

Methanol Poisoning Among Migrant Laborers in Penang, Malaysia, 2021

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ABSTRACT

Methanol poisoning in Malaysia still occurs despite efforts to trace the source and curtail the illegal production of alcohol. In 2021, laboratory surveillance alerted an outbreak in Penang, Malaysia. Our aim was to describe the outbreak, identify the source and take control measures. We conducted interviews on cases and contacts and actively searched for cases. We targeted the area with the cases and focused on the migrant laborers. Laboratory investigations were carried out at the hospital. Seized alcohol brands were assessed for methanol and compliance with the Malaysian Food Act 1983. We observed the living and working conditions of cases. Descriptive analysis was reported in frequency and percentage. There were 31 cases with 21(67.7%) deaths, all male, all foreigners from a neighboring country and with a median age of 35 years (IQR 9). They were low-skilled workers (18, 58.1%) or unemployed (6, 19.4%). Mean serum methanol for the cases that survived or died was 30.6mm/L and 87.5mm/L respectively. Mean urine methanol in those who died (107.5) was significantly higher than those who survived (38.6, $p=0.046$). Empty bottles and suspected distilling equipment were found in the area. Among the non-compliance were lack of labeling, absence of importer details on the label of bottles, and the outlets did not have a license to sell alcohol. One (8.3%) alcohol brand had methanol level of 38600mg/L. Evidence points to this outbreak being due to illegal production and noncompliance. All cases had high serum methanol. One alcohol sample had high methanol. Drinking alcohol is culturally acceptable amongst these nationals. Local production reduces costs, but it comes with its risk, and this is constantly communicated to employers who hire unskilled foreign labor.

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INTRODUCTION

Methanol, a colorless flammable liquid and the simplest alcohol has been present from the time of ancient Egyptians who used it in their embalming process (1). Pure methanol, first isolated by Robert Boyle in 1661, has since had a long illustrious history with many uses and due to its being used as a cheap substitute for alcohol. Despite its numerous uses, especially in industrial use (2), methanol is not meant to be consumed. Ingestion may result in a wide spectrum of adverse effects including headache, dizziness, blindness and coma resulting in significant morbidity and mortality (3). Most often methanol poisoning is accidental and associated with alcohol consumption. Methanol is closely related to ethanol, which is the alcohol found in spirits. The most common way that alcohol gets tainted with methanol is by intentional adulteration of legally produced alcohol or by improper brewing of homemade alcohol, whereby methanol is produced instead of ethanol (4). Both methanol and ethanol are broken down by the enzyme alcohol dehydrogenase in the body. With ethanol, the product is acetaldehyde which is then broken down further. But with methanol, the substance is oxidized to form formaldehyde and further oxidized to form formate which is highly toxic to the body. This accumulation of formate in the body results in metabolic acidosis, and accounts for a drop in the level of serum bicarbonate. This formic acid causes acidosis and ocular manifestations in methanol toxicity.

Cited as a new world challenge (5), the incidence of methanol poisoning around the world seems to be increasing in recent years (6,7,8,9). The COVID-19 pandemic may have had a role to play. With the prolonged lockdown, the pandemic has affected the economy worldwide and in tandem with it has affected mental health globally, contributing to increased consumption of alcohol, sometimes as a means of escape (10). With high taxes on alcohol in some countries, alcohol is expensive and not affordable to many, therefore cheap liquor is an attractive choice. Often this liquor has either been produced illegally or adulterated as a cheaper alternative to alcohol (11). Methanol poisoning in this country seems to be increasing and outbreaks have been documented in Malaysia over the last few years. In 2018 there was an outbreak in Selangor involving 31 cases (12). Cases have been documented in Johore as well (13). In June 2023, an outbreak was reported in the local newspaper involving school children in a boarding school in East Malaysia (14).

Chronology of Events

In late August 2021, through its laboratory surveillance, the National Public Health Laboratory noticed a sudden surge of methanol poisoning cases from clinical samples sent there for analysis. Seven cases had been detected from samples sent from Selangor, Johore, Penang and Perak respectively. One of the cases was from Penang. Following this, in early September 2021, a health alert was sent out by the Disease Control Section of the Ministry of Health on potential methanol cases throughout the country. On receiving this, the Penang State Health Department then sent an alert to all the public and private hospitals in the state to be on the watch for cases of methanol poisoning in their institutions. Following this we started to receive notification of cases. After verification of the cases, and on determining that this was an outbreak, we started a statewide

investigation. Our aim was to describe the outbreak, find the source, take control measures and provide recommendations to prevent future outbreaks.

METHODS

Our case definition for a suspected case was any individual residing in Penang and presenting with either gastrointestinal or neurological symptoms, or acute blurring of vision with a history of alcohol intake five days prior to onset of symptoms or presenting with the presence of high anion gap and metabolic acidosis (pH artery <7.3 , serum bicarbonate $< 20\text{mmol}$, osmolal gap $> 10\text{MOsm/L}$). Confirmed cases were those with methanol in blood or urine samples. Probable cases were cases that fulfilled the case definition with epidemiology link with a confirmed case or those that had a high anion gap, with sudden blurring of vision within 5 days of consuming alcoholic drinks.

We conducted both active and passive case detection. We actively followed up all the case notifications from the various institutions. We conducted face-to-face interviews with cases, household contacts, and friends, drinking partners, co-workers, employers and doctors managing the cases. We collected demographic data, symptoms, date of onsets, and drinking history (frequency, amount, and mixture, type of drinks, brand and source of alcohol)

We conducted community surveys in high-risk areas that we identified as where the migrant workers were likely to congregate. We targeted the area where the cases were first detected and focused on the migrant laborers there.

Laboratory investigations were done at the hospital, and we followed up on the detailed report of arterial blood gas, urine tests, renal profile, random blood sugar, urine and blood for methanol, CT brain, ECG and liver function tests.

Any alcohol that we came across in investigation was seized, sealed and sent for presence of methanol. We found high risk alcohol brands that were suspected to be fake or illegal brands, searched for them at stalls, grocery shops and eateries and sent for methanol level analysis. We also checked the bottles seized for compliance to the Malaysian Food Act 1985.

We visited the homes and workplaces of the cases and observed the living and working conditions. We also visited, investigated and observed conditions in the shops in the area, factories, home industries and manufacturing outlets selling alcoholic beverages. Since these involved deaths and foreigner, we involved the police and the immigration department in our investigations. We had some difficulty in translations, and we recruited the assistance of Doctors without Borders operating in the area to assist us with that.

We recorded all the cases in a line listing using Microsoft excel and analyzed them using SPSS version 24. Descriptive analysis is reported in frequency, percentage, median and interquartile range (IQR).

RESULTS

There was a total of 38 notifications. Of the 31 who fulfilled the case definition, 26(68.4%) were confirmed cases and 5 (13.1%) were probable cases. All were male and foreigners from the same neighboring country. The district of Seberang Perai Selatan (SPS) had the highest number of cases (19, 61.3%) followed by Seberang Perai Tengah (SPT) (9, 29.0%). Two cases were from Timur Laut (TL) and one from the district of Barat Daya (BD). There were 21 deaths (case fatality of 67.7%) of whom 11 were brought dead. The median age of those who died was 35 years (IQR 9). Of these cases, three (41.9%) were legal immigrants, 2 were UNHCR refugees and 16 (51.6%) were illegals. They were either low skilled workers (18, 58.1%) or unemployed (6, 19.4%). Due to language constraints and late investigations, we did not get information on seven of the cases. With this limited information, eight (25.8%) worked in the fishing industry, three (9.7%) were factory workers and seven (22.6%) were laborers.

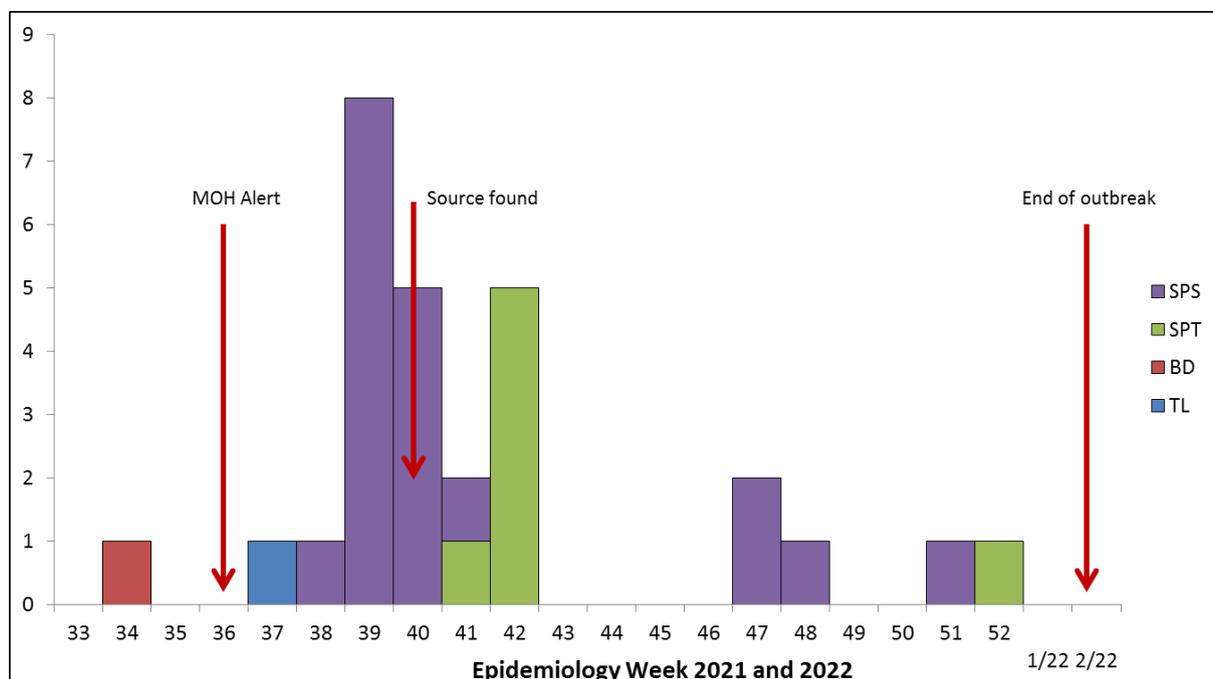


Fig 1. Epidemic curve of the cases from first onset.

On retrospect, we found one case with an onset on week 34 from the district of Barat Daya. Our investigations led us to more cases in the state with most from Epid week 37 to 42 and most of them from SPT and SPS, the two districts that are next to one another. Cases were occurring in week 47 up to week 52.

The most common presentation was difficulty in breathing (14, 45.1%), found unconscious (12, 38.7%), blurring of vision (9, 29%), and gastrointestinal symptoms of vomiting, nausea and abdominal pain (6, 19.3%). Five patients presented with fits (16.1%), five were in a confused disorientated state and four were found to be in coma.

Laboratory investigations were done at the hospitals. The median serum pH for the patients who lived was 7.07 and for those who died were 6.90. The median serum bicarbonate for the live cases was 9.45mmol and that for those who died was 8.80mmol. The mean serum methanol for the cases that lived was 30.6mm/L and that for the cases that died was 87.5mm/L. Samples for urine methanol in the patients who died were significantly higher than those who survived (urine methanol median of 107.5 vs 38.6 who survived, $p = 0.046$)

The location of most of the cases was in SPS and specifically in the Sungai Udang locality where the accommodation was provided by their employers. In the fishing village, the workers lived in rented houses or shop lots, and each unit housed between three to five migrant laborers. Those who worked in construction sites and the factories were housed in crowded hostels or terraced houses with up to 12 people in a unit and from one to 5 people in a room.

It was difficult to get information from the cases and contacts due to their fear of the police and fear of being caught and sent to the detention camp for illegals. In addition, they all denied any knowledge of any illicit alcohol being produced. The contacts denied knowing the cases as well. Through word of mouth and after much coaxing, we received information that a local man will come in an old car or motorbike to the fishing farm in Sungai Udang in SPS to sell alcohol. We were unable to find this man. Through someone who knows someone else we came to know the store where the bottles were kept. This was shown to the enforcement team by one of the laborers who were not a case, in the area. The owner of the store claimed he had no knowledge of illegal alcohol. This store was located away from the hostel quarters of the foreigners, and it was set up to store old fishing equipment. We found alcohol packed in 250ml plastic bottles. This was seized and sent for analysis.

One of the brought in dead cases was found in a rented house in the area. During our investigation the house was found abandoned and the other housemates could not be located. Within the accommodation we found alcohol bottles and apparatus which we suspected were used in distilling alcohol. The apparatus included rice, pails and tubing. However, we did not find any samples of alcohol here.

We did not source the actual methanol that was consumed. We found empty bottles while investigating the homes of the cases. Among the non-compliance we found were a lack of labelling and absence of the import details on the label. The outlets we visited did not have a license to sell alcohol. Of the 12 bottles that were sent to the National Public Health Laboratory for analysis, one sample that was found in the Sungai Udang fishing village storeroom had an exceedingly high methanol level of 38600mg/L. This alcohol had no labels on it. The rest of the samples seized for analysis were either cooking wine or beer. The two samples of cooking wine seized had methanol of 7.6mg/L and 8.4mg/L respectively, both of which were within the permitted level.

From our case investigation and interviews we found that consuming alcohol is quite normal for the foreigners, and the employers do not mind their foreign employees drinking as they do not cause trouble. Some drink every night. Drinking alone or with

friends is quite normal. They sometimes drink because they are bored. There was one case where the respondent drank since he had no job. He was laid off during the COVID pandemic. They have no preference for the type of alcohol beverage, and they usually get commercially sold bottles without labelling as it was considered cheap. The source of the alcohol may be from multiple sources, some are bought from the shop, sometimes given by friends and sometimes the seller comes to their vicinity. The cost ranged from about RM8 to RM10 per bottle.

DISCUSSION

This is a cluster of methanol poisoning cases that occurred in late 2021 in the state of Penang in Malaysia and involved 38 known cases. Penang was not the only state in the country to report methanol poisoning this year. According to the Annual Report of the Ministry of Health, throughout the year 2021, 104 cases had been reported from 8 states and resulted in 65 deaths. All these cases have been reported to have consumed alcohol that is suspected to have been contaminated with methanol (16). We believe that there may have been more cases. As was found in our study, some of those who were affected were illegals who are subject to detention and deportation, and therefore it is possible that if death occurred it may not have been reported. We made every effort to look for cases, but due to language barrier and the secrecy surrounding the illegals it is highly possible that there are more cases than reported.

The laboratory findings (serum PH and bicarbonate) of those who were assessed in the hospital were consistent with methanol poisoning. All cases in Penang had high serum methanol. Methanol levels of more than 6.25mmol/L are toxic, and levels more than 12.5 mmol/L is serious (15). This also implies that there may have been others affected with lower levels of methanol but maybe due to mild symptoms they did not present themselves. In addition, the pandemic was a challenging period for all, and consuming alcohol was a means of escapism as reported by some of the respondents here. There was also a myth that consuming high strength alcohol can help to prevent COVID-19 (17). This, compounded with alcohol that has been adulterated, is a lethal combination.

Large numbers of methanol poisoning cases have been documented in Malaysia's Ministry of Health annual report over the last few years (21,22,23), prior to this incident but most of the cases reported elsewhere were on the hospital findings (12,18,20). One field investigation of a cluster in Hulu Langat in 2018 has been documented (19). Almost all these cases involved foreigners. Finding the source has always been hard due to the illegal nature of its production, illegal immigration status of many of the victims themselves and the fact that alcohol is mostly produced or sourced illegally. This round we came close to finding a source in that we found samples that were positive, and we have found evidence of possible distilling taking place. Considering the number of cases reported in the country, we believe that there are many illegal production sites of alcohol within the country. Interagency involvement is crucial especially the police and the other law enforcement agencies, whom we rely on to be vigilant at all times of illegal brewing and production sites. We also depend on non-governmental agencies and in this outbreak, we depended on doctors without borders to assist us in translations.

Culturally drinking alcohol is well accepted among the residents of this country and this is not an issue. However, liquor is expensive in Malaysia due to the high taxes imposed and it is not affordable to many. Therefore, they resort to cheap liquor and the best way of obtaining cheap liquor is by local production to reduce the costs. In many cases methanol is used instead of ethyl alcohol in the home production of alcohol as it is cheap.

CONCLUSION

This was an outbreak of methanol poisoning in the state of Penang, most likely due to the illegally produced alcohol. The pandemic with its limited movement protocols and the illicit nature of the alcohol produced probably deterred the victims from seeking prompt treatment.

Due to the covert nature of the operations, the fact that alcohol is a favorite pastime for the foreigners and the high risk of illegal alcohol operations, employers who take in foreign labor especially in isolated areas should be aware that their employees may resort to buying or producing cheap liquor of their own. Therefore, they should always be alert and educate their employees about the risk involved in such activities.

Declaration of competing interest: None.

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