ORIGINAL RESEARCH

Summer Climbing Incidents Occurring on Fujisan's North Face from 1989 to 2008

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Objective.—Few studies exist on climbing-related incidents at Fujisan, although it is Japan's highest peak at 3776 m, and attracts dense crowds of summer climbers. A retrospective review was thus conducted to analyze the types of incidents and the demographics of climbers involved.

Methods.—Police reports of summer climbing incidents occurring along the Yoshida trail on Fujisan's north face from 1989 to 2008 were reviewed. Variables assessed included climber age, sex, experience, gear, altitude of incident, and whether the incident occurred during ascent or descent, as well as the cause and severity of any associated injury.

Results.—A total of 155 incident reports were assessed, including 28 deaths mostly attributable to cardiac events occurring among male climbers during ascent. The majority of nonfatal incidents occurred during descent and most involved tripping. More than half of all incidents were reported at the 8th step (approximately 3000 m). The frequent appearance of male climbers without experience or adequate footwear reflects Fujisan's summer demographics, yet the injury rate appears higher among older climbers more than 50 years of age. There were also 28 noninjury incidents attributed to acute mountain sickness or fatigue.

Conclusions.—This retrospective review describes the demographics of summer climbing incidents on Fujisan's north face. Additionally, limitations to the current method of incident reporting were identified. More comprehensive recordkeeping would increase understanding of injuries and illness, which could improve resource allocation and reduce the risk of fatalities from out-of-hospital cardiac events.

Key words: climbing, mountaineering, climbing incidents, injury, unintentional injury, accident, seasonal, national parks, Fujisan, Japan

Introduction

Fujisan is Japan's highest peak at 3776 m. Located in the Fuji-Hakone-Izu National Park, which receives more than 100 million annual visits, the stratovolcano is known for its short climbing season and dense crowds of climbers.¹ The estimated number of total summit attempts increased from 231,542 in 2007 to 305,350 in the summer of 2008, stabilizing thereafter around 300,000 per season (Figure 1).² However, there have been few

studies of climbing-related incidents on Fujisan, so injury and illness patterns remain largely unknown despite numerous equivalent studies elsewhere.^{3,4} A retrospective review was thus conducted to analyze the climber demographics and type of incidents involved.

Until the late 19th century, Fuji climbers faced a range of financial, logistical, and cultural barriers, with some sections of society—notably women—excluded from climbing. Today, Fujisan has few restrictions, and every summer sees a more diverse mix of climbers, including many female, foreign, and first-time climbers, who tend to be younger than at other mountains in Japan.⁵ Nonetheless, certain geophysical barriers remain; for example, the vast majority climb during July and August to avoid snowfields and ice. Within this brief window, climbers use 1 of 4 trails (Figure 2) to reach the summit, including the Yoshida trail situated on Fuji's

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Figure 1. The number of ascending climbers at the 6th step of the Yoshida trail on Fuji's north face (Yamanashi Prefecture) 1981–2013.

north face. This is the busiest of the 4 trails because of the relatively high altitude (2300 m) of the trailhead at the 5th station (Figure 3) and the short access time required from the greater Tokyo area. In the summer of 2008, 172,369 climbers used the Yoshida trail, accounting for 56% of that season's total according to infrared trail counters positioned around the 8th step to capture climber numbers (Figure 2). Summer summit attempts are clustered around certain days—especially weekends and public holidays—with most climbers timing their ascent to see sunrise, resulting in more than 90% of summit attempts occurring between 02:00 AM and 07:59 AM.⁶ This results in intense spatial and temporal congestion as thousands of climbers attempt to reach the summit crater simultaneously. The situation has potential ramifications for risk management, particularly as the majority are first-time climbers with no prior experience as depicted in the Japanese proverb: “only a fool never climbs Fuji, but only a fool climbs it more than once.”⁷ To improve the understanding of climber injuries and illnesses during the congested

Figure 2. Proportion of ascending climbers at the 8th step of the 4 major trails in the 2008 season.⁹

summer season, this paper reviewed police incident reports following the methods of Wild's retrospective review of injuries.⁸

Methods

The annual reports published by the local Yamanashi Prefectural Police from 1989 to 2008 were reviewed. No institutional review board consent was required because data were extracted from these official, publicly available reports. Exclusion criteria were threefold. First, any incidents that occurred outside of Fujisan's official season of July and August were excluded. Although police records run year-round and summit attempts are often undertaken out of season, it is strongly discouraged by management organizations, and facilities such as mountain huts are mostly closed. Also the presence of snowfields and ice is a deterrent to casual climbers, resulting in a broadly different demographic profile from that of summer climbers. Second, incidents involving nonclimber visitors such as tourists, trail runners at the annual road race, and foragers for herbs were likewise excluded, leaving a total of 155 incidents. Finally, the year and month of the incident were excluded after preliminary analysis revealed no clear chronological trends. The remaining 8 variables recorded in the annual report included climber age, sex, experience, gear, altitude of incident, and whether it occurred during ascent or descent, as well as the cause and severity of any associated injury. Police categorized injury severity into 4 levels: “fatal,” resulting in death; “severe,” involving climbers with injuries diagnosed to take more than 1 month to heal; “moderate,” taking less than 1 month to heal; and “mild,” requiring no treatment.

The selected data were then examined to look for recurring types of incidents and climber demographics. The 8 variables were coded and entered into SPSS (v. 21.0; IBM Corp, Armonk, NY) software before cross analysis. Dichotomous variables were compared by using Fisher's exact test, and other nominal variables were tested using χ^2 for expected values less than 5. These were viable methods given the small sample size ($n = 155$), and a probability value of less than or equal to .05 was considered statistically significant.

Results

DEMOGRAPHICS

The most common age range of climbers involved in incidents was 50 to 69 years ($n = 69$, 45%). Ninety-eight incidents (63%) involved male climbers, whereas 108 (78%) were “novices,” defined by police records as those without any previous climbing experience. Seventy-three

Figure 3. Approximate elevation breakdown of the Yoshida trail.

climbers (47%) lacked the minimum prerequisite “gear,” defined by police as appropriate footwear. [Table 1](#)

INCIDENTS

The most frequent cause of traumatic injuries was tripping or slipping ($n = 84$, 55%). The majority of all incidents were categorized as either “moderate” ($n = 51$, 33%), or “severe” ($n = 48$, 31%). There were 28 fatalities (18%) recorded by the police, mostly attributable to “cardiac events” ($n = 27$, 96%). There were also 28 “mild” incidents requiring no treatment, mostly attributed to acute mountain sickness (AMS; $n = 13$, 8%) or fatigue ($n = 12$, 8%). [Table 2](#) shows that more than half of the incidents were recorded at the 8th step

($n = 81$, 52%) situated at approximately 3000 m ([Figure 3](#)). Overall, incidents tended to occur more frequently during descent ($n = 98$, 63%), but these were mostly nonfatal injuries caused by trips or slips. [Table 3](#)

STATISTICAL ANALYSIS

A χ^2 test of independence revealed more deaths during ascent ($n = 23$, 85%) than descent ($P < .001$). [Table 2](#) shows that there were more mild incidents recorded among climbers equipped with gear, and more traumatic incidents among climbers without ($P < .004$). Although there was initially no significant difference for sex ($P < .05$), a difference did emerge after moderate and severe injuries were combined as a subgroup and compared with fatalities using Fisher’s exact test ($P = .047$).

Table 1. Cause and severity of recorded incidents (1989–2008)

Cause	Severity			
	Mild ^a ($n = 28$)	Moderate ^b ($n = 51$)	Severe ^b ($n = 48$)	Fatal ($n = 28$)
Lost the way	3	0	0	0
Fatigue	12	0	0	0
Illness	0	1	0	0
AMS	12	1	0	0
Tripping	0	41	42	1
Rock fall	0	7	2	0
Cerebral infarction	0	0	1	0
Cardiac events ^c	1	1	3	27

^a The “mild” injuries refer to incidents requiring no further treatment.

^b The “moderate” injuries were diagnosed as those expected to heal within 1 month, whereas “severe” injuries were those expected to take longer than 1 month to heal.

^c An umbrella term literally translated to mean “heart failure” but understood to include various conditions such as heart attacks (acute myocardial infarction), dysrhythmias, etc.
AMS, acute mountain sickness.

Discussion

This study provides novel information about common injury and illness patterns experienced by summer climbers on Fujisan’s north face. It is not possible to quantify the relative risk of different climber segments without knowing the specific denominators, but the existing literature offers certain clues. Studies have shown that summer Fuji climbers are mostly young (78% aged from 20 to 39 years), male (61%), without experience, and often without any preparation such as specific training or equipment purchases, yet approximately 90% still reach the summit successfully.⁹ The higher frequency of injuries among male novice climbers without adequate footwear therefore seems to reflect these Fuji climber demographics rather than indicate causation. The 45% of incidents attributed to older climbers in their 50s and 60s does seem anomalous at Fujisan given their relatively small proportion (11%) in the 2013 study, suggesting there are more injuries and incidents among older climbers. However, this age

Table 2. Cause and location of recorded incidents

Cause of incident	Recorded location of incident					
	5th step (n = 3)	6th step (n = 16)	7th step (n = 45)	8th step (n = 81)	9th step (n = 8)	Summit (n = 2)
Lost the way	0	0	0	2	1	0
Fatigue	0	4	5	2	1	0
Illness	0	0	0	1	0	0
AMS	0	1	5	7	0	0
Tripping	2	7	26	43	5	1
Rock fall	0	0	1	7	1	0
Cerebral infarction	0	0	0	1	0	0
Cardiac events	1	4	8	18	0	1

AMS, acute mountain sickness.

bracket—coupled with tripping or slipping as the most common cause of traumatic injury—reflects national trends for mountaineering injuries in Japan.¹⁰

Overall more incidents occurred during descent, and most involved nonfatal injuries caused by tripping or slipping. Accidents are universally more frequent during descent,¹¹ and conditions at Fuji are particularly treacherous with steeply cut sections of trail often composed of volcanic ash underfoot. The separate descending trail on the Yoshida route (Figure 3) is extra challenging owing to the lack of amenities such as water and the presence of only 1 toilet in contrast to the multiple facilities available during ascent. It is likely that sleep-deprived, novice climbers hurry down steep sections of the trail to find a toilet, or to catch a return bus from the 5th station at a fixed time, all factors that may contribute to the higher frequency of falls during descent.

The effect of altitude could also play a role, with AMS symptoms triggered at any altitude above 2400 m (at the level of the 6th step; Figure 3). However, results showed no clear correlation with elevation, as more than half of the incidents (n = 81, 52%) were recorded at the 8th step, whereas few were reported higher up, with only 8 cases at the 9th step (5%) and 2 at the summit (1%, including 1 death; Table 2). This clustering of incidents

suggests that the presence of the main first aid station at the 8th step may have affected the results, camouflaging the location of incidents that originally occurred elsewhere. As well as such selection bias because of the recordkeeping procedure, the aid station at the 8th step is also a cutoff point where climbers who have been struggling with actual or imagined AMS (or any other ailments) are advised to descend as a precaution. Finally, an especially steep section of trail between the 7th and 8th steps makes the latter a natural turnaround point as injured or ill climbers question their own physical ability to carry on to the summit.

The style of climbing is also a factor. Most of the mountain huts on Fuji's north face are clustered between altitudes of 2700 m and 3450 m, ensuring that this is the range in which climbers snatch a few hours of rest before their dawn summit attempt. Park managers currently recommend an overnight hut stay, arguing that the time spent resting could help climbers to acclimatize to the high altitude, but in practice the huts are cramped and sleeping quarters crowded during the season. Moreover, staying in the huts—especially those near the summit—runs contrary to the “climb-high, sleep-low” approach, which warns against ascending more than 600 m per day to sleep.¹² A 2013 pilot study found that both the

Table 3. Severity of injury by direction, gear, and sex

Variable	Severity				χ^2	P value
	Mild (n = 28)	Moderate (n = 51)	Severe (n = 48)	Fatal (n = 28)		
Ascending	11	12	9	23	40.86	<0.001
Descending	17	39	39	3		
With gear	20	23	19	11	41.86	0.04
Without gear	8	28	29	17		
Male	20	27	29	22	6.13	0.11
Female	8	24	19	6		

incidence and severity of AMS among climbers who had stayed at a mountain hut was significantly greater than that of single-day climbers.¹³ AMS typically takes many hours to develop, so by the time symptoms emerge in day climbers, they are already descending and alleviating the symptoms. This helps explain the relatively few AMS incidents ($n = 13$, 8%) even though rapid ascents are the norm at Fuji. Underreporting is also a factor, with many incidents—particularly less severe ones—not communicated to the police. A follow-up interview confirmed that the de facto criteria for listing in the police reports was whether or not an ambulance had been called out to the 5th station (the trailhead at 2300 m where climbers start and finish), thus skewing the data toward the more-serious incidents. Current recordkeeping procedure also lists all 155 incidents as single-choice categories, masking potentially important overlaps between multiple categories, such as whether a fatality caused by tripping had also been suffering from AMS. The use of secondary data had other limitations, including reliance on diagnosis of “moderate” or “severe” injuries by policemen without formal medical training, introducing substantial observer bias into the results. Other predetermined categories such as “suitable” gear were also evaluated by police according to the presence of “appropriate” footwear. “Cardiac event” was a vague term that literally translated as “heart failure” but was understood to include various conditions such as heart attacks (acute myocardial infarction), dysrhythmias, and so on. Finally, the official reports lacked a detailed breakdown of the precise nature of the injury, or any indication of whether the patients had preexisting medical conditions such as heart ailments.

These study limitations highlight several areas for improvement in incident recordkeeping at Fujisan. More detailed data are needed to pinpoint the actual cause of the injuries—for example, one case mentions a 49-year-old female climber who died after slipping in 1995 without any elaboration. Also, combining police incidents with additional case reports from first aid stations at the 7th and 8th steps—as well as data from other trails—would provide a more comprehensive representation of incident trends. In short, these results should be viewed within the context of a dataset limited by a small sample of somewhat ad hoc incident reports collected after ambulance call-outs. Nonetheless, knowing that more than half of the fatalities occurred during ascent could have implications for targeted resource allocation, which is a constant challenge for management given the sheer volume of summer climbers during peak periods. One suggested counterstrategy is to continue adding additional automated external defibrillators (AEDs) at strategic locations along the ascending trail

in case of cardiac events. Prior research has shown that “training and equipping volunteers to attempt early defibrillation can increase the number of survivors to hospital discharge after out-of-hospital cardiac arrest in public locations.”¹⁴ AEDs have numerous pragmatic advantages, including ease of use for nonmedics such as mountain hut staff or guides, which could in turn reduce the response time and thus the risk of fatalities. Yet AEDs are no panacea, and their set up would require a feasibility analysis of overall numbers and staggered deployment along the trail to ensure availability within 10-minute intervals in the event of a cardiac arrest. Such a study could be combined with compilation of a more comprehensive incident report.

Conclusions

Although Fujisan’s trails attract dense crowds of summer climbers, including many young novices, few studies have investigated their demographics or patterns of injury and illness. This research reviewed police reports of incidents occurring along the Yoshida trail on Fujisan’s north face from 1989 to 2008 to analyze the type of incidents and demographics of climbers involved. Most of the 155 incidents were nonfatal injuries caused by slips during descent. However there were 28 deaths, mostly attributable to cardiac events occurring among male climbers during ascent. More than half of the incidents were reported at the 8th step (3000 m). The frequent appearance in police records of male climbers without experience or adequate footwear reflects Fujisan’s summer demographics, yet the injury rate appears higher among older climbers. There were also 28 noninjury incidents attributed to AMS or fatigue, likely to be underreported categories. This study identified some limitations to the current method of incident reporting, paving the way for more-comprehensive recordkeeping that would increase understanding of common injuries and illness. This could ultimately improve resource allocation to reduce the risk of fatalities from out-of-hospital cardiac events.

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