How kitchen layouts affect consumers’ food safety practices

Food safety concepts should be incorporated into kitchen design. That is the conclusion of a strand of research undertaken as part of the EU’s Horizon 2020 project, SafeConsume. The project involves 32 partners, including the Dunarea de Jos University of Galati in Romania, where Anca Nicolau and Octavian Mihalache work, and the Norwegian Food Research Institute (Nofima) in Norway, where Solveig Langsrud carries out research related to food safety.

SafeConsume aims to reduce the health burden from foodborne illnesses originating from domestic settings. Around 5% of such illnesses are caused by infected food handlers and cross-contamination events. Cross-contamination means the transfer of bacteria between foods, surfaces, people or animals, for example when raw food touches or drips onto ready-to-eat food, utensils or surfaces. Five foodborne pathogens – Campylobacter, Toxoplasma, Salmonella, norovirus and Listeria monocytogenes – are thought to account for 70% of all cases.

Following extensive research, SafeConsume researchers have found that kitchen layout plays an important part in food safety. Designers have long supported the idea that, ergonomically, the most efficient kitchen layout depends on a work triangle with apexes at the sink, stove, and refrigerator. However, SafeConsume researchers recommend that this should now be replaced by a food safety work triangle with apexes at the sink, food preparation place, and stove.

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Three categories of elderly people, young families with infants and/or pregnant women, who are especially vulnerable to food risk; and young single men, who are vulnerable because they are recognised as risk-takers.

To pinpoint cultural differences and investigate how kitchen layout might impact hygiene practices, observers studied and filmed consumers in their homes as they prepared food. The data were then analysed using a recognised multiple signal software package to code consumer’s behaviour, including the frequency of hand washing. Then, a design software was used to determine the dimensions of kitchen layouts.

Researchers then analysed possible connections between kitchen arrangements and actions taken by consumers to prepare food which could lead to cross-contamination.

According to the survey, 15% of the respondents had their sinks located outside the kitchen. Researchers found that this had a significant negative correlation with hand-washing after touching raw chicken and also increased the chance of consumers reusing a cutting board or knife without washing it.

Analysis of the observation data showed that the more frequent actions after touching raw food of any type included opening drawers or the fridge door, handling food containers, checking or answering the phone, and inefficient hand cleaning by wiping with a cloth rather than washing with soap and water. Potential cross-contamination also occurred by consumers handling different types of food consecutively without hand washing between times, including between preparing raw and cooked foods, or touching their own or their children’s hands or face.

The researchers suggest that it is time to rethink the traditional kitchen working triangle and to transition to the food safety triangle, with apexes at the sink, food preparation place, and stove.

The countertop should ideally be situated no more than one metre away from the sink.

40% of foodborne illnesses are estimated to stem from domestic settings.

Less predictable was the finding that the location of the food-preparation place, either worktop or table, and its distance from the sink, was also highly significant for food safety. For this reason, the researchers propose that, to enhance food hygiene, the traditional model of a work triangle with apexes at the sink, stove and refrigerator should be replaced by the concept of a food safety triangle with apexes at the sink, food preparation place and stove.

The researchers found that for optimum food safety, a kitchen’s food preparation place (usually the countertop) should be situated no more than one metre away from the sink in order to increase the likelihood of hand washing.
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**CHANGING PRACTICES**

The SafeConsume project investigates how kitchen layouts affect food safety practices. This research into consumers’ food-hygiene practices and kitchen layout is the first to show correlations between kitchen equipment placement and food safety practices, and the findings should be of interest to sociologists, food safety risk evaluators, hygiene experts, and kitchen designers, as well as consumers.

The hope is that, by changing the way kitchens are designed – in particular by replacing the work triangle with the food safety triangle – consumers can be both efficient and reduce the risk of food safety problems in the home.

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of washing. In addition, the perimeter of the food safety triangle should be no more than four metres.

Nicolaou explains: “In kitchens where the sink-to-countertop distance was more than one metre, the estimated probability of cross-contamination events was nine times higher than when the sink-to-countertop distance was less than one metre.” She adds: ‘We expect to obtain a reduction of foodborne illnesses attributed to household environments when ergonomics principles are combined with those of food safety.’

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Another situation refers to kitchen sinks which had problems that made correct positioning impossible. The water is carried in buckets and stored in barrels as it is not continuously supplied or does not have enough pressure. It is interesting to note that it is not only having the sink outside the kitchen which may generate problems. For example, in urban areas, the inhabitants of small flats extended their kitchens into the balcony to gain space and placed their sinks in this part of the extended room. While the working space stayed where it was, in this situation the distance between the sink and the working place (countertop or table) became longer than 1m, making washing hands frequently a difficult task.

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Personal Response

Were you surprised that 15% of respondents to your survey had no sink within their kitchens? Do you think that this percentage is representative of Europe as a whole?

**Octavian Augustin Mihalache**

Yes, we were surprised to find that 15% of European households have no sinks in their kitchens. This percentage represents the mean value for the ten European countries where the survey was performed (Denmark, France, Germany, Greece, Hungary, Norway, Portugal, Romania, Spain, and the UK). The country with the highest percentage of sinks placed outside the kitchen was Greece (23%) and the country with the lowest percentage was Hungary (8%).

When we visited consumers, we found explanations for this situation. For example, in Romania, where the percentage of households with sinks outside the kitchen based on the survey was 14%, we found that being connected to a water supply is a new facility for the rural population and, in old households, the tap remained outside the kitchen (mainly in the garden, from where the water is carried in buckets and stored in barrels as it is not continuously supplied or does not have enough pressure).

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Another situation refers to kitchen sinks which had problems that were unsolved for years and the owners of the households used the bathroom sink instead of making the necessary repairs. Then, there were households where kitchen had sinks that were correctly positioned near countertops but the owners preferred to work on a table which was not in the proximity of the sink.