Tracking smartphone with mobile SMS technology as dietary data collection method:
A case study in Lynge School.

Sagar Koirala.

AALBORG UNIVERSITY DENMARK

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Abstract

Objective: The present study investigates the feasibility and challenges using tracking smartphone devices and mobile SMS technology in dietary data collection. And conducting in practical setting among students from 7th and 9th grade students in Lynge School to explore their eating behavior in relation with available foodscapes.

Methods: Data were collected using three methods; Questionnaire, tracking smartphones and mobile SMS survey. Questionnaire included two parts, student's socio economic status and their dietary patterns (food buying place and eating food items) during lunchtime. Tracking smartphones were through installing three devices in three food outlets available in school foodscapes. MAC addresses and mobile numbers received form participant students were filtered in the web control operational system. Tracking data were extracted and collected from log files only during lunchtime. Mobile SMS survey was conducted in two system: online and collectively. Web control operating system visualized online MAC addresses and instant SMS questions were sent individually or collectively through web control operational system regarding their purchasing and eating behavior. Data were analyzed in SPSS using correlation, and general linear model.

Result: The result indicated the association between gender and class in bringing foods from home or going out during lunchtime. 9th grade boys would go out to buy pizza from outside food outlets whereas 7th grade students bring food form home more often. Correlation between questionnaire, tracking and SMS data was not significance, which indicated less accuracy in response from students in questionnaire and tracking and mobile SMS survey. But the use of tracking as method for data collection was discussed in the paper.

Conclusion: This study investigated the need of policy in macro system, from school administration in selling food in canteen to change the dietary habits among students. Additionally, despite of some practical challenges of using tracking smartphones with SMS technology, it can be used as an effective tool in collecting dietary data with certain precautions. Furthermore, more study is needed in order to invent validate and reliable of using tracking and SMS technology as method in data collection.

Introduction

The increasing rate of overweight and obesity is an epidemic problem, and the number is even growing every year. In Denmark, prevalence of overweight among women is 14.8%, where as men is 15.6% (Nordic council of minister, 2012). Overweight and obesity causes many health risk such as, diabetes, coronary diseases and other heart related diseases (Tirosh et al, 2011). Similarly, there is high prevalence of occurring other diseases as high blood pressure, coronary heart diseases as stroke, liver and gall bladder diseases (Kopelman, 2007). The causes of obesity are complex (Fox et al, 2009). Many researchers explored genetic as biological, and nutritional imbalance caused by over consumption of high energy (Lakshman, 2012) but the focus nowadays has been shifted towards the environmental surrounding of the resident (Casey et al, 2011). The view upon childhood obesity has been shifted towards the neighborhood building environment and increasing numbers of food outlets around every neighborhood surrounding (Chen et al, 2012). This cluster of increasing number of food outlets is highly prominent among school environment (Day & Pearce, 2011).

School children are highly vulnerable with this epidemic problem, obesity (Ogden et al, 2014). With the increase in number of food outlets, the availability and accessibility of fast food restaurants and fatty foods around school environment is increasing and students are more expose to these kinds of food (Davis & Carpenter, 2009). Due to the fact that students are more time in school (Story et al, 2005), there is high likely that students consume those foods during their break times.

The traditional methods of self monitoring dietary assessments tools at individual level, such as food frequency questionnaire, 24-hr recall and food records, were broadly used by researchers and nutritionists as successful tools to track food consumption (Kolodziejczyk et al, 2012; Wharton et al., 2014). But self-reported dietary data is discussed as one of the limitation as social biases (Fox, et al 2009) due to issue of accuracy, inconsistency of self-reported information (Wharton et al., 2014). With the development of technology, there has been change in the way researchers practices in dietary data collection. The traditional methods of dietary assessments has been changing innovatively with the invention of portable devices, which make easier to study spatial correlation between physical environment and food behavior (Wharton et al., 2014). Smartphones as an innovative invention for its everyday use as communicating media and checking online stuffs, it has also been easier for researchers to study human's food choices behavior (in any location. Smartphones provide opportunity for researchers to track the behavior of individuals with the different features installed in the smartphone devices such as GPS, Wi-Fi and Bluetooth (Versichele et al., 2012) and scanner can used to track smartphones.

Research Problem

-"Is the availability and accessibility of different fast food outlets and convenience store in the buffer of 1.5 km around Lynge school foodscapes affecting/influencing the eating behavior of 7th and 9th graders, aged 13-17 years?"
-"Is smartphones tracking system is practicable to investigate students food eating behavior by tracking student's smartphones during school lunchtime".
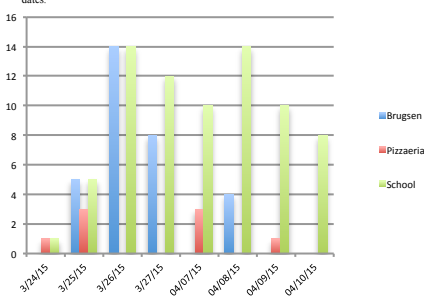
Results

80% students never eat food bought from outside food outlets. Similarly, 66% students brought foods from home during their lunchtime. But, it was found 39% students would buy foods from school canteen at least 1-2 days. Most of the students would bring foods from their home than buying from school canteen or outside food outlets. The bar chart shows total number of students tracked in three different locations during the study days. In this study, large numbers of MAC addresses were detected in school canteen and than in super brugsen.
shows the tracked MAC addresses and SMS survey responses on 26th march in different study locations. Because SMS responses was high on that date compared to other two dates. SMS responses were corresponded with tracking, it was found that 6 mobile SMS replied as they ate food bringing from home but were tracked in super brugsen's device. Similarly, one SMS saying food from home but were tracked in Rey's pizzeria. Therefore, it is not clear whether there was fault in the devices or students are not doing what they are saying.

Frequency of students trend of bring or buying foods from home or school or outside school food outlets in weekly basis among 7th and 9th grades boys and girls of Lynge School's in percentage.

Grade & Gender		Frequency	Home%	School%	Outside school %	No Lunch %
7th		Never	2 (7%)	17 (56%)	28 (93%)	25 (83%)
	Girls (30)	1-2 days	1 (3%)	12 (40%)	2 (7%)	2 (7%)
		3-4 days	9 (30%)	0%	0%	1 (3%)
		5 days	18 (60%)	1 (4%)	0%	2 (7%)
	Boys (28)	Never	3 (11%)	14 (52%)	20 (74%)	23 (84%)
		1-2 days	0%	12 (44%)	7 (26%)	2 (8%)
		3-4 days	6 (22%)	1 (4%)	0%	0%
		5 days	18 (67%)	0%	0%	2 (8%)
9th		Never	2 (6%)	23 (72%)	29 (90%)	26 (81%)
	Girls (32)	1-2 days	0%	8 (25%)	2 (7%)	15 (6%)
		3-4 days	5 (16%)	0%	0%	0%
		5 days	25 (78%)	1 (3%)	1 (3%)	1 (3%)
	Boys (15)	Never	4 (27%)	5 (33%)	6 (40%)	11 (73%)
		1-2 days	2 (3%)	9 (60%)	4 (6%)	3 (20%)
		3-4 days	4 (27%)	1 (7%)	3 (20%)	1 (7%)
		5 days	5 (33%)	0%	0%	0%
Total		Never	11 (11%)	59 (57%)	83 (80%)	85 (82%)
		1-2 days	3 (3%)	41 (39%)	17 (16%)	12 (11%)
		3-4 days	24 (23%)	2 (2%)	3 (3%)	2 (2%)
		5 days	66 (63%)	2 (2%)	1 (1%)	5 (5%)

Frequency of students buying food from different study locations during study dates.

Pivotal table (Count of Tracking data and SMS response on different location on 26/03/2015)

	Super Brugsen	Canteen	No tracking	Rey's pizzeria	Total
Canteen			1		1
Home	6	5	3	1	15
No SMS Reply	1		1		2
No food	1		1		2
Pappas	1	1		1	3
Total	**9**	**6**	**5**	**3**	**23**

Discussion

This is the first study conducted using tracking and SMS technology in dietary data collection. This study aimed to investigate the use of smartphones in online tracking and mobile SMS receiving instant messages as data collection method in dietary assessment studies. This method is comprehended as an effective tool in collecting data to examine the human movement in large foodscapes and investigating dietary habits through instant SMS messages.

This study resembles the finding from the study done in Denmark (Svastisalee et al., 2011) on the density of fast food around different socioeconomic status, as neighborhood in high economic has more availability of fast food outlets with supermarkets. low-grade students tend to bring food from home whereas high-grade students more likely to go out during school lunchtime. Although certain number of students buy foods from school canteen. The foods sold in the canteen were less fruits and vegetables and selling more fast foods like, Pizza, meatballs, cakes, concentrated juices and other food items. Due to selling of fast foods in the canteen might be of great concern of school administration to create policy in the canteen selling healthy foods.

Some practical challenges were discovered during study using tracking and SMS technology. **Ethical consideration** was taken into account but could be concern among many because of smartphones and issue regarding hacking. Students could remove themself from the study by turning the Wi-Fi signals off on there mobile phones. This was important to participants can decide to be part of the study. And also providing mobile number is quiet a problematic and concern among adolescence and their parents. There was found mobile associated with risk of bullying in cyber crime (Slonje & Smith, 2008). **Strength measurement** as distance between tracking device and smartphones could provide more accurate data about student's presence in the location. **Wi-Fi connection** was essential in conducting online survey using tracking and SMS technology as data collection method.

This study has several limitations. Firstly, this is a cross sectional study limitation in itself, precluding in concluding causal association between foods from home, school or outside food outlets and gender, class and family socio-economic status. The measures were self-reported, and were categorized from the original scales due to low response rate, however this may have affected validity and reliability. Due to less significant use, some questions from the questionnaire have not been used in analysis. That could have affected the findings in other way. Additionally, findings from this study may not be possible to generalize due to low number of participants. Since this is the first study conducted using tracking and SMS technology in data collection, there was few issues concern. Therefore, the process in itself is biased in data collection operating tracking and SMS survey due to errors occurred.

Conclusion

This study provided different approach of data collection in dietary studies. However in this study, the data collection through tracking and SMS survey was not fully accomplished because of some practical concern and there was found some concern about the students' behavior. But this method was found more effective in examining the reliability of response from the participants by testing saying vs. doing using tracking technology. But conducting this study has shown the potential benefits in data collection using tracking device and SMS survey in low budget. More research is needed to validate tracking and SMS technology as method in dietary data collection.

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