffic and litter problems, the forces that have created their market – urbanization, migration, industrialization – have made them an inextricable part of the social fabric.

However, because street-vended food may not be produced and stored hygienically, serious concerns about its safety have been raised [2, 3]. Street vendors may not have access to potable water, methods for water disinfection, toilet facilities, refrigeration, or

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means for adequate sanitary practices within their businesses. Even if they do have these resources, they may lack the knowledge or motivation to use them to produce safe food. Microbiological studies in several countries in Asia and Latin America have found massive bacterial contamination of street-vended food [4–8]. Street-vended food has often been implicated as the vehicle of foodborne outbreaks, including cholera in Latin America [4, 9, 10], and Asia [11, 12] and typhoid in Chile [13]. As a result, national authorities have tried to improve the safety of street-vended food through training, licensing and regulating street vendors; the Food and Agriculture Organization of the United Nations has attempted to coordinate these activities [1].

These efforts to improve the safety of street-vended food have been hampered by the lack of reliable data about street vendors. By the nature of their business, many street vendors are itinerant. Therefore, they are difficult to reach, count and survey reliably. Furthermore, the generalizability of information obtained from those reached in surveys is questionable. The resulting information gap means that measuring the magnitude of food safety problems associated with street vending and assessing the efficacy of interventions have been problematic.

In this paper, we report a new method for surveying street vendors that is rapid and inexpensive and that adequately samples the population. We implemented this method in studies in two Guatemalan cities, where eating street-vended food has been the most important risk factor for epidemic cholera [4]. The goal of these studies was to develop accurate information about street-vending operations that could be used to target practical and effective public health interventions.

METHODS

General survey methodology

We developed a two-phase approach for sampling street vendors. In the first phase, we asked knowledgeable local authorities to identify the areas of the city in which concentrated street vending activity occurred – the ‘main vending areas’. These areas were outlined on a map of the city, and street vendors working within them were interviewed. In the second phase, a transparent grid with numbered boxes was superimposed on a map of the city. Excluding the main vending areas, the boxes of the grid were

randomly sampled, and vendors operating within the selected boxes were interviewed. This second phase was used to estimate the total vendor population, to confirm the information obtained from the local authorities, and to determine whether street vendors working outside the main vending areas had different characteristics from those working inside them.

Escuintla survey

The main goals of this survey were to assess vendors’ knowledge, attitudes, practices and training in food hygiene and to generate data-based proposals for improving the safety of street-vended food.

Geographic selection

In Escuintla, a provincial capital with a population of 120 000, we surveyed street vendors, defined as persons selling food or beverages whose business is not conducted from a formal building, and consumers of street-vended food. The main market and the three bus terminals were identified by local public health inspectors as the main vending areas and were defined on a map of the city (Fig. 1). Interviewers used a standard questionnaire to interview all street vendors present in these areas who were selling peeled cut fruits or vendor-produced beverages, items that had been previously identified as risk factors for cholera transmission [4, 14]. This survey was conducted from 13–16 September 1994, with interviews in each area conducted on a single day. A random sample of street vendors operating outside the main vending areas was also conducted. To determine which areas would be sampled, a grid was placed at random over a map of the urban centre (Fig. 2). One quarter of the squares of the grid falling within the urban centre, but excluding the main vending areas, were randomly selected. Each of the selected locations was visited, and all street vendors operating within them who were selling peeled cut fruits or vendor-produced beverages were interviewed using the same questionnaire. This survey was conducted on 14 September 1994.

Vendor and consumer interviews

Interviewers, working in pairs, observed the sale of a peeled cut fruit or vendor-produced beverage, then one investigator interviewed the vendor while the other interviewed the consumer. Each interview took 5–10 min. The consumer who was selected was the

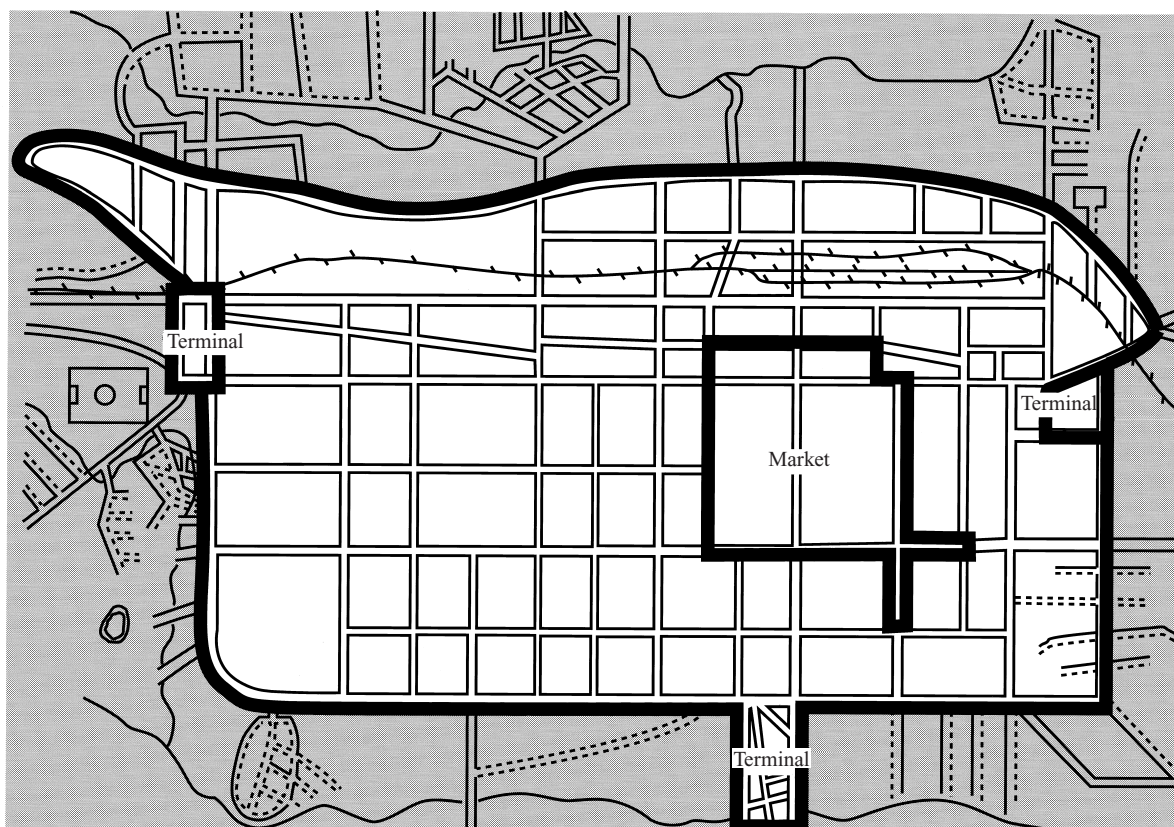


Fig. 1. Urban centre, Escuintla, Guatemala. Main vending areas, the market and bus terminals, are outlined.

first consumer to purchase from a vendor after the vendor was identified by the investigating team. If no sale was made within 15 min of observation, the vendor was interviewed without a corresponding consumer interview. The vendor interview and observations included the following: closed-ended questions regarding demographics, food hygiene training, food and water safety practices, and knowledge of cholera; interviewer observations of whether the vendor's hand touched the beverage while serving and whether soap, water, and waste receptacles were available at the vending site; and laboratory measurements, including the pH of the type of fruit or beverage bought by the consumer (S/P pH indicator strips; Baxter Diagnostics Inc., Deerfield, IL) and free and total chlorine levels of water used in the vending operation (Free and Total Chlorine Kit; Hach Co., Loveland, CO). Coliform counts of a convenience sample of beverages were performed at the Instituto Nutricional de Centro America y Panama by the Most Probable Number technique, three tube method [15]. The consumer interview consisted of closed-ended questions similar to those asked of vendors; consumers were also asked about their knowledge and attitudes regarding the food hygiene training and

practices of the vendor from whom their purchase was made.

Guatemala City survey

The main goals of this survey were to assess the safety of vendors' water as well as vendors' practices in water storage and disinfection and their awareness of issues of food and water hygiene.

In the national capital, Guatemala City, population 3 million, we surveyed street vendors, defined as persons selling food or beverages from either a municipal market or from a location not in a formal building. Local authorities assembled a list of areas within the commercial zones of the city that were likely to include the main vending areas. This list contained 9 markets, of which 2 were randomly selected, and 64 non-market locations, such as parks, plazas and the ends of bus routes. The area of interest in a location was defined as the identified block and the sidewalks and other outdoor areas on both sides of the streets around the block. Interviewers used a standard questionnaire to interview all street vendors in the 2 selected markets and in 64 other locations

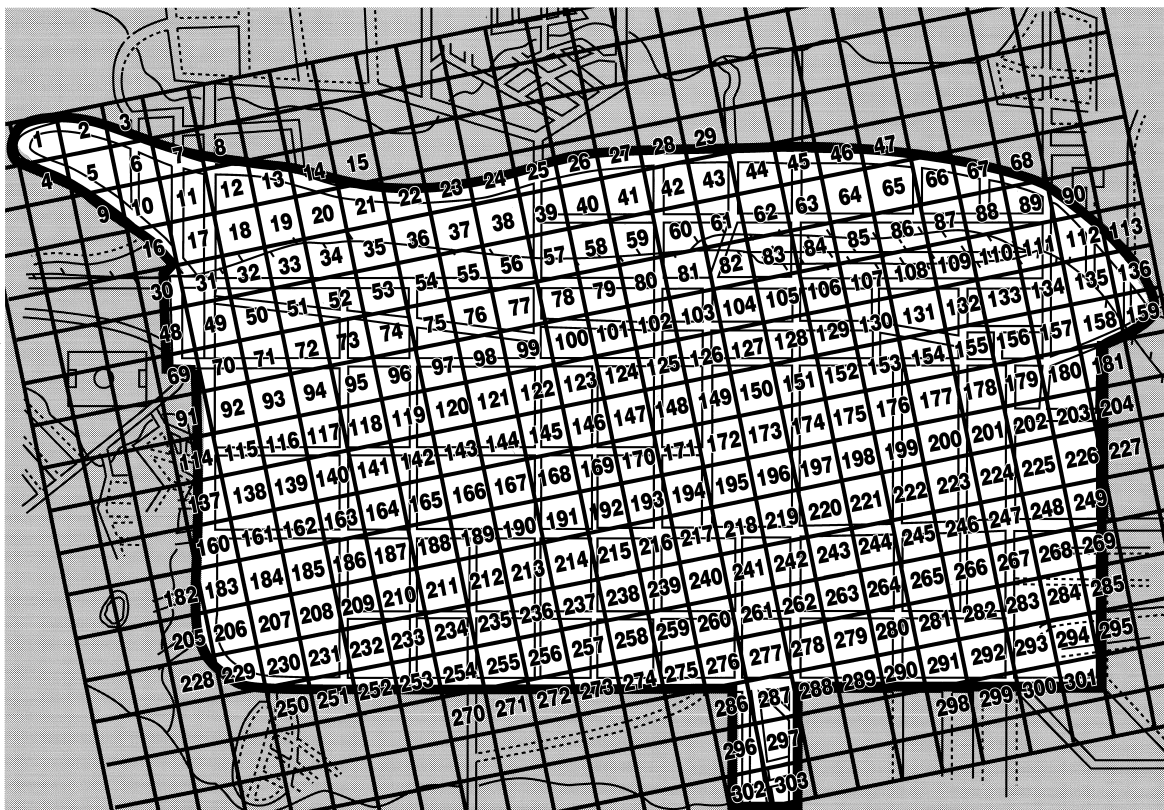


Fig. 2. Numbered grid placed at random over map of Escuintla urban centre. Squares of the grid were chosen at random, after excluding the main vending areas.

who were selling vendor-produced beverages on 11–13, 16–17 and 24 October 1995.

A random sample of street vendors operating outside these main vending areas was also surveyed. A grid was placed at random over a map of the city. Nine of the 88 squares of the grid falling within the commercial zones, but excluding the areas on the list of main vending areas, were selected at random. All streets within the selected grid squares were visited, and all street vendors selling vendor-produced beverages were interviewed.

The Guatemala City vendor interview included closed-ended questions and interviewer observations. Customers were not interviewed. Questionnaire items included demographic information; information about water sources, storage, purification and use; methods of beverage preparation and dispensing; and history of training in food hygiene. Interviewers also made observations of water and beverage storage vessels. Using the same methods as in the Escuintla survey, free and total chlorine levels were measured and total and faecal coliforms counts were obtained from municipal tap water. Stored water, beverage, ice, and hand rinse samples were obtained from a

convenience sample of vendors and were tested for free and total chlorine levels, total and faecal coliform counts, and the presence of *Escherichia coli* by previously described methods [16].

RESULTS

Escuintla survey

In Escuintla, 42 vendors and 36 consumers were interviewed in the market and bus terminals identified as main vending areas, and 17 vendors and 12 consumers were interviewed in areas chosen at random; 1 market vendor refused to be interviewed. Since 25% of the area of Escuintla was selected for the random sample, we estimate that 17×4 , or 68, vendors were operating outside areas of concentration during the study period, and $68 + 42 + 1$, or 111, vendors of peeled cut fruits or vendor-produced beverages were operating in the entire municipality. There were no significant differences in important variables between vendors working in the main vending areas and those working in the areas selected at random, so combined results are presented.

Demographic characteristics of vendors are re-

ported in Table 1. Seventeen (29%) vendors stated that they had received training in food hygiene. Fifty-five (93%) vendors had heard of cholera, 49 (83%) knew it could be fatal, 55 (93%) thought it could be prevented, and 46 (78%) thought it could be transmitted through foods and beverages. There was no association between having received training in food hygiene and any of these measures of knowledge about cholera. An index of knowledge about food safety was constructed from six questions asking whether certain practices were safe in terms of not causing cholera. The six items included eating hot foods, drinking river water, drinking chlorinated water, eating without prior hand-washing, washing fruit before eating it, and eating raw seafood. A perfect score was six. Forty-three (73%) vendors received scores of 5 or 6; there was no association between higher scores and having received food safety training.

Food safety practices were evaluated both by questions and by observations. Five (13%) of 40 beverage vendors reported using bottled water to make their beverages. An additional 24 (60%) reported always using chlorinated water, and 11 (28%) reported always using boiled water. However, when water samples from those vendors who reported that they always chlorinated their water were tested for chlorine, 15 (83%) of 18 tested had no detectable chlorine. There was no association between vendors' having received training and either stating that they used safe water (bottled, boiled, or chlorinated) or the presence of chlorine in their water. Fifty-one (86%) of the 59 vendors said they washed their hands before preparing their product, but only 46 (78%) said they had water for handwashing at the vending site, and 29 (51%) of 57 were observed by the interviewer to actually have water available; 14 (24%) of 58 had soap. Sixteen (41%) of 39 beverage vendors for whom an observation was noted were observed to put their hands into the vessel, thereby touching the beverage while serving it. Having received training was not significantly associated with either an increased likelihood of having water available for handwashing or a decreased likelihood of touching the beverage while serving it. Several types of beverages consistently had pH levels above 5, the range in which *Vibrio cholerae* can grow. In the eight beverages tested for total and faecal coliforms, counts per millilitre ranged from 23 to > 1110 and from 4 to > 1100, respectively.

The 48 consumers had a median age of 29 years (range 15–53), and 26 (54%) were female. Thirty-

seven (80%) of 46 consumers stated that they would prefer to purchase food from a vendor who had been trained in food hygiene. However, 73% (33/45) did not know whether the vendor from whom they had purchased had been trained. The most common reason for purchasing from a given vendor was convenience; only 10 (22%) of 46 consumers stated that they had chosen a vendor based on cleanliness. The vendors chosen for cleanliness were not significantly different from other vendors in terms of the proportions who had received food hygiene training, believed that cholera could be transmitted by foods or beverages, believed that chlorinating water was a good practice, had food safety scores (as defined above) of 5 or 6, were observed to have water at the vending site, touched the beverage while serving it, or had detectable chlorine in the water used for preparing their products.

Guatemala City survey

In Guatemala City, 78 vendors were interviewed, 77 from locations on the list (35 from the 2 markets and 42 from non-market locations) and 1 from an area chosen at random; 4 market vendors refused to be interviewed. Since 2 of 9 markets and 9 of 88 grid squares were chosen at random, we estimate that $(9/2)(35+4)+42+(88/9)(1)$, or 228 vendors of vendor-produced beverages were operating in the study area during the survey. Demographic characteristics of Guatemala City vendors are reported in Table 1.

Thirty-nine vendors (50%) had a water tap within their establishment. Vendors had access to running water for a median of 7 h/day (range, 0–24 h). Sixty-eight (87%) vendors stored water. All 68 vendors who stored water stored municipal tap water, and 7 of them (10%) also stored commercially bottled purified water. Among 251 vessels used for water storage, 211 (84%) had a mouth > 10 cm in diameter, large enough for a hand to enter, and 40 (16%) had a mouth ≤ 10 cm in diameter. Beverages were made with municipal tap water by 72 (92%) vendors and with commercially bottled purified water by 7 vendors (9%). Of the 72 vendors who used tap water to prepare their beverages, 60 (83%) thought this water was always potable; 7 (10%) thought it was sometimes potable; 3 (4%) thought that it was never potable; and 4 (5%) did not know whether it was potable. Seventy (90%) vendors stated that they thought that chlorination was a good method of water

Table 1. *Demographic characteristics of street vendors surveyed in two urban locations in Guatemala*

	Escuintla, 1994	Guatemala City, 1995
Number surveyed	59	78
Median age, years	36 (range 13–67)	36 (range 12–70)
Female	31 (53 %)	72 (92 %)
Speak only Spanish (%)	45 (76 %)	70 (91 %)
Illiterate (%)	26 (44 %)	14 (18 %)
Vending > 1 year (%)	48 (81 %)	75/77 (97 %)
Vended \geq 5 days/week (%)	54 (92 %)	78 (100 %)

purification, 6 (8%) said it was not, and 2 (2%) did not know. The median volume of vessels used to store beverages was 3 gallons (range 0.5–20 gallons). Seventy-seven (99%) of the 78 beverage-storage vessels had mouths > 10 cm in diameter. To serve the beverage, 68 (87%) vendors used a method that required introducing the server's hand into the storage vessel.

All vendors stated that a toilet facility was available near their place of work; 61 (78%) said that water was always available for handwashing at the facility, and 6 (8%) that soap was always available. Fifty-one vendors (65%) stated they had received training in food hygiene; those who had received training were more likely to report chlorinating the water used to make drinks (38/51 vs. 13/27, relative risk = 1.55, 95% confidence interval 1.01–2.36, $P = 0.04$). When asked if they thought improving hygienic conditions at their establishments would increase sales, 48 (64%) said 'very much', 16 (21%) said 'somewhat', and 11 (15%) said 'not at all'.

Among five samples of municipal tap water, all had free and total chlorine levels \geq 1.0 ppm – levels of free chlorine \geq 0.5 are considered adequate to disinfect water – and no coliforms were detected. However, free chlorine levels in stored water from 9 vendors were 0.1–2.2 ppm and in ice from 7 vendors 0–0.5 ppm. In stored water from 10 vendors, total and faecal coliform counts both ranged from < 1 to too numerous to count (TNTC). The World Health Organization standard for potable water is less than one coliform per 100 ml. Among beverages from these 10 vendors, both total and faecal coliform counts ranged from < 1 to TNTC, and among ice samples from 7 vendors from 20 to TNTC and from < 1 to TNTC, respectively. Coliforms were found in hand

rinse samples from all 10 vendors tested, ranging from 100 to TNTC per 50 ml rinse for both total and faecal coliforms, and *E. coli* was detected in 5 of the 10 samples.

DISCUSSION

We have developed a new two-phase sampling method for surveying street vendors that addresses the difficulties inherent in surveying an itinerant population. In the first phase, persons with local knowledge identify areas of concentrated street-vending activity within the metropolitan region of interest. Street vendors working within these areas are surveyed, either by census or by appropriate sampling. In the second phase, a grid is placed on a map of the metropolitan region, and squares of the grid are randomly selected. Street vendors working within these randomly selected squares are then surveyed. This two-phase method allows estimation of the total population of street vendors by extrapolation from the sampling frequencies during each phase, confirmation of the information about street vending activity collected from local experts by assessing whether the second phase reveals previously unidentified areas of concentrated street vending, and comparison of the characteristics of street vendors working inside and outside the areas of concentration. The goals of the survey determine the content of the survey instrument, which may include laboratory testing and customer interviews as appropriate. We used this method for rapid, efficient collection of useful information in two Guatemalan cities.

In Escuintla, although the consumption of street-vended foods was known to be a major risk factor for cholera (Mario Gudiel, Direccion General de

Servicios de Salud, Guatemala, 1994, personal communication), little was known about vendors' knowledge, attitudes, or practices in food hygiene or about how the safety of street-vended food could be improved. Our survey, conducted over 4 days, showed that less than one third of the estimated 110 street vendors of cut fruits and vendor-prepared beverages reported having received any training in food hygiene, and that self-reported history of training was not associated with any of a variety of food safety knowledge, attitudes, and practices. Although vendors generally demonstrated knowledge of food safety, this knowledge was not reflected in safe practices. Assessment of vendors' previous training and reasons for its ineffectiveness were needed in order to develop more effective training of more vendors, including education in how to chlorinate water, how to wash hands, and how to serve beverages without touching them.

We found that Escuintla street vendors generally worked full-time, and most had been vendors for an extended period of time. Those found outside areas of concentration were similar to those in markets and terminals. This suggests that a large percentage of vendors could be reached through outreach efforts concentrated in time and place, thereby using scarce public health resources efficiently. Escuintla consumers, selected at the point of sale and interviewed concurrently with vendors, also displayed substantial general knowledge about cholera and its prevention and perceived street-vended foods as potentially risky. Most said that they would prefer to buy from street vendors who had received training. Therefore, if street vendors were more effectively trained, consumers could be educated to seek trained vendors and identify safe vending practices. It is likely that vendors would rapidly change their practices to meet consumer demand.

In Guatemala City, where street-vended food, and especially vendor-produced beverages, had also been shown to be a risk factor for cholera [4, 14], we determined that the source water used by vendors was generally chlorinated and of good microbiologic quality, but was at high risk for subsequent contamination. The intermittent availability of municipal tap water meant that most vendors stored water, usually in storage containers with wide mouths that allowed hands to be introduced. Stored water often had no detectable chlorine. Hands were contaminated with faecal coliforms. Beverages were frequently contaminated, either because they were made with

contaminated water, were made from ingredients requiring extensive manipulation, or were dispensed from wide-mouth containers into which hands had been introduced. Vendors showed a high level of awareness of issues of food and water hygiene, and their understanding and acceptance of water chlorination showed that they had been reached with public health messages. These findings led to a field test of a new system of specially-designed water vessels for water storage, disinfection, handwashing and beverage production that, in a later randomized controlled trial, decreased the contamination of water and beverages [16].

In summary, we have developed a simple, rapid and widely applicable method of surveying street vendors. We implemented this method to study street vendors selling food items that had been associated with cholera transmission in two Guatemalan cities. In both surveys, we were able to efficiently gather information that was crucial to planning effective public health interventions. This method could easily be adapted for use in other areas where street-vended food poses a threat to public health.

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