Zip Line/Canopy Tours

Safety Record & Historical Background

Are Zipline & Canopy Tours Safe?

PROJECT ADVENTURE OVERVIEW

Project Adventure began as a model program in the Hamilton-Wenham Regional School District in 1971 in Hamilton, Massachusetts. An interdisciplinary approach with components in physical education, academics and counseling, the program was granted National Demonstration Site status by the National Diffusion Network of the U.S. Office of Education in 1974, and was widely disseminated to schools and other educational agencies in the years following. Hospitals, counseling centers, corporate training programs, camps, universities and others have implemented one or more aspects of the program. The physical activities of the curricula involve a series of games, initiative problems, and low and high ropes course events. Some programs have expeditionary components or top rope climbing instruction.

20 Year Safety Study for Project Adventure

(Ropes Course & Zip Lines compared to other activities)

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Previous Studies

This current study is the third of its kind, a follow-up on both the 10- and 15-year safety analyses. Table 1.1 shows a breakdown of this earlier work.

Table 1.1

Year	#Surveys	#Respondents	%	Injuries (per mil. hrs.)	Hours on Task	Injury Rate
1981	246	116	47	78	15,190,864	**5.13**
1986	725	392	54	157	42,752,242	**3.67**

About this study

The 20-Year Study differs from both the 10- and 15-Year Studies in several ways. In this study, additional information was gathered concerning the date and time of the accident, whether the accident occurred on an indoor or outdoor course, and whether medical attention was required. This survey distinguished between injuries to instructional staff and program participants. Programs also provided information about the number of instructional staff and the amount of formal training each had received, the size of the Ropes Course and about some safety-related policies such as the use of helmets. More detailed reporting of accidents and injuries also allowed us to better assess and classify the severity of the accident.

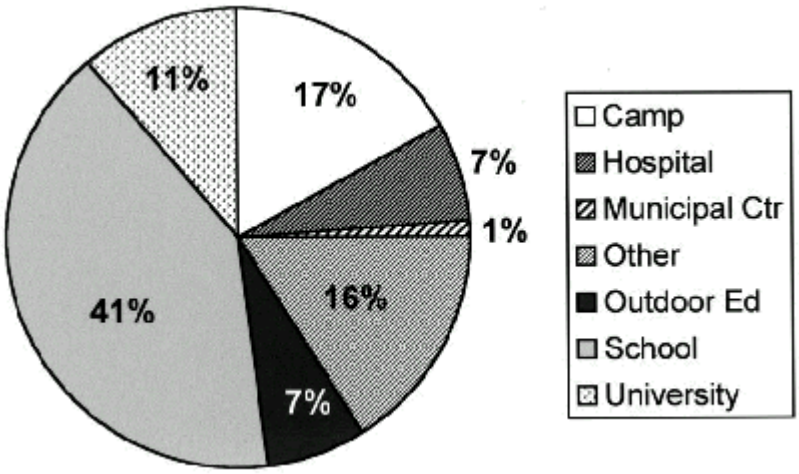
In January 1992, we sent out a total of 1,484 Safety Study Survey Instruments to program sites. These sites represented programs with which PA had either trained staff, constructed courses on-site, or supplied with information, publications or equipment. Some surveys were sent to programs known to have similar activity bases even though they would not be considered Project Adventure or PA-type programs. The results that we have gathered should be considered representative of Project Adventure programs and programs using similar activities.

The population for the study included schools, camps, hospitals, municipal centers, universities, outdoor education centers, and others. Only activities that are part of the the normal Project Adventure curriculum were included in the study. This includes Low and High Ropes Course activities as well as Initiatives and Games. Climbing, paddling, camping and other common outdoor program components were not included in this survey.

When we closed the returns in May 1993, there was a total of 604 returned surveys for a return ratio of 41%. Of the 604 respondents, 129 reported they had no ropes course, 39 had low (non-belayed) elements only, 12 had high (belayed) elements only, and 424 had a combination of both high and low elements.

Who Responded

The following chart shows a breakdown of the respondents according to the *type* of institution:



"Other"
This category represents 16% of the returned surveys, a percentage that suggests the growing diversity in the field of adventure. Examples of such institutions that responded in the "other" category were: human service and youth programs, corporate training centers, 4-H and Scout organizations, religion-centered organizations, therapeutic centers, juvenile court programs and more. Relative to the 15-year Study, there were also increases in the return percentages from schools, universities, and hospitals.

Participant Hours

For the 10- and 15-Year Studies, we chose to examine an accident rate based on injuries per 1 million participant hours. To ensure consistency, the same rate was used for our current analysis, as well.

On our survey, we asked the question:
• "Approximately how many persons participate in your program every year?"

This was followed by:
• "What is the average time (hours) a participant spends on these Adventure Program activities?"

By multiplying the number of participants by the number of hours of participation, an approximate figure was reached describing the site's total number of participant hours for each year from 1986 to 1991. **The six-year combined total of reporting sites gave a total number of 14,938,582 participant hours.**

The new data collected has also been combined with earlier data. The number of participant hours computed for this study, when added to the **grand total from the 15-Year Study, equals a total of 57,690,824 participant hours** on task.

Accident/Injury Definition:

The term accident has generally been used to describe "an event that is unexpected or unforeseen, and which may result in some injury, damage or loss." The data that we have collected primarily concerns **accidental injuries** that occur during Project Adventure-type activities. Injuries have been further divided into two categories listed below, along with a third category which is described as "medical incidents."

A. Lost Time Injuries:
Injuries which result in at least one day lost from work or school following the day of the accident itself. Many studies use a similar definition to create some basis for comparison to other activities. Our 10- and 15-Year Studies also used this definition to designate a significant accidental injury. In the most recent data collected, there were 93 reports of this category of injury. This represents 29% of the total injury/incident total.

Case example - Nitro Crossing; The participant's hands slipped on the rope while crossing to the platform, causing a fall on the posterior. This resulted in a fractured ankle and wrenched back. Number of days lost: *5*

B. No Lost Time Injuries:
Injuries which are generally less serious and do not result in lost time away from work or school. These are injuries which were recorded by the program and which may have required some first aid or medical attention, but which did not result in time lost form work or school. Bruises, light sprains, twists, rope burns, contusions, etc., usually fall into this category. 217 "minor" injuries of this category were reported representing about 67% of the total.

Case example - Wall: The participant was hoisted to the top of the Wall appropriately but then "froze" and could not lift her legs up and over the Wall. Bruising resulted from excessive weight and strain on participant's arms. Number of days lost: *0*

C. Medical Incidents: A third category was used to describe events that did not properly fit the definition of an injury. *Generally, a pre-existing medical condition that was triggered while participating in an activity in the Adventure Program was classified as a Medical Incident.* There were 11 medical incidents - representing about 3% of the injury/incident total - reported in the study. Some resulted in missed time from work or school.

Case example - Willow in the Wind (Trust Activity): The participant was diabetic and 55-65 pounds overweight. He was standing at the edge of the circle shortly after morning warm-ups, and asked to sit down after the second person went. The participant indicated that he did not take his medicine that morning, nor did he eat anything before arriving at the course. A hospital visit was required where a mild heart attack was diagnosed. Number of days lost: *60*

Results: Accidental Injury Rate

Table 1.2 shows the accidental injury rate computed only from the results of the most recent survey. **This rate is 6.22 injuries per 1 million hours of program exposure.**

Table 1.3 shows the total accidental injury rate for the last 20 years. 93 new "lost time" injuries are combined with 157 injuries from the 15-Year Survey. The hours of program exposure collected in the most recent survey - 14,938,582 - are combined with 42,752,242 hours of program exposure (from the 15-Year Survey) produce a 20 year total of 57,690,824 hours of program exposure. **The combined accidental injury rate for 20 years is 4.33 injuries per 1 million hours of program exposure.**

Table 1.2 - New Data Collected

Year	#Surveys	#Respondents	%	Injuries (per million hrs.)	Hours on Task	Injury Rate
1991	1484	604	41	**93**	14,938,582	**6.22**

Table 1.3 - 20 Year Combined

Year	#Surveys	#Respondents	%	Injuries (per million hrs.)	Hours on Task	Injury Rate
1991	2209	996	45	**250**	57,690,824	**4.33**

Comparable Statistics

To put the data in the proper perspective, it useful to look at accidental injury rates for some other activities. Table 1.4 shows published injury rates gathered from a variety of sources.

Table 1.4 - Comparable Statistics	
Program Activity	**Injury Rate Per Million Hours of Program Exposure**
Project Adventure (20 yr) Ropes Course - Zip Lines, etc	**4.33**
Project Adventure (15 yr) Ropes Course - Zip Lines, etc	**3.67**
Project Adventure (10 yr) Ropes Course - Zip Lines, etc	**5.13**
Backpacking[1]	192
Sailboarding[2]	220
Downhill Skiing[1]	724
Competitive Orienteering[3]	840
Basketball [4]	**2,650**
Soccer [4]	**4,500**

Table 1.5 show some additional accidental injury rates from a 1989 U.S. Department of Labor[5] survey on job related injuries. In this survey injury rates in different occupations are tracked. **It is interesting to note that roughly speaking participating in a Project Adventure program is approximately as risky as working in the field of real estate insurance or finance.**

Table 1.5 - Other Comparable Statistics[5]	
Occupational Activity	**Injury Rate Per Million Hours of Program Exposure**
Educational Services	8
Amusement and Recreational Services	19
Finance, Insurance, and Real Estate	**4.5**

The overall accidental injury rate for Adventure programs continues to be remarkably low. When considering this data, some important points should be kept in mind. Because the data in our study have been collected by programs' voluntary participation, we cannot be certain that programs with poorer safety records or less careful record keeping have been equally represented in the study. **Ideally, for every program with a relatively poor safety record, which did not participate in the study, there is a program with an excellent safety record also not participating.** For a study of this type, the relatively large number of total accumulated hours of participation - **more than 57 million hours over a 20-year period - is our best available indication of the relative accuracy of the data.**

The comparison with some competitive sports raises some interesting points. The level of activity undoubtedly accentuates the relative injury rate of some sports during the time of participation. For

most Adventure programs, participation includes not only periods of high-intensity activity, but also much less intense activity such as walking to the Ropes Course, or participating in a group discussion. Even non-contact sports, such as orienteering, will have much higher levels of "in motion" activity. Participants in Adventure games would certainly have a higher injury rate if we only measured the time during which they are 'in motion' during a game. **Even considering these factors, the measured injury rate for participation in Adventure programs is exceptionally low.**

Types of Injuries

Table 1.6 shows a breakdown of the types of injuries that resulted in lost time.

Table 1.6 - Types of Injuries Resulting in Lost Time Injuries

Injury Category	Number of Injuries
Broken Bones (general)	46
Broken Noses	6
Tendon and Ligament Injuries	8
Back Injuries/Back Strain	8
Sprains/Twists	5
Dislocations	4
Broken Teeth/Tooth Knocked Out	2
Concussion	2
Other	12
Total	**93**

Serious Injuries and Deaths

Serious injuries and deaths that occur while participants are engaged in Adventure activities are extremely uncommon. Unfortunately, they do occur and given sufficient hours of exposure are virtually inevitable. **The data we collected for this study included two reported deaths due to cardiac arrest**. Both incidents involved participants in corporate training programs that use Ropes Course activities. **Both participants were over the age of 50, and because of the underlying pre-existing conditions connected with heart failure, these incidents are classified as a medical incidents rather than as injuries.**

In recent years, many programs that have participants who are considered to be at greater risk for potential cardiac failure are implementing a variety of medical screening procedures. Age, high blood pressure, family history of heart disease, diabetes, smoking, and sedentary life style are all examples of factors that are recognized as being associated with increased risk of cardiac failure. And while the risk of heart failure can never be totally eliminated, medical screening is now being increasingly used to help reduce this risk.

If your program has participants that you believe may be at risk, we would encourage you seek additional information about current medical screening procedures from a well-qualified source.

Injuries by Element

Table 1.7 - Accident Class By Element				
Activities	**Total Injuries**	**Major**	**Minor**	**Medical**
Games, Initiatives*	**81**	**20**	**54**	**7**
Wall	38	**9**	27	2
Trust Fall from Height	35	**5**	30	0
Zip Wire	**26**	**9**	**16**	**1**
Mohawk Walk	23	**5**	18	0
Nitro Crossing	20	**7**	13	0
Pamper Pole	16	**6**	10	0
Hickory Jump	10	**3**	7	0
Electric Fence	7	**4**	3	0
Beam	6	**1**	5	0
Cat Walk	6	**2**	4	0
Swinging Log	5	**1**	4	0
Trolleys	5	**5**	0	0
All Aboard	4	**2**	2	0
Pamper Plank	4	**0**	3	1
Spider's Web	4	**1**	3	0
Swinging Tires	4	**2**	2	0
Fidget Ladder	3	**2**	1	0
Flying Squirrel	3	**0**	3	0
Rebirth	3	**1**	2	0
Tension Traverse	3	**1**	2	0
Dangle Duo	2	**1**	1	0
Heebie Jeebie	2	**1**	1	0
Inclined Log	2	**2**	0	0
Postman's Walk	2	**1**	1	0
Rappel Wall	2	**1**	1	0
Teeter Totter	2	**1**	1	0
Wild Woosey	2	**0**	2	0
Totals	**320**	**93**	**216**	**11**

When considering the information in Table 1.7, it is important to remember that not all elements are used with the same frequency. Some elements and activities are clearly more popular and consequently account for a greater amount of exposure to injury. For instance, the Trust Fall is a very popular activity and ranks third behind Games and the Wall in frequency of injury. It would be inaccurate to conclude that it is *necessarily* more likely to produce injuries than a less popular activity such as the Hanging Teeter Totter. Further study which considered the relative popularity of the different elements would be needed to make that type of determination.

Conclusion

The conclusions of the 20-Year Safety Study are similar to results of our earlier studies. **Over 20 years of Adventure programming has allowed us to record over 57 million participant hours. A total of 250 injuries were reported giving a overall injury rate of 4.33 injuries per million hours of participation.** Better reporting of injuries is believed to account for a slightly higher injury rate - **6.22 per million hours of participation - for the most recent five-year period. The overall accidental injury rate of participation in Project Adventure and other facility based Adventure programs is remarkably low. Participants in these programs are exposed to statistical injury rates which are significantly lower than many well accepted sports and other physical activities.**

References

[1] Gentile, Douglas A. et al: Wilderness Injuries and Illnesses. *Annals of Emergency Medicine* July 1992.
[2] McCormick D.P., Davis A.L.: Injuries in Sailboard Enthusiasts. *British Journal of Sports Medicine.* September 1988. Reprinted in *The Year Book of Sports Medicine,* 189, Shephard, Roy J. (ed.)
[3] McLean, I.; First Aid for Orienteering in Scotland. *Scientific Journal of Orienteering,* V: 2 Autumn 1990
[4] National Collegiate Athletic Association - *Injury Surveillance System* 1992/93 winter report.
[5] U.S. Dept of Labor: Bureau of Labor Statistics. Occupational Injuries and Illnesses in the U.S. by Industry, Washington, GPO, 1989, Bulletin #2328

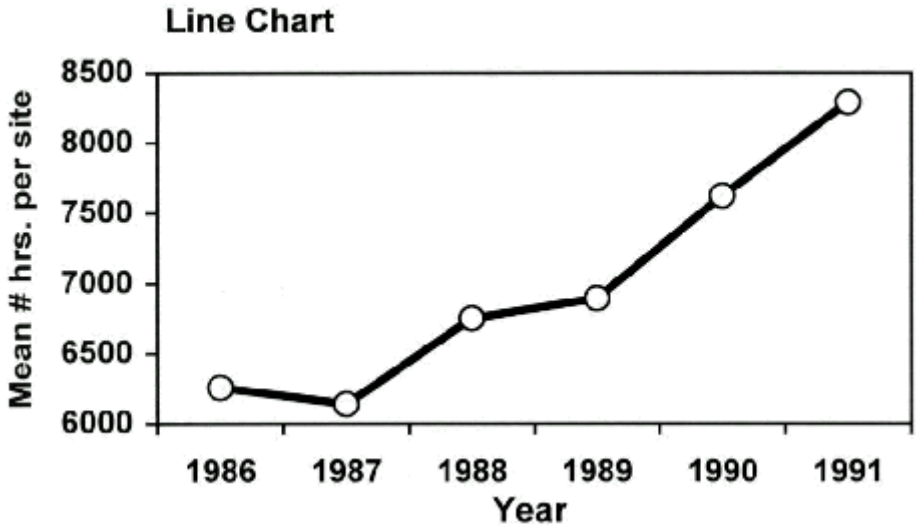
Appendix A: Survey Data 1986 - 1991

Analysis of Accident / Survey data:

This data was compiled from the 20 Year Study alone and reflects information gathered for the period 1986-1991.

- Total # of participants reported for the years 1986-1991: **2,292,834**
- Total # of participant hours reported for the years 1986-1991: **14,938,582**

Breakdown of participant hours: (mean # hours for each site)					
1986	**1987**	**1988**	**1989**	**1990**	**1991**
6257	6140	6753	6895	7626	8291



- Mean number of participants at each site per year: **870**
- Average time spent by each participant in Adventure Program: **20.73** hours.
- One participant in **26,055** falls victim to a major accident.
- One participant in **7,143** falls victim to an injury of any class (major, minor, medical incident).

*An informal survey of athletic coaches was conducted at the Boston University Department of Human Movement Studies. This revealed that, according to the reporting sample of 13 coaches, one out of every 5 athletes falls victim to a major injury during the course of a season for a varsity level team in each of the following sports: Soccer, Football, Basketball, and Baseball/Softball.

- Mean number of instructors per site: **6.9**
- Mean number of days of formal instruction /per instructor: **4.1**
- Average instructor/participant ratio: **1: 11.9**
- Mean # high elements per course: **6.9**; low: **10.3**

The following is a breakdown of injuries that occurred to *participants* and to *instructors*. It is an analysis based on *only* the years 1986 to 1991, since the information was unique to the 20 year study alone. The accident rates listed below conform to our earlier rate definition; that is, # of injuries per one million participant hours. It is based on 14,938,582 hours, the total number of hours reported for the years 1986-1991.

	Participant	**Instructor**	**Total**
Total Major Accident Rate:	**5.89**	5.09	.80
Total Minor Accident Rate:	**14.79**	13.19	1.60
Total Medical Incident Rate:	**.80**	.70	.10

The mean age of participants was 22 years (range=6 to 63 years of age) while the mean age of instructors was 33 years (range=18 to 60 years of age).