

Mushroom Poisoning Surveillance Analysis, Yunnan Province, China, 2001-2006

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Introduction

More than 600 mushroom species can be found in Yunnan Province, of which approximately 450 are edible. In 2002, 17,000 tons of mushrooms, most of which were wild mushrooms, were commercially harvested in Yunnan¹. Yunnan, with its semitropical climate, provides an ideal environment for the growth of mushrooms. In Yunnan, local cuisine prizes mushroom dishes and collection and ingestion of wild mushrooms is a common practice.

However, it is difficult to visually distinguish poisonous wild mushrooms from edible ones. Food poisoning due to mushroom ingestion has long been noted in this province. From 1985 to 2000, 378 wild mushrooms poisoning events were reported in Yunnan, including 2,330 cases and 326 deaths².

Recently disease surveillance reporting methods have changed in China. The “Law of the People's Republic of China on the Prevention and Treatment of Infectious Diseases,” first enacted in 1989, was revised in 2004 after SARS³. Accordingly, “The regulation on Health Threats emergent response” was issued in 2004, in which the definition of Health Threat and specific criteria for reporting of food poisoning, as a kind of Health Threat, was described: any event involving 30 or more cases or a fatality. Also in 2004, training for reporting of mushroom poisoning events was provided to public health personnel.

We conducted a descriptive study in order to understand the burden of wild mushroom poisonings and evaluate possible risk factors; compare pre-2004 surveillance data with post-2004 data; investigate the role of specific mushroom species in poisonings; and, given our findings, consider implications for control.

Methods

Yunnan Province, located in southwest China, has a population of more than 44 million people residing in 129 largely rural, mountainous counties. We conducted a descriptive study to summarize surveillance data from Yunnan annual epidemiological reports (2001–2006) and mushroom poisoning investigation reports (2004–2006). We collected data on each event including number of cases, deaths, demographic and clinical data of cases and species of suspected mushroom.

We also collected county-level rain fall, temperature and income data from the Yunnan Statistical

Yearbook⁴, and compared these variables between counties that reported a mushroom poisoning event and counties that did not. In these comparisons, we used the Kruskal-Wallis Test for non-normally distributed variables and t-tests for normally distributed variables.

We created a database and completed our analyses in EpiInfo 3.32. To reduce data error we coded all data collection forms, used double-entry and randomly selected 10% of all forms to double-check our data entry.

Results

From 2001 to 2006, 97 mushroom poisoning events were reported in Yunnan including 662 cases and 148 deaths. The overall case fatality proportion was 22.4% (mean = 30.7%, standard deviation = 15.7). The mortality rates due to mushroom poisoning in 2001–2006 were 0, 0.01, 0.03, 0.07, 0.17, and 0.06 per 100,000 respectively (Figure 1).

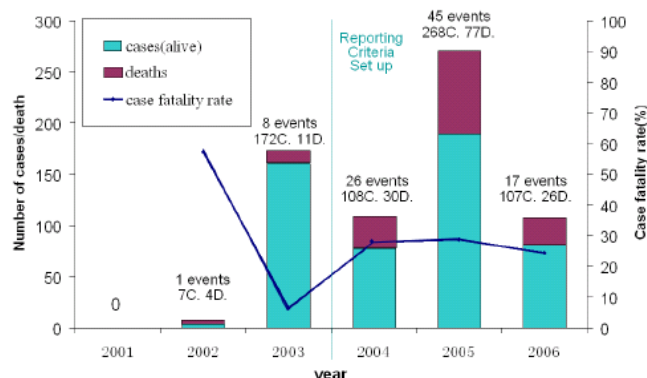


Figure 1. Number of mushroom poisoning event, cases, deaths and case fatality proportion by year, Yunnan, China, 2001-2006

Table 1 compares events, cases, and mortality reported in the three years (2001–2003) prior to adoption of specific event-based reporting requirements with the three years after (2004–2006) adoption of reporting requirements.

Table 1. Comparison of events, cases, and case fatality proportions reported before (2001-2003) and after (2004-2006) adoption of specific event-based reporting requirements, Yunnan, China

	Before (2001-2003)	After (2004-2006)
Number of events	9	88
Number of cases	179	483
Case fatality proportion	8.4%	27.5%

The majority (86.6%) of events occurred from May to August, the rainy season in Yunnan. Table 2 summarizes case demographics from events reported

from 2004–2006. Most poisonings occurred in rural settings and were limited to a single household. Table 3 presents environmental and economic variables in counties where a mushroom poisoning event was recorded and counties where no event was reported.

Table 2. Demographic characteristics of mushroom poisoning cases, Yunnan, China, 2001-2006

Age Group	Male		Female		Total	
	Case (n)	Death (n)	Case (n)	Death (n)	Case (n)	Death (n)
0-9	19	12	14	7	33	19
10-19	27	16	12	6	39	22
20-29	22	10	17	9	39	19
30-39	29	16	16	7	45	23
40-49	19	10	8	4	27	14
50-59	13	7	13	8	26	15
60	16	8	9	5	25	13
Total	145	79	89	46	234	125*

*Age and gender were recorded in only 2/3 of total cases. This proportion was much higher in dead cases as there was no standard investigation form for mushroom poisoning and fatal cases usually drew more attention.

Table 3. Comparison of environmental and socio-economic factors among reported counties and non-reported counties, Yunnan, China, 2004-2006

Factors	Reporting Counties	Non-reporting Counties	P value
Median rainfall (range)	917 (483.7-2360.3)	833 (493.9-1864.7)	0.02*
Mean temperature (SD) (°C)	17.4 (2.6)	17.2 (3.0)	0.75**
Median income of peasants in Renminbi (range)	1377 (848-2967)	1728 (697-5333)	0.002*

*Median was tested with Kruskal-Wallis Test

** Mean was tested with t-Test

Source: Yunnan statistical yearbook 2005

In two-thirds (65.9%) of the events, a suspected poisonous mushroom species was documented. Figure 2 shows the mushroom species associated with 42 events where a single species was implicated. Multiple species were implicated in 16 events.

In 85.2% of events, the source of the suspected poisonous mushroom was reported; the majority (94.3%) of events was associated with using fresh mushrooms; most were collected by victims themselves and fried before consumption (Figure 3).

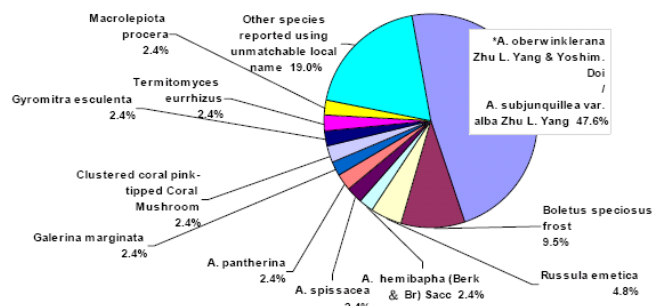


Figure 2. Proportion of single suspected mushroom species in mushroom poisoning events, Yunnan, China, 2004-2006

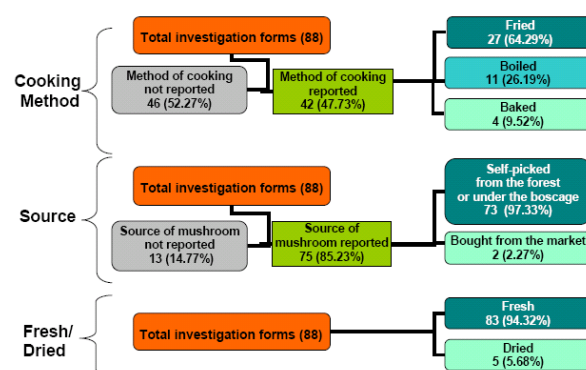


Figure 3. Cooking method, source of mushroom, and type of suspected mushrooms, Yunnan, China, 2004-2006

Figure 4 shows the facilities at which health care was sought by mushroom poisoning victims. The distribution of incubation periods is shown in figure 5 and clinical manifestations are presented in figure 6. Based on our audit of 10% of our data, we estimated an error rate of less than 1.5%.

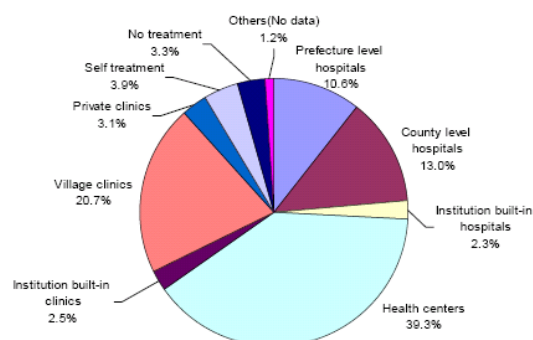


Figure 4. Facilities at which health care was sought by victims of mushroom poisoning, Yunnan, China, 2004-2006

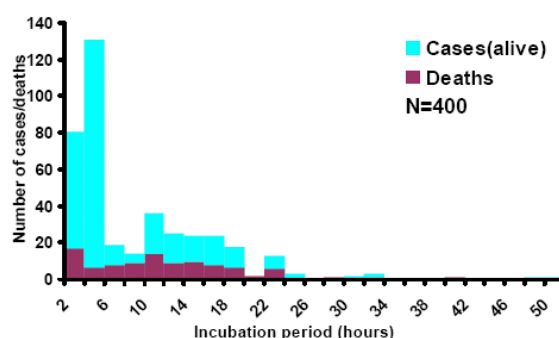


Figure 5. Number of mushroom poisoning cases by incubation period, Yunnan, China, 2004-2006

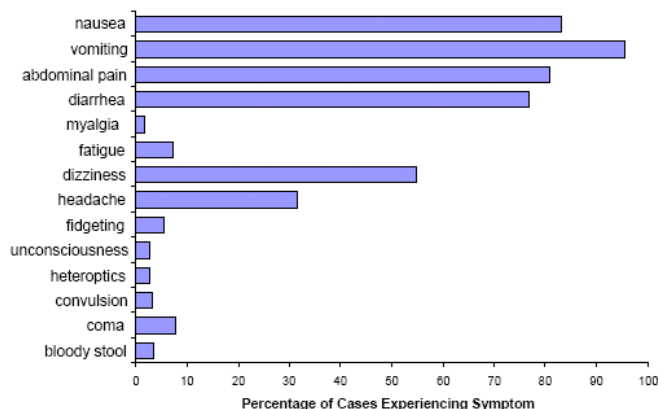


Figure 6. Symptom frequency of mushroom poisoning cases, Yunnan, China, 2004-2006

Discussion

Our results showed that the majority of mushroom poisoning events were associated with ingestion of wild mushrooms picked in rural areas, and limited to single households. Ingestion of commercially cultivated mushrooms appears to have minimal risk. Population-based mortality rates were very low. Mushrooms figure prominently in Yunnan cuisine; population-based rates probably provide a good indicator of overall risk. Despite the low rates, mushroom poisoning is the most common form of lethal food poisoning in Yunnan.

We found that after the adoption of specific reporting criteria in 2004, the number of reported wild mushroom poisonings in Yunnan Province dramatically increased. This likely reflects an increase in identification and reporting of cases rather than an increase in actual poisonings.

The most common poisonous mushrooms in this study were *Amanita spp.* This genus is composed of both edible and poisonous mushrooms which are generally indistinguishable without laboratory tests for the presence of toxin.

Despite the mountainous, remote character of rural Yunnan Province, healthcare is highly accessible to poisoning victims. Primary care such as fluid resuscitation, gastric decontamination by both gastric lavage (with gastric contents submitted immediately for toxicological analysis and spore examination) and multiple doses of activated charcoal (1g/kg initially, 0.5g/kg subsequently) can reduce toxin absorption, decreasing morbidity and mortality⁵.

Public Health Action and Recommendations

The adoption of specific reporting criteria and public health training specific for mushroom poisoning appears to have successfully increased surveillance system sensitivity for mushroom poisoning. However, this system is not designed to be 100% sensitive. Event-based reporting has inherent sensitivity limitations and its results usually overestimate case fatality proportion. The utility of event-based

surveillance should continue to be assessed over time.

Our results show no clear geographic clustering, and few epidemiological targets for focused prevention programs. Although the poisonings occur seasonally, peak occurrence is not confined to a few weeks or a month; although rural persons are predominantly afflicted, the province itself is largely rural. Little information exists to differentiate poisoning victims from the numerous people who enjoy wild mushroom dishes with no ill effects.

Eating purportedly edible mushrooms appeared to be associated with two poisoning events though possible misclassification makes this uncertain. It is not possible to compare the rate of poisoning due to ingestion of cultivated vs. wild mushrooms given the lack of denominators, but cultivated mushrooms are probably much less likely to be poisonous than wild mushrooms. Cultivated mushrooms were not found to be associated with any mushroom poisonings.

Public health professionals trying to prevent cases of mushroom poisoning might advise people in rural areas to eat only cultivated mushrooms but altering eating customs is difficult. Thorough cooking of certain species of toxic mushrooms reduces the risk of poisoning, but many fungal toxins, including those in poisonous *Amanita spp.*, are heat stable; cooking does not make them less dangerous⁶. Cooking of wild mushrooms should certainly be encouraged though that will likely not eliminate poisonings.

Collaboration with botanical experts and GIS analysis of the site of origin of poisonous mushrooms may provide future clues that will allow more specific targeting of prevention efforts.

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