

Assessment of Knowledge, Attitude and Practice of Solid Waste Open Burning in Terengganu, Malaysia

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Abstract

With more than 40 percent of the world's rubbish is burned, open burning is a significant source of atmospheric pollution globally and remains one of the main environmental issues and health concerns for many developing nations. Despite having stringent criminal penalties for illegal open burning, Malaysia encounters increasing trend in open burning incidents. A better understanding of the knowledge, attitudinal, and perception towards open burning would inform more effective intervention efforts towards changing this trend. A questionnaire survey to assess knowledge, attitude and practice of public was conducted in Kuala Terengganu. A total of 384 respondents from various demographic backgrounds participated in the survey. Descriptive analysis was used to analyse the respondents' socio-demographic profiles. Pearson correlation was used to uncover the relationship between knowledge, attitude and practice among the respondents. Results showed that the respondents had good knowledge on open burning and showed positive attitude towards protecting the environment from the problem. However, they displayed lack of practice to tackle the problem in real life. The study also found a weak relationship between knowledge with attitude and practice on open burning. Policy-makers should, therefore, devise intervention programmes that can encourage higher practice rather than merely focusing on raising awareness.

Keywords: attitudes; knowledge; law; open burning; practice

1. Introduction

More than 40 percent of the world's rubbish is burned in open fires which emit polluting gases and particles into the atmosphere (Wiedinmyer *et al.*, 2014). For many developing countries where relatively fewer trash disposal facilities like landfills and incinerators available compared to developed nations, open burning provides cheap alternative to more expensive and labour-intensive waste disposal methods (Ramaswami *et al.*, 2016). In Malaysia, waste generation and disposal has become a national concern due to the steady increased generation of solid wastes. It was estimated that in 2020 Malaysians would generate 30,000 tonnes of solid wastes per day but by 2012 the country had generated 33,000 tonnes of solid wastes per day (SWCorp, 2014). Malaysia still depends largely on landfills to dispose solid wastes. As the population of the country grows, land available for landfills becoming scarce. On top of that, solid waste management in the country also faces a number of implementation problems including low collection coverage, irregular collection services,

inadequate equipment used for waste collection, crude open dumping and burning and resource constraints (Saat, 2013). Similar problems of solid waste management are faced by municipalities in many developing countries (Guerrero *et al.*, 2013; Norbu and Dilokwanich, 2010). In light of these problems, the concern that people might resort to open burning as a way to dispose their solid waste is real.

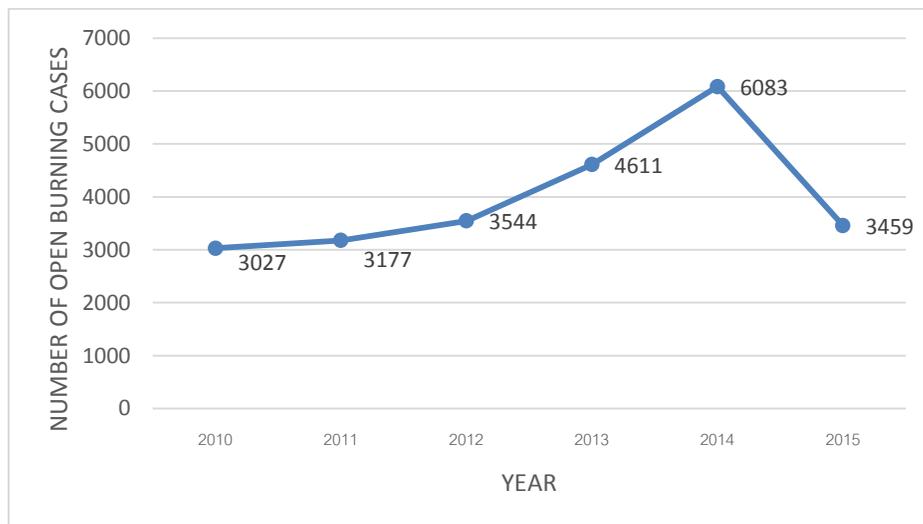
In Malaysia, between 2010 and 2012, open burning cases used to primarily occur in forests, bushes, agricultural and plantation areas, (DOE, 2010; DOE, 2012; DOE, 2013). However since 2013, the recorded cases of open burning in the country are mainly from activities such as burning of garbage in residential areas and by roadsides as well as the burning of any article as part of religious rites (DOE, 2014; DOE, 2015; DOE, 2016). In 2015 alone, almost 25% of the open burning cases detected were from these activities (DOE, 2016). Accordingly, open burning becomes one of the main health and environmental issues that concern the Malaysian public (Haron *et al.*, 2005). Open burning of wastes is a significant source of air pollutants and greenhouse gases (Shi *et al.*, 2015). Fiedler

(2007) found that open burning is one of the major sources of polychlorinated dibenzo-para-dioxins and dibenzofurans (PCDD/Fs) in many countries including Malaysia. The burning of wastes such as plastics, tires, and electronic wastes in open air also expose nearby residents directly to health hazards from these pollutants (Estrellan and Lino, 2010). It was estimated that carbon dioxide emissions from open burning of wastes worldwide contributes 5 percent of reported human-related emissions (Wiedinmyer et al., 2014). In Malaysia, on top of its hazardous health impacts, open burning has been partly blamed for worsening the recurrence of haze in the country (Forsyth, 2014).

There is no specific international law on open burning but several environmental treaties are relevant to address the problem. Through the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, countries are required to take measures to ensure the management of wastes including their disposal is consistent with the protection of human health and the environment and be disposed of in the state where they were generated. For Southeast Asian countries, they have adopted regional guidelines on zero open

burning for crops plantations and forestry sector in the effort to tackle transboundary air pollution (ASEAN Secretariat, 2003). At national level, countries also pass legislation to control open burning. Any open burning activities which contravene the law requirements are illegal.

In Malaysia, the Environmental Quality Act 1974 (“the EQA”) and its regulations provide the most comprehensive regulatory control of pollution and its abatement. Under the EQA, anyone that allows or causes open burning on any premises including land commits an offence. The maximum penalties for the offence are quite high namely a fine of MYR 500,000 and five years imprisonment. Furthermore, the law is quite strict in providing a legal presumption that where an illegal open burning occurs, an owner or occupier who has control over the premise is presumed to have committed it, unless the contrary is proved. Despite this, as seen in Fig. 1, a steady increase in open burning cases from various source including burning of bushes, forests, agriculture areas, plantations areas and garbages had been recorded in Malaysia since 2010 before decreasing in 2015 (DOE, 2011; DOE, 2012; DOE, 2013; DOE, 2014; DOE, 2015; DOE, 2016).



Source: Department of Environment Malaysia (DOE) Annual Reports

Figure 1. Numbers of detected open burning cases

The EQA gives exclusion from open burning prohibition for 15 instances of declared activities. Apart from campfire, worshipping activities and cremation, such declared activities also include the burning to control plant disease and animal or bird infection; the burning of paddy stalks prior to replanting; the burning of sugar cane leaves prior to harvesting in an area that does not exceed 20 hectares during the harvesting period; the burning of plants for land clearing to plant crops by smallholders in an area that does not exceed 2 hectares per day; the burning of agricultural plant for land clearing to plant or replant crops by subsistence farmers in rural areas which is not carried out at any peat soil area; and the burning of leaves or tree branches in rural areas which is not carried out at any peat soil area. There are certain specified conditions attached to these declared activities like how and which hours the open burning should be conducted but no permit or license is required; though a few of the activities require prior written notification to be given to the Director General of Environment.

Researches have looked at the environmental and health impacts of open burnings, but less effort to examine the public's knowledge, attitudes and practices towards the issue has been made (Wood and Tsu, 2008; Vandamme, 2009). KAP surveys have been widely used to measure public's knowledge, attitude and practice on topics related to environmental awareness (Besar *et al.*, 2013). Public knowledge, attitude and practice (KAP) are very important aspects because each individual has the right to live in a healthy environment and holds the responsibility to protect the environment.

2. Materials and Methods

Surveys were conducted in Kuala Terengganu, Terengganu. Terengganu is located at latitude 5°19'48"N and longitude 103°08'26"E in the northeastern Peninsular Malaysia. The state is bordered on the northwest by the Kelantan state, southwest by the Pahang state, and east by the South China Sea. Kuala Terengganu was chosen because open burning has been identified as one of the primary source of pollutants affecting air quality in the district (Abdullah *et al.*, 2015) and that daily generation of municipal solid waste in Kuala Terengganu had increased steadily since 1970 (Agamuthu and Fauziah, 2011).

A set of self-completed questionnaire that had four sections was developed. Section A intended to gather respondent's demographic information, Section B tested the respondents' knowledge on open burning, Section C and D respectively aimed at evaluating the

respondents' attitude and practice in addressing open burning problem. All items were measured using Likert scale. Pilot test was conducted and the reliability of items in the questionnaire was estimated using the Alpha Cronbach method and reliability for each section was greater than 0.7 which indicated that the questionnaire was reliable. Respondents' knowledge of open burning were measured by to what extent they knew what open burning is as well as its health and environmental impacts. The respondents' attitudes were examined through their perception towards responsibilities to address open burning, while their practices were gauged by their individual measures and engagement with others to tackle open burning. Some 384 respondents were selected through convenient sampling to participate in the study. The context of the study, which focused on open burning of solid waste by individuals against the laws, was explained to the respondents prior to answering the questionnaire. The term waste in the study refers to "solid waste" as defined under the Solid Waste and Public Cleansing Management Act 2007 (Act 672) which includes any scrap material or other unwanted surplus substance or rejected products arising from the application of any process; any substance required to be disposed of as being broken or otherwise spoiled but excluding hazardous wastes and radioactive wastes. Results of the study provides inputs for policy-makers in developing programme to improve the existing public's awareness and compliance with open burning laws.

3. Results and Discussion

3.1 Socio-demographic

Descriptive analysis was used in this study to describe the socio-demographic profiles of the respondents. As seen in Table 1, most of the respondents in this study were female (64.3%) and about one-third (35.7%) were male. In term of races, the majority of them were Malay (78.6%), followed by Chinese (14.3%) and Indian (7%). Approximately 32% of the respondents aged between 18 to 27 years old, about 26.8% aged between 28 to 37 years, 20% were between 38 to 47 years old and the rest were older. With regard to education level, about one-third (33.3%) of the respondents were degree holders and 15.4% had diploma. About 27% of them had the Malaysian Certificate of Education, a national examination taken by fifth-year secondary school students in Malaysia and the rest had Malaysian Higher Certificate of Education (21.6%), taken by sixth-year secondary school students.

Table 1. Socio-demographic profile of the respondents

Variables		Frequency (n=384)	Percentage (%)
Gender	Female	247	64.3
	Male	137	35.7
Race	Malay	302	78.6
	Chinese	55	14.3
	Indian	27	7.0
Education	SPM	104	27.1
	STPM	83	21.6
	Diploma	59	15.4
	Degree	128	33.3
	Master/ PhD	4	1.0
	Others	6	1.6
Age level	18-27	123	32.0
	28-37	103	26.8
	38-47	77	20.1
	48-57	59	15.4
	>58	22	5.7

3.2 Knowledge, attitude and practice towards open burning issues

Table 2 indicates the respondents' knowledge on open burning and its impacts. Generally, they were aware and concern about the problem of open burning. For example, when asked about the impact of open burning, 97.7% of the respondents agreed that open burning threatens human health whereby it can trigger asthma attacks and other respiratory problems. The majority of them (75.8%) also concurred that open burning is hazardous to ecosystems and 84.1% believed it exposes nearby property to fire hazard. Most of them

also (90.4%) knew that open burning can form smog which can damage crops and other vegetation. Besides that, 84.6% of the respondents agreed that open burning contribute to acid rain and can worsen haze situation (97.7%). In addition, the results showed that 78.9% of the respondents knew that open burning refers to any fire, combustion or smouldering that occurs in the open air and which is not directed through stack or chimney. About 70.6% of them were also aware that open burning is an offence in Malaysia and 82% knew that burning of leaves and other wastes is considered an illegal open burning activity, except for people living in rural areas.

Table 2. Knowledge about open burning and its impacts

No.	Items	Agreed (%)	Not sure (%)	Disagree (%)
1.	Open burning causes health problems to human	97.1	1.0	1.0
2.	Open burning can trigger asthma attacks and other respiratory problems	88.1	9.1	2.9
3.	Open burning can form smog which damage crops and other vegetation	90.4	3.9	5.7
4.	Open burning exposes surrounding properties to fire hazard	84.1	11.5	4.4
5.	Open burning is hazardous to ecosystem	75.8	20.6	3.6
6.	Open burning contributes to acid rain	84.6	11.7	3.6
7.	Open burning can worsen haze problem	97.7	1.3	1.0
8.	Open burning refers to any fire, combustion or smouldering that occurs in the open air and which is not directed out through a stack or chimney	78.9	10.4	10.7
9.	Open burning is an offence in Malaysia	70.0	20.6	9.4
10.	Burnings of leaves and rubbish are illegal open burning activities	82.0	13.0	5.0

Table 3. Attitude on open burning

No.	Items	Agree (%)	Not sure (%)	Disagree (%)
1.	Everyone is responsible for protecting the environment	97.1	2.9	0.0
2.	We should all do our part to reduce open burning incidences	97.1	2.9	0.0
3.	Community should recycle their household waste instead of burning them	97.1	2.9	0.0
4.	People should be made aware of the danger of open burning	94.0	6.0	0.0
5.	Government should be more stringent in enforcing environmental rules and regulation on open burning	95.8	2.9	1.3
6.	Let the government handles the open burning problem alone	3.4	2.9	93.7
7.	Immediate action to tackle open burning is necessary	95.8	4.2	0.0
8.	Protecting the environment from open burning should be one of our priorities	97.1	2.9	0.0

Overall, the respondents showed positive perception on the need to address open burning issues. Table 3 shows that almost all of the respondents (97.1%) believed every individual is responsible for protecting the environment from open burning. They also agreed that people should recycle their household waste instead of burning them (97.1%). Over 93.7% of the respondents did not agree that open burning problem should be tackled by the government alone and most of them (95.8%) consented that the government should be stricter in enforcing environmental rules and regulations on open burning. The respondents' perceived everybody should contribute and make effort to reduce open burning incidences (97.1%).

With regard to practices, as seen in table 4, more than half (56.5%) of the respondents admitted that they had done open burning before and 54.1% suggested that they were not ready to stop burning their trash in open fire as a way to dispose them. Furthermore, when asked about their action in addressing open burning, just a little more than half of the respondents (52.1%) took an initiative to advise people to avoid open burning. Other than that, 50.5% of the respondents were not sure whether to report any illegal open burning activities in their areas. Respondents also disclosed that they were not sure (48.2%) if they had talked to friends about other options that they could choose in order to dispose their garden wastes rather than burning them. When asked about composting their wastes as alternative to open burning, only 18.7% of respondents were doing it.

Table 4. Practices on addressing open burning

No.	Items	Agree (%)	Not sure (%)	Disagree (%)
1.	I have advised people to avoid committing open burning	52.1	4.2	43.2
2.	I have done open burning activities	56.5	15.6	27.8
3.	I talks to my friends about the things that they can do to dispose their garden wastes rather than burning them	20.8	48.2	31.0
4.	I will not dispose my rubbish by burning them	36.2	9.6	54.1
5.	I usually compost organic material including leaves, grass clippings, vegetable and others	18.7	20.6	60.7
6.	I will report any illegal open burning activities in my areas to the authority	44.1	50.5	5.5

Table 5. Correlation test between knowledge and attitude

		Knowledge	Attitude
Knowledge	Correlation coefficient	1	.211**
	Sig. (2-tailed)		0.00
	N	384	384
Attitude	Correlation coefficient	.211**	1
	Sig. (2-tailed)	0.00	
	N	384	384

**Correlation is significant at the 0.01 level (2-tailed).

3.3. Relationship between public’s knowledge, attitude and practice towards open burning

Spearman correlation test was used to observe the strength of the relationship between knowledge and attitude as well as practices respectively. As seen in table 5, there was a weak positive correlation between public’s knowledge and attitude ($r = 0.211, n = 384, p < 0.001$). This result suggests that better knowledge about open burning and its negative impacts is insufficient to induce higher positive attitude towards open burning. This result was consistent with the finding of De Pretto *et al.* (2015) in their study related to attitude and practices towards atmospheric pollution in Malaysia.

With regard to the relationship between public’s knowledge and practice, the spearman’s correlation showed a positive but weak correlation between the two variables ($r = 0.195, n = 384, p < 0.01$). This indicates that high knowledge of open burning does not necessarily result in high tendency to practice more responsible acts to address open burning. Similar finding was made by Besar *et al.* (2013) in relation to general environment-friendly practices among public in Malaysia. Haron *et al.* (2005) also found

environmental knowledge was significant and correlated positively, though weakly, with public’s attitudes, behaviour and participation in environmental causes.

Several past studies have offered some explanations on this issue of lack of practice. Ramaswami *et al.* (2016) found that social and infrastructural difficulties faced by the people are among the reasons open burning continues to occur despite people’s knowledge of the health risks associated with it. Therefore, better infrastructure and service for waste disposal might have a significant impact in reducing open burning practice at the local scale. Ghani *et al.* (2013) also found that people’s participation in environmental-friendly practice is conditioned upon several factors including adequate facilities and situational factors like storage convenience and collection times. Another primary cause of open burning is lack of enforcement. For instance, Indonesia has legislation at various levels of the government which explicitly prohibit open burning and provide imprisonment, license withdrawals and heavy monetary fines as penalties (Tan, 2015). However, the lack of effective enforcement of these laws makes widespread open burning to recur in the country.

Table 6. Correlation test between knowledge and practice

		Knowledge	Practice
Knowledge	Correlation coefficient	1	.195**
	Sig. (2-tailed)		0.00
	N	384	384
Practice	Correlation coefficient	.195**	1
	Sig. (2-tailed)	0.00	
	N	384	384

**Correlation is significant at the 0.01 level (2-tailed).

4. Conclusions

The current study found that the public in Kuala Terengganu knew what open burning is and had good knowledge about its adverse impacts to human health and the environment. They also indicated positive attitude towards individual roles in tackling open burning and were supportive of stricter enforcement of laws in this regard. Despite these, similar to previous studies on KAP in environmental area, the existing study established a weak relationship between knowledge and attitudes as well as between knowledge and practices. Practical impediments especially infrastructural facilities have been identified by previous studies as the major hindrances to better practices despite high knowledge and positive attitude towards environmental protection. Therefore, efforts in Malaysia should also look at the infrastructural needs to increase environmental-friendlier practices among the public in tackling open burning problem. Malaysia has strict national environmental law on open burning. However, without adequate enforcement, the law has failed to encourage better environmental practices to address open burning problem in the country.

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