The Medical Consequences of Smoking "Chop-Chop" Tobacco

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by

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Definition

"Chop-chop" is illegally home grown or produced unbranded tobacco. Home grown tobacco is common around the world, particularly in developing countries where licensing and taxation formalities are poor to non-existing and many farmers may grow tobacco for personal use or local sales[1]. Tobacco growing, curing, processing, distribution and sales are highly regulated industries in Australia. Licensing is required for the sale of seed, and for growing, manufacturing, processing and distribution through to the sale of finished tobacco products such as cigarettes. Seventy percent of the cost of cigarettes today in Australia are accounted for by combined excise tax and GST. Excise is paid to the Australian Taxation Office (ATO) once only when the product leaves the manufacturer, while sales tax is levied on the sale of each cigarette at point of sale to the smoker. "Chop-chop" tobacco may come from an illegally grown field of tobacco in a large farming enterprise, a small home based suburban plot or stolen raw tobacco. "Chop-chop" tobacco thus circumvents the regulatory authorities in order to avoid excise and taxation levies. In this way this type of tobacco also bypasses routine curing and manufacturing processes.

As this tobacco is produced in often amateur conditions and roughly cut into fine strips it has been called "chop-chop" in Australia (see Figures 1–4). Distribution and sale of "chop-chop" tobacco is a very lucrative endeavor. Loss to the Federal Government in excise alone is estimated at more than $200 million dollars per annum. Seizures by the ATO of clandestine "chop-chop" tobacco have resulted in commensurate rises in sales of manufactured branded cigarettes and the market price of "chop-chop" [*].

In his review of the illegal market and its impact on tax revenue in Australia, Geis has shown that this tobacco is primarily grown in the traditional tobacco growing areas of Victorian and Queensland[2]. Cartwright has detailed the social and fiscal effect that "chop-chop" has on these growing areas and the implications of the "niche market" of "chop-chop" tobacco[3].

Accessibility

One in five smokers in Australia has acknowledged awareness of "chop-chop". Of them, 60% volunteer having smoked it[4]. In Australia, "chop-chop" is usually bought in bulk, often in 250 gram lots and sold on in plastic bags (Figure 5). It is then hand or machine rolled into cigarettes. "Chop-chop" cannot be purchased directly but is usually offered, mostly at tobacconists, to regular smoking customers when it is considered safe to do so, as fines for the sale of this are considerable[2]. Recent purchases of "chop-chop" at a tobacconist were costed at $90 Aus dollars for 500 grams which is approximately ½ the price of equivalent manufactured branded cigarettes[*].

Sophisticated rolling machines have long been available for loose tobacco and paper and filters have also achieved a degree of sophistication (see Figures 6 and 7) and are often provided by tobacconists free of charge as inducements to buying loose tobacco[*].

[*] Personal communication – material described as "personal communication" is material communicated to the author which may have confidential medical or security implications

Tobacconists are not the only outlets that have been known to sell “chop-chop”. Grocers, pubs, petrol stations and private individuals have been known to traffic in “chop-chop” tobacco[*].

Figure 1. Illicit crop of adult tobacco.

Figure 2. The drying of illicit crop in private yard.

Figure 3. Apparatus used for cutting dried tobacco.

Photos courtesy of The Australian Taxation Office.

Figure 4. Roughly cut tobacco.

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Figure 5. 250 grams of "chop-chop" tobacco as sold in plastic bags.

Figure 6. Rolling machine with stylus for inserting tobacco into empty tubes of cigarette paper.

Figure 7. Empty and filled cigarettes tubes.
Note filters and simulation of brand-like crest.
Photos courtesy of Author.

Botanical Additions and Contamination

This author has shown that smokers buy “chop-chop” because it is cheap and believe “chop-chop” is “natural” and unadulterated[5]. However we have seen a vast array of contaminants included in this type of tobacco. Twigs and pulp from raw cotton, hay, cabbage leaves (see Figure 8) and grass clippings are just some of the vegetable matter that may be added to “chop-chop” tobacco in order to bulk up the weight for sales. Purchasers have described to this author buying “chop-chop” that is wet and having to pour off excess water. It is believed that water is added to increase the bulk weight of the bought product and that it is also a byproduct of the deterioration process of the leaf. It has also been reported sold frozen to some purchasers, possibly to prevent spoilage. Smokers have reported heating the product using microwave or sun drying in order to dry out their purchase prior to smoking.

Others report a pungent chloride odour as well as musty and mushroom-like, mouldy odours emanating from the “chop-chop”. Rarely are two “batches” of “chop-chop” purchases the same. As the purchase of “chop-chop” is illegal, there is no recourse by the purchaser to complain regarding the quality of the tobacco.

Figure 8.
Cabbage leaf contaminate in “chop – chop” sample.
Photo courtesy of Author.

Effects of “Chop-chop” Smoking and Handling

As “chop-chop” tobacco and its medical effects due to use and handling has not been actively studied in this country and the global effects are unknown, scientific and medical inferences that are made can only be hypothesised. The microbiological, bacteriological and medical consequences listed below are potential outcomes of the storage, handling and smoking of “chop-chop” tobacco and are inferred from the scientific data that has been published on the storage and handling of raw unprocessed tobacco. Listed below are the microbiological and bacteriological findings regarding raw tobacco in the literature as well as the only study carried out in Australia of the some of microorganisms found in “chop-chop” tobacco to date.

Microbiology and Bacteriology

Raw adult tobacco plants contain bacteria, fungal spores (mould), pollen, insects and residue of pesticides and insecticides[6]. Pesticides and insecticides are known to be used in some, not all, illicit tobacco growing but vary in use and type and may or may not be effective[*]. Bacteria and mould are the main microorganisms responsible for the natural deterioration and spoilage of all plant matter including tobacco leaf. External water, heat and natural leaf sugar content are the ideal environments for the proliferation of these microorganisms. Differing types (strains) of tobacco leaf contain different sugar contents and have differing water absorption propensities hence spoilage depends on the tobacco type as well as the environment in which tobacco is handled and stored[7]. Increasing amounts of microorganisms occur when environmental conditions are opportune such as when tobacco is poorly processed, stored and distributed or intentionally adulterated as occurs with "chop-chop". Not all microorganisms are capable of producing illness in man. Listed below are the most important and well documented of those that have been reported in the pathogenisis of illnesses related to tobacco handling, production and use.

Fungus

Fungi (or mycological flora) are filamentous organisms that absorb and digest food from their environment for growth. There are hundreds of thousands of fungi and many species are known to grow on tobacco. Some varieties are mesophilic, surviving well at room temperature, while others are thermophilic, surviving and often proliferating at high temperatures. This high temperature survival is believed to be an adaptation to humid and high temperature environments such as occur in the tropics. The best documented of fungal organisms found on raw unprocessed tobacco leaves and tobacco products are Aspergillus and Penicilium of which there are many strains or types [8, 9, 10, 11, 12, 13]. Findings from an unpublished Australian study by this author and colleagues are presented in Box 1[14].

Mycotoxins

All fungi release enzymes into their local environment in order to digest food to a soluble form for absorption. Through the digestion process they release new enzymes, some of which are toxic to some forms of life, including bacteria. These are called mycotoxins of which aflotoxins, ergot alkaloids, fumonisins and stachybotrys are the best known[15]. Mycotxins can be useful to man as they have been the foundation of antibiotics, immunosuppressants and some pain relievers. However some are toxic to man.

Aflatoxin has been implicated as a carcinogen in humans and recognised by the World Health Organisation as a Class 1 carcinogen, and is produced, amongst others, by the moulds Aspergillus flavus and Aspergillus paraciticus[16]. These fungi and the aflotoxins produced are known to contaminate tobacco leaf[17, 12, 18, 19].

Burge has shown that fungi and their related mycotoxins can cause toxic responses in the liver, kidneys and skin. They may cause haemorrhages, nausea, vomiting, eczema, immunosuppression, photosensitivity and dermatitis[20.]

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Box 1

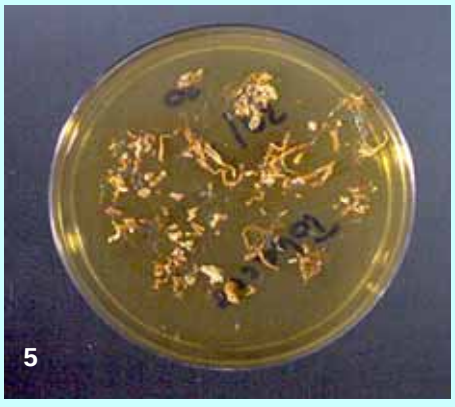
Findings from Bittoun et al. (2003)[14]

A study was conducted to examine fungal activity in "chop-chop" tobacco samples voluntarily donated to this author. Eight samples of smokers' current "chop-chop" tobacco were set for fungal cultures. Samples of manufactured cigarette and pouch tobacco were cultured as controls.

Technique Tobacco strands were inoculated onto culture plates in the routine manner for fungal culture. Plates were incubated at 28 and 35 degrees C. Plates were kept for four weeks and inspected daily.

Results Abundant fungal organisms such as Rhizopus Oryzae and Aspergillus Niger were found in culture on all samples within 24 hours. Actinomycetes bacteria were also cultured (see photographs 1, 2 and 3).

Control samples of manufactured cigarette and pouch tobacco were negative for fungi (see photographs 4 and 5).



1. Aspergillus Niger
2. Rhizopus Oryzae
3. Rhizopus Oryzae and Actinomycetes.
4. Manufactured cigarette tobacco, negative for fungi.
5. Manufactured pouch tobacco, negative for fungi.

Bacteria

There is little recent literature on bacterial growth on tobacco leaf as most tobacco is bactericidal. There is some evidence that this may be due to 1) tobacco fungi being toxic to bacteria and that 2) nicotine may be bactericidal[21]. There may however be the potential for the growth of Legionella bacteria. However, endotoxins are a constituent of some bacteria and can be very toxic to man in high levels. Bacterial endotoxins have been found in tobacco[22, 23].

Actinomycetes

Actinomycete spores are very tiny organisms that possess properties that straddle bacteria and fungus and are deemed a higher-order bacteria. A few species are pathogenic. Actinomycetes israelii and Nocardia asteroid cause disease in man[24]. These microorganisms are found widely in soil and contribute to the decay of organic matter[25]. Mycobacteria, for example, are of the actinomycetes family and cause leprosy and tuberculosis. Actinomycetes can be thermophylic and proliferate in warm conditions. Due to the tiny nature of this organism when airborne and inhaled it is able to penetrate deep into the respiratory tract. Actinomycetes have been found on raw tobacco leaf [26, 27]. Hence there is potential for actinomycosis and other mycobacterial infections of the lung to occur [24].

Medical Consequences

The most serious consequences of the microorganisms mentioned above are caused through inhalation of airborne microorganisms, though skin, eye and nose irritation is not uncommon. That inhalation of these organisms has a potential to cause adverse health effects is well known and has been recognised for many years [28, 20, 15, 24]. The adverse medical consequences of exposure to moulds has also been well documented [29, 24]. The most extensive human research carried out are studies amongst farmers who, by the nature of their work, are frequently exposed to grain and plant moulds [25,30, 31, 32, 33]. Studies have shown that tobacco farmers are subject to exposure of spoilage fungi which compromises their health [34, 35, 36, 23, 37, 38]. As the handling of raw untreated tobacco plants and their contaminants is amplified with “chop-chop” tobacco usage, there is potential for the health consequences to be as serious, or more so, as those that occur in tobacco farmers.

Allergies

IgG and IgA, and IgE and Serum Antibodies and Allergens
Immunoglobulins (Ig) or antibodies are large proteins that help ingest and destroy antigens, that is, foreign often toxic microorganisms. IgG is a quick acting antibody produced when an antigen is encountered more than once, while IgA are the antibodies produced when microorganisms invade body surface linings such as the respiratory and digestive tracts. IgE is the antibody responsible for allergic reactions when an allergen (an antigen that causes allergic reactions) is encountered. Atopic asthma is the result of exposure to environmental antigens and patients have IgE responses to these antigens.

All fungi probably produce allergenic substances. However, of the hundreds of thousands of different kinds of fungi, only a very few have been tested for allergenicity. Fungal allergy is common (as many as 10% of the entire population and at least 40% of asthmatic patients may be fungal-sensitive), and those with fungal sensitivity may have more serious disease than those with other sensitivities[20].

Healthy airways can easily eliminate fungal spores which rarely cause pathological conditions [39]. However, those predisposed to lung diseases, and smokers, who are poor clearers of inhaled particulate matter, are at risk of illness[6]. Agricultural employees (including tobacco workers) have been shown to suffer from significantly more rhinitis, chronic bronchitis and asthma than their peers in other

employment and to have IgE and IgA antibody responses[40,37]. "Farmers Lung" has long been described and attributed to thermophyllic actinomycetes[41,25].

These adverse respiratory responses are primarily due to exposure to large quantities of dust, fungi and mycotoxins in stored material. Kauffman, in a review of fungus-induced respiratory diseases, suggests that asthmatic reactions may occur in atopic individuals and that persistent exposure to fungi could result in damage to the bronchi and complications such as allergic bronchopulmonary aspergillosis in susceptible indivuals[39].

Aspergillosis

Aspergillosis is a disease of the lung that occurs world-wide and is commonly caused by only a few species of the Aspergillus fungus. A.fumigatus and A.niger are such fungi in particular[42,43]. Aspergillosis is manifested in various forms (see Table 1).

Aspergillosis of all types can occur in asthmatics, patients with chronic lung diseases, cyctic fibrosis and in those with immunosuppression[44,45]. Patients may colonise the aspergillus in the lung or have allergic responses to the fungus. Untreated, the disease may progress to allergic alveolitis and pulmonary fibrosis and may be fatal[46]. Aspergillus Niger, one species of aspergillus, has been shown to date to grow on Australian samples of "chop-chop"[14] and has been shown to grow on other raw tobacco and on marijuana leaves[47,18].

Table 1. The various forms of Aspergillosis

General Form	Specific Disease
Aspergillosis	Airways colonisation, Aspergilloma (Fungus Ball), Invasion of necrotic tissue.
Allergic Aspergillosis	Hypersensitivity pneumonitis, allergic bronchopulmonary aspergillosis.
Invasive Aspergillosis	Acute bronchopneumonia, Angioinvasive aspergillosis, Acute tracheobronchitis, Millary aspergillosis, Aspergillus pleurisy and empyema, Chronic necrotising aspergillosis.

From Fraser (1993)[42]

Extrinsic Allergic Alveolitis

This is an acute IgE mediated alveolar response to an antigen which results in inflammation of alveoli (see Box 2, a case presenting to Sydney Smokers Clinic[5]). Tobacco Workers Lung (TWL) is a type of Extrinsic Allergic Alveolitis or hypersensitive pneumonitis. It is caused by the inhalation of tobacco moulds. Patients with the disease produce serum antibodies to the fungus Aspergillus (the antigen). The antigen causes pulmonary inflammation. Acutely, patients present with fever, cough, chills, myalgia, headache and malaise within hours of exposure to mouldy tobacco. Breathlessness, wheezing, rales, weight loss, digital clubbing, fever, right heart failure as well as pulmonary fibrosis may occur after chronic exposure. Removal of the patient from the antigen can effect immediate relief within hours, however symptoms may recur with re-exposure[38]. Huuskonen has shown that 51% of tobacco workers had antibodies to fungal spore and that a small proportion of workers had symptoms and signs of undiagnosed allergic alveolitis such as reduced diffusion capacity (18%) and radiological changes (14%)[48].

Carcinogenisis

Aflatoxin have been linked to carcinoma of the lung as a teratogen, mutagen, carcinogen, immunosuppressant and inhibitor of protein synthesis[16, 49, 50]. Aflatoxins have been implicated in many cancers and the US Food and Drug Administration regulates aflatoxin contamination of ingested agricultural products, particularly peanuts, corn and grains. Raw tobacco workers have been shown to have measurable exposure to mutagens in their urine[51]. However, there is, to date, little regulation on the control of aflatoxin in tobacco products.

Emphysema

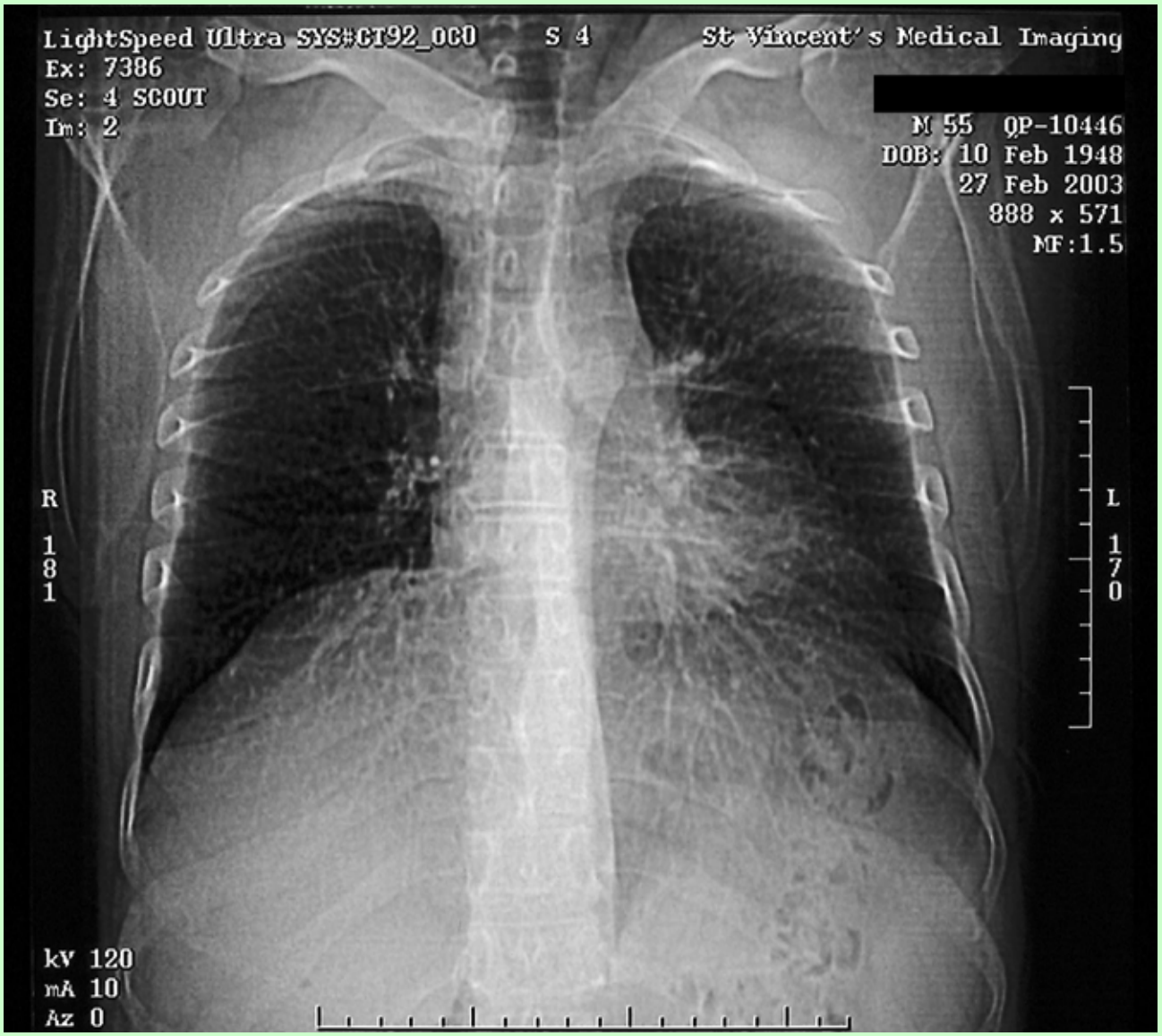
There is little evidence that fungi are directly involved in the etiology of emphysema with the exception of one article in the literature by Forgacs and Carll in 1966 that showed a relationship with inhaled Alternaria and Aspergillus Niger spores and the development of emphysema in mice[52].

Tobacco Industry Response to Mouldy Contamination

The tobacco industry has had knowledge of the effect of mould on tobacco leaf production and on human usage for some time[53]. Curing tobacco and drying leaf has historically been the method to preserve raw tobacco leaf and to prevent moulding and natural deterioration[21]. The process of curing (drying) tobacco has been the mainstay of techniques by illicit tobacco growers and handlers as well. More recently, there have been successful attempts by the tobacco industry to eradicate mould using Gamma Irradiation techniques[54]. It is evident that illicit tobacco growers sometimes attempt to eradicate mould with chloride products, hence the chloride smell of some samples. The medical consequences of smoking irradiated tobacco leaf is unknown, as is the inhalation of chloride mixed with tobacco which is then burnt and inhaled.

Box 2

Male aged 54 smoked manufactured cigarettes for 40 years. He had no previous history of respiratory illness or environmental exposure. He presented to a large teaching hospital in Sydney with acute respiratory distress, lung function tests showed mild restriction in spirometry with a reduced diffusion capacity (DLCO) 67% of predicted. Chest X ray showed "ground glass" diffuse patchy interstitial infiltrate consistent with extrinsic allergic alveolitis. Bronchoscopy showed actynomycetes in bronchial washings. He was referred to Smokers' Clinic where he revealed that he had recently been smoking cheap illicit "chop-chop" tobacco that was mouldy. He was encouraged to quit smoking all types of tobacco and was followed up for three weeks. After ceasing to smoke "chop-chop" but continuing to smoke manufactured cigarettes his lung function has improved, clinically his chest is clear and he remains asymptomatic, though his CT chest scan (see below) continues to show extrinsic allergic alveolitis described as ground glass opacity in a patchy distribution throughout all lobes.



Case presented at Thoracic Society of Australia and New Zealand Annual General Meeting in Adelaide, 2003 by Bittoun.

Conclusion

Smokers attending a smoking cessation clinic dedicated to Chronic Obstructive Pulmonary Disease (COPD) in the central Sydney area have described acute respiratory reactions to smoking "chop-chop"[5]. The very dense volume of fungal contamination found in our samples of "chop-chop" is alarming. Harriet Burge, in her review of fungi in human health, describes the factors that effect inhalation exposure and subsequent reaction include the amount of spores, the time fungi spend as aerosol and the amount of toxin reaching the organ[20].

Burge recommends the "absolutely essential step for controlling fungal growth is to remove water from the environment." The fungi we have found in local "chop-chop" samples are thermotolerant hence would survive and replicate in warmed conditions such as heating in the sun or a microwave. Patients have presented with extrinsic allergic alveolitis, acute asthma, bronchiectasis and acute exacerbations of chronic obstructive pulmonary disease due to recent smoking of "chop-chop". Some of the presentations resemble "farmers lung" or "tobacco growers' lung". Large quantities of Aspergillus Niger were found on local "chop-chop" tobacco and may be amongst many other fungi yet to be isolated that are the cause of respiratory illness in patients smoking "chop-chop".

Smokers of marijuana are equally at risk of developing diseases due to inhalation of contaminants from mouldy plants. There have been reported cases of Allergic bronchopulmonary aspergillosis[55], Pneumonitis[56] and fatal invasive aspergillosis in immunocompromised patients smoking marijuana for therapeutic reasons[45, 57].

There is serious potential for hazardous inhalation responses to "chop-chop" in hosts that are compromised in their respiratory function and lung clearance, such as patients with asthma, chronic respiratory disease, those that are immunosupressed and smokers themselves. A large minority of Australian asthmatics are smokers[58] and many smokers with COPD continue to smoke[59]. Since the commencement of this investigation a chronic "chop-chop" smoking patient with a long history of COPD has died from Legionnaires disease. He was found to have Legionella longbeachii in his serum. As there are no other mitigating circumstances it is possible he acquired this through smoking "chop-chop" tobacco[60].

Illicit tobacco trafficking is growing[2] and smokers do not readily volunteer that they use this illegal product despite no smoker having been prosecuted for smoking "chop-chop" in this country. It is likely that smokers have had severe medical repercussions from using this type of tobacco but are not aware of the implications nor make the link with the type of tobacco smoked. Health workers are also not versant with the usage nor the possible medical implications of patients smoking "chop-chop" and thus the probable effect of smoking "chop-chop" is not reported. At risk of the possible health consequences of "chop-chop" are those who smoke it as well as authorities and workers who may handle it.

Summary

The smoking and handling of "chop-chop" tobacco has the potential to induce illness and possible fatality in those who use it. These illnesses may range from allergic reactions, chronic bronchitis, asthma, aspergillosis, alveolitis, pneumonitis, lung cancer to Legionnaire's disease.

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