

Epidemiology of Chinese Martial Arts Injuries

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According to the Chinese Wushu Association, there are now 158 member countries and 120 million practitioners, yet research on Chinese martial arts injuries is limited. This study aims to examine the epidemiology of sports injuries among Chinese martial arts practitioners.

A descriptive cross-sectional survey design was used to collect data on injuries associated with Traditional Kungfu, Modern Wushu, Taichi, and Sanda practitioners aged 18 and above. The survey, distributed via email over eight weeks, included both open-ended and closed-ended questions, covering demographics, training history, and injury history. A total of 387 responses were received, with 239 complete responses included in the analysis.

Results showed 300 injuries among the 239 participants: 83 injuries in women, 207 in men, two in non-binary participants, and eight in participants who did not report their gender. The one-year cumulative incidence of injuries was higher in women (20.5%) than in men (17.1%), but this difference was not statistically significant ($p=0.589$).

Most respondents were from North America and Asia, with a majority practicing Traditional Kungfu followed by Modern Wushu. Female respondents were generally younger than male respondents. At least one injury was reported by 68.6% of participants, with 84.3% of injuries occurring during training. Lower extremity injuries were most frequent, with the knee being the most common injury site (26.0%), followed by the ankle (16.0%), a pattern consistent across genders.

This study fills the gap in research on the epidemiology of Chinese martial arts injuries, providing a foundation for future research. Limitations include the use of only two languages, the inclusion of participants aged 18 and above, and recall bias. Future research should aim for a larger sample size, targeted exercise prescriptions, and the involvement of athletic trainers in Chinese martial arts.

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1.0 Introduction and Literature Review

Chinese martial arts, originating from ancient Chinese civilization, are practiced in many countries around the world. With the increasing global influence of martial arts and the proliferation of competitions, the proficiency level of its practitioners has also been on the rise. However, injuries remain a perennial concern in all sports disciplines. Compared to other internationally recognized sports, the epidemiology of injuries in martial arts has not been extensively explored in existing literature. This research aims to understand the incidence, types, and characteristics of injuries associated with Chinese martial arts, specifically focusing on routines (Tao Lu, choreographed) and Sanda (Chinese boxing). To achieve this, we distributed surveys online and analyzed self-reported injuries from adult Chinese martial arts practitioners.

1.1 Chinese Martial Arts

Chinese martial arts include a wide variety of different combat styles, whose primary function ranges from self-defense to health and fitness, and competitive sport. Collectively, the many styles of Chinese martial arts are often referred to by the umbrella terms Kung fu (gōngfu), Kuoshu (guóshù), or Wushu (wǔshù). Originating in primitive society thousands of years ago,¹ they have developed into a family tree of different styles that represent an extensive culture. Historically, the practice of Chinese martial arts has evolved through several periods of rise and decline, but it remains very popular today. According to the IWUF's news report in 2022, approximately 120 million people practice Chinese martial arts worldwide.² However, practicing Chinese martial arts is very physically demanding. Sports injuries are a major concern and can adversely impact a practitioner's sports career. Understanding the burden of injury and associated factors in Chinese martial arts practitioners through effective scientific means can assist in maximizing training efficiency. In the future, this information can be used to design preventive and rehabilitation measures, decrease the incidence of injury, and improve health outcomes for Chinese martial arts practitioners.

1.2 Literature Review

1.2.1. Introduction to the Chinese Martial Arts

1.2.1.1 History of Chinese martial arts

Chinese Martial arts originated in primitive society many centuries ago. Legends from Chinese history include heroes such as Chi You, Shennong, and Huangdi that are considered to be representatives of early martial artists. As humans entered the Stone Age, the appearance of stone weapons such as stone cones, stone axes, and stone knives enhanced the combat capabilities of primitive humans. Martial arts skills have gradually become essential skills for human survival and self-defense, and they expressed their joy and victories against enemies in martial dances and wrestling.¹



Figure 1 Primitive Society Picture From Sandawang²

During the Xia, Shang, and Western Zhou Dynasties (between approximately 1600 BCE and 771 BCE), martial arts techniques and equipment were further refined, and war became a means for rulers to expand their territory and consolidate their power. Martial arts also became a prestigious component of society. Ideas from martial arts extended into the ‘six arts’, which

were an important part of the moral education of scholars in Chinese culture at the time. These were (1. (Lǐ) Rites or Etiquette 2. (Yuè) Music 3. (Shè) Archery 4. (Yù) Charioteering or Horse Riding 5. (Shū) Calligraphy or Writing 6. (Shù) Mathematics or Arithmetic). In the first four arts, there is a wealth of martial arts educational content. This content demonstrated it that martial arts had become a cultural phenomenon in ancient societies, playing an active role not only in military activities but also in other social activities. At the same time, unarmed combat skills and martial arts are also valued and blended with the thoughts and cultures of Xia, Shang, and Western Zhou.¹



Figure 2 Western Zhou Openwork Snake-Patterned Scabbard Sword. Courtesy Of The National Museum Of China

During the Spring and Autumn Period and the Warring States Period (Between 770 BCE and 221 BCE), wars were frequent, and martial arts skills were widely used. Weapons and

equipment such as swords, halberds, bows, and shields were continuously improved. Martial arts theory gradually developed, such as "Sun Tzu's Art of War" and other military books. During the Spring and Autumn Period and the Warring States Period, chivalrous culture began to rise. At the same time, the idea of health preservation was gradually integrated into the practice of martial arts.¹



Figure 3 Spring and Autumn Bronze Sword. Courtesy of the National Museum of China.

During the Qin and Han Dynasties (Between 221 BCE and 220 CE), martial arts training and weaponry in the army were further improved. The establishment of the martial arts system meant that skill in martial arts became an important criterion for selecting officials. During this

time, martial arts also started to be combined with Daoyin, a traditional Chinese exercise based on the principles of traditional Chinese medicine³, allowing practitioners to pursue both internal and external training. During the Wei, Jin, Southern and Northern Dynasties, the development of martial arts was diversified. Folk martial arts activities were rich and varied, and women's martial arts and martial arts exercises also gradually emerged. During the Sui and Tang Dynasties, the prominence of martial arts in Chinese society gradually declined, but martial arts still held a certain influence. Martial arts performances such as martial arts dance and Jiaodai began to emerge. At the same time, Daoyin's idea of health preservation gradually developed, emphasizing the maintenance of body and mind through martial arts exercises.¹



Figure 4 Qin Bronze Sword. Courtesy of the National Museum of China.

During the Ming and Qing Dynasties (The period from 1368 AD to 1912 AD), folk martial arts developed vigorously, forming a variety of schools and boxing methods, and martial arts organizations also began to appear. Daoyin health preservation was further combined with martial arts, emphasizing health preservation and prolonging life. In modern times, China faced aggressions and wars, and martial arts skills became an important part of the anti-aggression struggle and peasant war. With the increase of foreign exchanges in modern times, western sports and martial arts theories have had an impact on Chinese martial arts. After the founding of the People's Republic of China, Wushu became valued by the state, and was standardized as a

competitive national sport. A complete Wushu education system has been established, which has promoted the inheritance and development of Chinese Wushu. Wushu has become an important cultural heritage of China.¹



Figure 5 Ming Steel Sword. Courtesy of the National Museum of China.

1.2.1.2 The values of Chinese martial arts

1.2.1.2.1 The Spiritual Value of Chinese Martial Arts

Traditionally, the spiritual value of Chinese martial arts was manifested mainly in the aspects of being vigorous and promising, constantly striving for self-improvement, advocating martial arts, being a pillar of the nation, being patriotic, and fighting the enemy bravely. In the stable period, it was reflected more in the concepts of the harmony of body and mind, harmony between man and nature, strengthening the body and maintaining health, stretching muscles, its aesthetic beauty, and as a cultural symbol. The spiritual value of Chinese martial arts encourages

people to build a strong will and noble qualities, as well as integrate with national culture and spiritual traditions.⁴

1.2.1.2.2 The Biological Value of Chinese Martial Arts

Practicing Chinese martial arts involves movement of the muscles and joints of the whole body, so it is a relatively comprehensive exercise. Chinese martial arts can help people build coordination and balance of the internal and external environment and achieve the purpose of physical and mental health. The practice of Chinese martial arts helps maintain balance and stability of the body.^{5,6}

1.2.1.2.3 The Philosophical Value of Chinese Martial Arts

Chinese Martial Arts is a way to express the instinctive consciousness of human survival through powerful movements of the body. In practicing martial arts, students need to overcome themselves; overcome physical pain, fatigue, and injury; and cultivate a tenacious and unyielding spirit. unyielding spirit. At the same time, in competition with opponents, Chinese martial arts present contradictions of opposition and unity, and students need to use rational thinking and quick responses to turn a passive stance into an active one. This requires students of martial arts to not only pay attention to physical skills but also to the improvement of their mind and reflexes.⁷

1.2.1.2.4 The artistic and aesthetic value of Chinese martial arts

Chinese Martial Arts, as a sport, displays artistic value. The movements and skills of martial arts contain the beauty of human physique, strength, posture, and super-destructive power, presenting a simple, practical, and beautiful form of movement. The artistry of Chinese martial arts is not only for self-improvement and spiritual elevation, but also to help people discover,

understand and improve themselves, and be harmonious, beautiful, and objective with the natural world.⁸

1.2.1.2.5 The Psychological Value of Chinese Martial Arts

In Chinese martial arts training, there are many successes and failures. The process of experiencing success and failure will have a great impact on people's psychology and is of great value to people's physical and mental health, growth, and development. Through Chinese martial arts training, people can cultivate a mentality of tenacity, bravery, and self-confidence, and at the same time learn to accept failures, face challenges actively, and promote psychological strength.⁴

1.3 Classification of Chinese Martial Arts

There are a variety of ways that the different styles of Chinese martial arts have historically been classified. Some of the more common traditional ways to categorize them are by their region of origin, by their association with famous rivers and mountains, by the surname of the style's creator, or by the technical characteristics of the style.⁹ More recently, different styles have been categorized using the Form and Category classification method and the Function classification method. These are now widely used in organized competitions, as they are a more systematic and complete way to categorize the many styles.

The Form and Category Classification Method primarily categorizes martial arts based on their movement forms, namely the practice of routines (Tao Lu) and combat sports (Bo Dou), and their five main categories: Fist Techniques (Quan Shu), Weapon Techniques (Qi Xie), Sparring (Dui Lian), Collective Projects (Ji Ti), and Offensive and Defensive Techniques (Gong

Fang). Routines refer to pre-arranged sets of movements, which include individual practice and partner practice, with Fist Techniques and Weapon Techniques being part of individual practice. Sparring, on the other hand, involves two individuals engaging in a combat contest following specific rules, including disciplines such as Sanda (San Da), Tai Chi Push Hands (Taichi Tui Shou), and Short Weapons (Duan Bing).⁹

Table 1 Classification

Main Classification	Sub-Classification	Description/Types	Figures
Routines (Tao Lu) Modern	Fist Techniques (Quan Shu)	Long Fist (Chang Quan), Tai Chi Fist (Taichi Quan), Nan Fist (Nan Quan)	Fig. 6, Fig. 7, Fig. 8
	Weapon Techniques (Qi Xie)	Straight Sword (Jian Shu), Broad Sword (Dao Shu), Spear (Qiang Shu), Staff (Gun Shu)	Fig. 15, Fig. 16, Fig. 17 Fig. 18
Routines (Tao Lu) Traditional	Fist Techniques (Quan Shu)	Tai Chi Fist (Taichi Quan), Northern hand Systems, Southern hand Systems, other	Fig. 7, Fig. 9-11, Fig. 12,13 Fig. 14
	Weapon Techniques (Qi Xie)	Single weapon Double weapon Flexible weapon	Fig. 19, Fig. 20, Fig. 21
	Partner Practice (Dui Lian)	Unarmed Partner Practice, Weapon Partner Practice, Unarmed-Weapon Partner Practice	Fig. 22, Fig. 23, Fig. 24
	Collective Performance (Ji Ti)	Group practice of unarmed or weapon routines or a combination.	Fig. 25
Combat Sports (Bo Dou)	-	Sanda, Tai Chi Push Hands, Short Weapons (Duan Bing)	Fig. 26, Fig. 28, Fig. 29

1.3.1 Routines (Tao Lu):

Tao lu (choreographed routines) use combat movements as the main content, and routines and fighting as the main forms of exercise. Tao lu routines are similar in some ways to gymnastic floor routines. They can include dramatic spinning jumps, splits, strikes and kicks. It is a whole-body sport that requires high speed, explosive power, coordination, agility and flexibility, so sports injuries often occur in Tao Lu training. Routines are divided into several types, such as compulsory routines, Traditional Routine, Long Fist (Chuang Quan) optional routines, popularization routines, and instructional routines. These routines are composed of a series of movements and techniques derived from martial arts techniques, arranged according to the dichotomies of principles of offense and defense, movement and stillness, and strength and softness. Routines are further categorized into three practice formats: individual practice (Dan Lian), partner practice (Dui Lian), and collective performance (Ji Ti). Individual practice includes Fist techniques and weapon techniques, while partner practice includes unarmed sparring, weapon sparring, and unarmed-versus-weapon sparring.

1.3.1.1 Fist techniques (Quan Shu)

Fist Techniques refer to routine exercises performed without weapons. There are many different types of Fist Techniques, known as fist styles. Some major styles include Long Fist (Chang Quan), Tai Chi Fist (Taichi Quan), Southern Fist (Nan Quan), Xing Yi Fist (Xing Yi Quan), Bagua Palm (Ba Gua Zhuang), Eight Extremities Fist (Ba Ji Quan), Through-the-Back Fist (Tong Bei Quan), Pi Gua Fist (Pi Gua Quan), Tumbling Fist (Fan Zi Quan), Ground-Tumbling Fist (Di Tang Quan), and Animal Imitation Fist (Xiang Xing Quan), among others.

(1) Chang Quan: Chang Quan is a Quan technique composed of movements and techniques such as hand shape, technique, step shape, footwork, legwork, balance, jumping, jumping, flashing and moving, ups and downs, and turnings. Its sports are characterized by stretched posture, flexible movements, fast and powerful, and clear rhythm. It is the main event in competitive martial arts. Traditional Chang Quan includes Cha Quan and Hua Quan.



Figure 6 ChangQuan

(2) Taijiquan: Taijiquan is a soft, slow, coherent, and round Quan technique. It uses Peng - ward off; Lu - roll back; Ji - press; An - push; Cai - pull down; Lie - split; Zhou - elbow; Kou - shoulder; Jinpu - step forward; Tuipu - step backward; Zhougu - step to the left side; Youpan - step to the right side; Zhongding - central equilibrium etc. technical. Taijiquan is widely popular at home and abroad, mainly for fitness and self-cultivation, and it is also a competition event.



Figure 7 TaijiQuan

(3) Nan Quan: As the product of the combination of Southern Shaolin and other Quan styles with Quan styles from various parts of southern China, it has various technical routines. The characteristics are the routine is short and compact, the structure is compact, the movement is simple, the technique is changeable, the short-handed continuous strike, the footwork is steady, the attack is brave, often accompanied by sound cheers.



Figure 8 Nanquan

In addition to the three categories of Chang Tai Nan, Baguazhang and Xingyiquan are the traditional fist techniques also popular in the competition. Many other types of hand form can be simply divided into the northern traditional category, the southern traditional category, and others.



Figure 9 Northern Traditional Fanzi Quan



Figure 10 Northern Traditional Bajiquan



Figure 11 Northern Traditional Shaolin



Figure 12 Southern Traditional Hong Quan



Figure 13 Southern Traditional Nan Quan



Figure 14 Other Style - Monkey Hand

1.3.1.2 Weapon Techniques (Qi Xie)

Weapon Techniques encompass various routines involving short weapons, long weapons, double weapons, and soft weapons. Short weapons include straight swords, broad swords; long weapons include staffs, spears, and Pu Dao; double weapons include double knives, double swords, double hooks, double spears, and double whips; soft weapons include three-sectional staffs, nine-sectional whips, rope darts, and meteor hammers.

Some major individual practice weapon routines are:

(1) Straight Sword (Jian Shu): Straight Sword originated from the Shang Dynasty and consists of thrusting, pointing, scooping, hooking, intercepting, piercing, collapsing, and picking techniques, combined with footwork, steps, balance, and jumping movements to form routines. Sword techniques are characterized by light, nimble movements, agile footwork, and a combination of strength and softness.



Figure 15 Jianshu

(2) Broad Sword (Dao Shu): broad swords can be traced back to the Late Paleolithic Age. Knife routines include winding, contesting, chopping, hacking, scooping, and stabbing techniques, combined with footwork, steps, and jumping movements. The movements of broad swords

techniques are rapid, vigorous, and closely integrated with the body, showing a strong and bold character.



Figure 16 Daoshu

(3) Spear (Qiang Shu): Spear belongs to the category of long weapon martial arts and is one of the ancient weapons derived from sticks and Mao (A type of long implement from ancient China). Spear routines mainly include blocking, gripping, and thrusting techniques, with additional spear methods such as collapsing, pointing, hacking, piercing, and picking, combined with footwork, steps, and body movements. Spear Techniques are characterized by expansive movements, power concentrated at the spearhead, soaring up and down, and unpredictable changes.



Figure 17 Qiangshu

(4) Staff (Gun Shu): Staff techniques include techniques such as chopping, sweeping, swinging, thrusting, lifting, and picking, combined with footwork, steps, and jumping movements. Staff techniques are characterized by bravery, ferocity, a horizontal and sweeping style, and frequent use of combined techniques.



Figure 18 Gunshu

(5) Other Single Weapons:

Broadsword (large), fan, dagger, staff whip, cane, stick, crutch, spade, fork, tai chi sword (including 42-form tai chi sword), tai chi saber, tai chi spear, southern sword, southern staff, other weapons.¹⁰



Figure 19 One Of The Other Single Weapons

(6) Double Weapons:

Double swords, double straight swords (including long-tasseled double swords), double whips (including saber and whip), double hooks, double daggers, double axes, other double weapons.¹⁰



Figure 20 Shuangdao

(7) Soft Weapons:

Nine-section whip, nunchaku, three-section staff, meteor hammer, rope dart, and other soft weapons.¹⁰



Figure 21 Soft Weapon

1.3.1.3 Partner Practice (Dui Lian)

Partner Practice involves two or more individuals engaging in pre-arranged combat routines.

(1) Unarmed Partner Practice: Unarmed Partner Practice consists of sparring routines that use kicking, striking, grappling, and seizing techniques, following the principles of attack, defense, and counterattack. Common examples include fist techniques sparring, grappling sparring, southern fist partner practice, and xingyi fist partner practice, among others.



Figure 22 Unarmed Partner Practice

(2) **Weapon Partner Practice:** Weapon Partner Practice consists of routines using techniques such as chopping, hacking, striking, thrusting, blocking, parrying, and intercepting with weapons. It includes various forms, such as short weapon partner practice, long weapon partner practice, long and short weapon partner practice, single and double weapon partner practice, single and soft weapon partner practice, and double and soft weapon partner practice. Some common examples are single knife against spear, three-sectional staff against staff, double daggers against spear, double-staff, sword against dagger, and chopping knife against sword.



Figure 23 Weapon Partner Practice

(3) Unarmed-Weapon Partner Practice: Unarmed-Weapon Partner Practice involves one individual unarmed and the other holding a weapon, engaging in combat routines. Common examples include disarming a weapon from an opponent's hand, unarmed against a spear, and unarmed against double guns.



Figure 24 Unarmed-Weapon Partner Practice

1.3.1.4 Collective Performance (Ji Ti)

Collective Performance involves group practice of unarmed or weapon routines or a combination of both. In competitions, the requirement is usually for teams of 6 or more performers, showcasing routines such as collective basic skills, collective fist routines, collective knife routines, collective long-tassel sword routines, and collective offensive and defensive techniques. Teams must maintain a unified formation and consistent movements, and the formation patterns can be changed during the performance, sometimes accompanied by music.



Figure 25 Collective Performance Jiti

1.3.2 Combat Sports (Bo Dou)

Combat Sports refer to a form of combat where two individuals compete against each other using a set of specific rules. This category includes Sanda, tai chi push hands, and short weapons. Some combat sports widely practiced in China are Sanda, tai chi push hands, and short weapons (duan bing).

1.3.2.1 Sanda

Sanda has the characteristics of antagonism, protection and competition, and its training is more difficult. It is easy to get injured during training. Sanda is a competitive martial art in which two participants use kicking, striking, and grappling techniques to defeat their opponent. It is a popular martial arts sport that combines traditional Chinese martial arts with modern combat techniques.

1.3.2.1.1 Dress Code and Safety Equipment

For men, attire encompasses Sanda shorts and a vest, while for women it comprises Sanda shorts paired with a t-shirt. Both pieces of attire—shorts and vest or t-shirt— either in red or blue.

Safety equipment comes in two designated colors: red and blue. This equipment comprises a helmet, gloves, and a chest shield. Participants must also bring their own mouth guards, protective cups, and hand wraps. The protective cup is to be worn beneath the shorts, and hand wraps must range from 3.5m to 4.5m in length.



Figure 26 Sanda competition rules 2017

In the Junior and Children categories, gloves should weigh 230 grams. Within the Senior categories, gloves for women and for men's categories weighing 65kg or less will be 230 grams. For men competing in the 70kg and above categories, the gloves should weigh 280 grams.

Female contestants practicing the Islamic faith must wear the complete Islamic attire set and should avoid choosing items selectively.¹¹



Figure 27 Female Islamic faith

1.3.2.2 Tai Chi Push Hands

Tai Chi Push Hands is a two-person training exercise in Tai Chi, emphasizes to neither lose contact (separate) nor resist forcefully (push against). Practitioners use various hand techniques to sense and respond to the opponent's force, attempting to push them off balance or cause them to fall.¹²



Figure 28 Taichi Push Hands

1.3.2.3 Short Weapons (Duan Bing)

Short Weapons refer to combat sports involving short sticks made of rattan, leather, or cotton. Participants engage in combat within a circular area with a 16-foot diameter, following specific rules for striking, defending, piercing, collapsing, and blocking, to determine the winner.¹³



Figure 29 Duan Bing

1.3.3 The Function Classification

The function classification method focuses on the educational and social functions of Chinese martial arts. It includes three main categories.

1.3.3.1 School Chinese Martial Arts:

School Chinese Martial Arts emphasize the educational function of Chinese martial arts. The focus is on physical fitness, promoting national spirit, and cultivating qualities such as

discipline, respect, perseverance, and mindfulness. Through Chinese martial arts practice, students aim to achieve educational goals, enhance health and physical fitness, and instill these positive values.

1.3.3.2 Competitive Chinese Martial Art

Competitive Chinese Martial Arts mainly aim to achieve excellent athletic performance. It includes competitive disciplines and combat sports such as Sanda, Tai Chi Push Hands, and Short Weapons. The primary goal is to excel in competitions and follow specific rules.

1.3.3.3 Fitness Chinese Martial Arts

Fitness Martial Arts refer to various fist styles in traditional Chinese martial arts, as well as newly designed fitness routines with health promotion as the main objective. Fitness Chinese martial Arts are used as a means of exercise to improve health and physical fitness.

These two classification methods provide insights into the diverse and comprehensive nature of Chinese martial arts. As Chinese martial arts continue to develop, their content and forms continue to evolve and improve.¹⁴

1.4 The widespread practice of Chinese Martial Arts

1.4.1 Characteristics of Chinese Martial Arts Practitioners

1.4.1.1 Age

Chinese martial arts encompass a multitude of schools and styles. The age for starting martial arts is flexible, with specific training methods and routines suitable for all ages, from children to the elderly. Typically, Chinese martial artists could begin their systematic training or amateur hobby training early in childhood, between the ages of 6 and 8, while there's no fixed starting age for amateur enthusiasts.¹⁵

In China, Chinese martial arts enjoy a high level of popularity. Most cities and villages have their own Chinese martial arts schools, and there are also representative teams at the municipal and provincial levels. The national support for martial arts is evident, with policies such as "Chinese Martial Arts Talents" and the "Chinese Martial Arts into Schools" programs, ensuring that children are introduced to martial arts from a very young age. In other countries like the USA, the majority of Chinese martial arts schools typically accept students as young as 4-5 years old, and some specialized programs even accommodate children as young as 3. Also, it's not uncommon to see Chinese martial arts masters in their 70s or 80s over the world.

In terms of specific training content, Sanda, a Chinese martial art focusing on offense, defense, and actual combat, is usually better started at a younger age. Experts recommend beginning fundamental training at the age of 12, followed by a gradual progression to routines and actual combat training.¹⁶ Children under 12 have advantages in terms of body flexibility,

muscle memory, and recovery. Conversely, Tai Chi, a Chinese martial art that emphasizes internal harmony and balance, generally attracts an older demographic. Although in recent years, short video platforms have showcased children between 5-10 years old demonstrating exceptional Tai Chi skills, the core audience for Tai Chi remains adults and the elderly. Those wishing to transition into professional Tai Chi practice often pivot from Taolu disciplines in their teens.

Chinese martial art offers a realm of learning and development opportunities for practitioners of all age groups.

1.4.1.2 Sex

The discussion on Chinese martial arts and sex is rarely found in historical literature. Chinese Martial art fundamentally transcends it in both spirit and practice. In ancient times, men dominated the scene of martial arts because it was closely related to combat and the responsibility of protecting homes. However, as times changed, women not only began to venture into Chinese martial arts but also brought a fresh perspective, as seen in fields like Tai Chi and Wing Chun.

In modern society, countless female Chinese martial artists have achieved brilliant results in this field, competing and performing alongside men. Among the many branches of Chinese martial arts, whether it's Taolu, Sanda or others, both men and women are provided with equal opportunities for learning and training. Naturally, physiological differences between men and women lead to some nuances in Chinese martial arts practice. For instance, men might have an advantage in explosive power, while women often excel in flexibility and coordination. These

inherent differences add a rich diversity to Chinese martial arts, allowing individuals of all types to choose the most suitable practice style based on their characteristics.

Although in certain traditional cultures and communities, women's participation in Chinese martial arts or other sports activities is still restricted, this phenomenon is gradually diminishing with globalization and the changes in societal views. Nowadays, in international competitions, we see an increasing number of female athletes wearing headscarves and adhering to certain dress codes. Every style and school of Chinese martial arts has its uniqueness, some might be more suited for a particular gender, but broadly speaking, Chinese martial arts welcome every enthusiast. Importantly, Chinese martial arts are not just physical exercises; they profoundly shape emotions and minds. Cultivating resilience, focus, and confidence through Chinese martial arts is gender neutral. Observing the actual composition of participants, men still make up a significant portion in Chinese martial arts routines and Sanda, whereas in community Tai Chi activities, female participants are more active.

1.4.2 Geographic Distribution

The geographic distribution of Chinese martial arts reflects a rich tradition deeply influenced by history, culture, and societal factors. China, as the cradle of many martial arts, boasts a profound martial arts heritage. Today, the allure of Chinese martial arts has transcended borders, capturing global attention and study. According to the Chinese Wushu Association, there are now 158 member countries. There are 40 national martial arts associations in Africa, 39 in Asia, 46 in Europe, 9 in Oceania, and 24 in Pan America. These figures reflect that Chinese martial arts has been actively promoted and widely accepted by audiences in different regions.¹⁷

Countries that develop Chinese martial arts well mainly include the United States¹⁸, Canada¹⁹, the United Kingdom²⁰, France²¹, Australia²², Singapore²³ and Malaysia²⁴. There are a large number of martial arts gyms, schools and groups in these countries, which provide various types of Chinese martial arts training and are popular with local residents and students. In these countries, Chinese martial arts have gradually become a popular fitness sport and cultural element. The United States, as one of the countries where Chinese martial arts have been widely spread and developed overseas, not only has many martial arts masters and coaches, but also holds martial arts performances and training courses of various sizes. There are also many martial arts schools and groups in Canada¹⁹, the United Kingdom²⁰, France²¹, and Australia²² dedicated to promoting Chinese martial arts. In addition, Singapore²³ and Malaysia²⁴ have numerous martial arts gyms and schools.

1.4.3 The Popularity of Chinese Martial Arts

According to IWUF 2023 news, there are currently about 120 million people practicing Chinese martial arts in the world, of which more than 50% are young people.¹¹ According to the official data from The HYX 16th World Wushu Championships (WWC), over 80 countries are anticipated to participate, with 600-800 athletes from across the globe attending. Additionally, 1,200-1,500 international delegates/participants are expected.²⁵ After more than 30 years of development, the International Wushu Federation (IWUF) has grown into member associations in 156 countries and regions across five continents. In 2021, the International Wushu Federation officially became a member of the International World Games Association, an achievement that marks the wide recognition of Wushu on the international sports arena. The 2026 Dakar Youth Olympic Games have been confirmed to include Chinese martial arts.²⁶ This means that Wushu

will be displayed on the Olympic stage as an official event, bringing competitions to audiences around the world. .¹¹

1.4.3 1 Chinese martial arts and Olympics

On January 8, 2020, the International Olympic Committee announced in Lausanne that Chinese martial arts will be included in the 2022 Dakar Summer Youth Olympic Games (postponed to 2026). This is the first time Wushu has become an official event in the Olympic series. So far, the 2026 Dakar Youth Olympic Games has added 7 competition events including Chinese martial arts in addition to the original 28 major events. As early as 2001, the International Wushu Federation applied for the first time for Wushu to become an official event of the Olympic Games.

The official inclusion of Wushu in the Olympic series will provide more young people with the opportunity to show their skills, and will further enhance the popularity of Wushu around the world.²⁶

1.4.3 2 Chinese martial arts and school

1.4.3.2.1 Chinese martial arts and school In China

In China, more and more schools have introduced Chinese martial arts into their campuses, from kindergarten²⁷ to collage²⁸ . Through Chinese martial arts education and the promotion of the spirit of Chinese martial arts, young people can learn about traditional Chinese culture while practicing Chinese martial arts. With the improvement of people's health awareness, schools pay more and more attention to the all-round development of students.

Wushu, as a traditional culture and sport, is regarded as an educational method beneficial to the healthy growth of young people.

At the same time, Chinese martial arts is not only a kind of sports skills, but also a kind of cultural heritage. In the process of learning Wushu, students can understand the historical origin, philosophy and values of traditional Chinese Wushu. Chinese martial arts emphasize the integration of martial arts and morality, so that students know how to respect teachers, be patient and tolerant, and cultivate a personality with noble qualities and spiritual pursuits.

Introducing Chinese martial arts education in schools is also helpful to cultivate students' self-confidence and self-protection awareness. By learning Chinese martial arts skills and tactics, students can better protect themselves when encountering danger, improve safety awareness, and enhance self-protection ability. Therefore, more and more schools incorporate Chinese martial arts into their curriculum, offer elective courses of Chinese martial arts or campus Chinese martial arts clubs, and provide students with a variety of extracurricular activities and physical exercise methods.²⁹

1.4.3.2.2 The practice of Chinese martial arts in the USA

The United States is one of the countries where Chinese martial arts are spread the most overseas. It has a large number of Chinese martial arts gyms and schools that provide various types of Chinese martial arts training.

In the late 19th and early 20th centuries, some Chinese martial artists brought their Chinese martial arts skills to the United States with the arrival of Chinese immigrants. Most of these early martial artists came from regions such as Guangdong and Fujian, and they passed on Chinese martial arts through community groups and individual teaching.³⁰

In the late 1960s and early 1970s, the famous Chinese martial arts movie star Bruce Lee achieved great success in the United States, and his films and teaching were deeply loved by American audiences. Bruce Lee's influence not only drove the upsurge of Chinese martial arts movies, but also attracted a large number of Americans' interest in Chinese martial arts.³¹

The development of Chinese martial arts in the United States has also benefited from the holding of various Chinese martial arts competitions and competitive activities. These competitions increase the popularity and recognition of Chinese martial arts in the United States. Chinese martial arts troupes and coaches often conduct tours and training activities in the United States³², and American Chinese martial arts enthusiasts also actively go to China to study and communicate.³³

With the popularity of Chinese martial arts in the United States, more and more Chinese martial arts academies and gymnasiums have been established across the United States. The number of Chinese martial arts schools in the United States varies widely, and determining an exact number can be difficult. But taking Pittsburgh as an example, Google Maps shows that there are 17 Chinese martial arts gyms³⁴. These Chinese martial arts halls provide opportunities for local residents and students to learn and practice Chinese martial arts, and also reflect the popularity and popularity of Chinese martial art.

1.4.4 Competitions

1.4.4 1 IWUF Official Events

The six major events hosted by the International Wushu Federation (IWUF) demonstrate the diversity and competitive level of Wushu on a global scale.

Table 2 Six Major Events by IWUF

Event Name	Description	Frequency	Participants & Competition Details
World Wushu Championship (WWC) ³⁵	The highest-level world-class event in the Chinese martial arts competition.	Every two years	Including routine and Sanda competitions. It is participated by national teams composed of players from all over the world.
World Junior Wushu Championships (WJWC) ³⁶	World-class event for young professional Chinese martial arts athletes.	Every two years	The highest-level world-class Chinese martial arts event among young people, demonstrating the future development of martial arts.
World Kungfu Championships (WKFC) ³⁷	World-class event for traditional Chinese martial arts practitioners all over the world.	Every two years	For traditional Chinese martial arts practitioners; focus on display, communication, and promotion.
Wushu Sanda World Cup (SWC) ³⁸	Competitive platform for professional Sanda players around the world.	Every two years	Top 3 players from each weight class in the WWC; showcases top level of Sanda competition.
Wushu Taolu World Cup (TWC) ³⁹	Focuses on the competition of Wushu routine players.	Every two years	Top eight players in the WWC; platform for elite routine players to compete and learn.
World Tai Chi Championships (WTJQC) ⁴⁰	World-class event for Tai Chi events.	Every two years	Covers Tai Chi and Tai Chi swords; emphasizing patience, balance and harmony; platform for communication and discussion.

1.4.4 2 Wushu in Multi-sport Games

Table 3 Wushu in Multi-sport Games

Event Name	Description	Wushu Inclusion
International Wushu Federation (IWUF)	Established in 1990, serves as a major international body for Wushu.	Significant in promoting Wushu's international influence and popularity.
Asian Games (Asian Games)	One of the most important comprehensive sports games in Asia. Established in 1951.	Gradually became an official event, showcasing Wushu's prominence in the Asian sports scene.
The World Games	Important international multi-sports event.	Wushu is included, providing a platform for martial arts athletes globally to compete and showcase.
World Chinese Martial Arts Games	Global Chinese martial arts competition.	Organized by the International Chinese Martial Arts Federation to promote and develop Chinese martial arts internationally.
World University Summer Games & World University Individual Championships	International games for college students.	Wushu is one of the events, attracting young Chinese martial arts athletes worldwide for competition and exchange.
African Youth Games	Comprehensive games for African regions.	Wushu is a competitive event, aiding in spreading and popularizing the art in the African region.
Islamic Solidarity Games	Comprehensive games for Islamic solidarity countries.	Wushu is included as a competitive event, promoting the art's dissemination in Islamic countries.
Asia-Pacific Veteran Games	Focuses on sports activities of the elderly.	Wushu is included, offering a platform for elderly Chinese martial arts enthusiasts to showcase their skills and interact.

1.4.5 Tai Chi

Tai Chi has played an important and unique role in the promotion and inheritance of Chinese martial arts. It is famous for its unique exercises and slow-flowing movement postures and is deeply loved and recognized by Chinese martial arts enthusiasts at home and abroad. Statistics show that in 2018 alone, the number of Taijiquan participants (aged 6 and above) in the United States was about 3.76 million.⁴² Tai Chi, short for Tai chi chüan, sometimes called “shadowboxing”,⁴³⁻⁴⁵ is a Chinese martial art practiced for defense training, health benefits and meditation. Tai chi has practitioners worldwide from Asia to the Americas. Tai Chi was created and developed based on the traditional Chinese Confucian and Taoist philosophy while it takes the dialectical concept of yin and yang as its core idea and from a traditional Chinese boxing methodology that combines rigidity and softness.⁴⁶ Quite a lot of those publications about Tai Chi have shown that long-time Tai Chi practice has positive effects on balance, headaches, depression, and more.^{6,47-56}

1.5 Injuries in Chinese Martial Arts

1.5.1 Overview of Chinese Martial Arts Injuries

The NIH states that "sports injury" is a term used to describe injuries typically sustained during sports or physical activity.⁵⁷ The different branches of Chinese martial arts each tend to involve distinct kinds of sports injuries.

Taolu, the portion of Chinese martial arts consisting of choreographed routines based on combat moves, emphasizes a blend of offense and defense, movements that alternate between fast and slow, hard and soft, real and feigned. Such routines demand peak levels of speed, explosive power, and coordination, inevitably leading to various injuries.

For example, Nanquan (southern fist) routines often include an aerial kick where the practitioner must make a difficult jump and then land with their weight balanced on one leg. This move can cause contusion of the meniscus in the knee if the practitioner lands with a straight leg instead of bending it for cushioning. In other cases, ligament sprains can result from joints moving beyond their normal range, tearing the ligaments. Commonly affected joints in martial arts include the ankles, knees, wrists, and elbows. An example would be ankle sprains caused by improper landings after aerial moves like spinning kicks. Muscle strains occur due to vigorous contractions or overstretching. Common strains in martial arts affect the hamstrings or the adductor muscles of the thighs.⁵⁸

In Sanda, Chinese martial arts are used in sport combat. Although participants wear protective gear, injuries in Sanda are often the result of strikes from the opponent. Attacks mainly target the head, torso, thighs, and shins, leading to injuries in areas such as the head, neck, shoulders, arms, knee joints, and ankle joints.⁵⁹

Many studies have proved that Tai Chi is beneficial to the body, but there are also sports injuries during the practice of Tai Chi. Although Tai Chi is a low-intensity martial art, it demands a lot of leg strength and endurance, with the knees being the most common injury site⁶⁰.

1.5.2 Incidence

Very few studies have described incidence of injuries in martial arts routines. In Sanda, based on a survey with 235 valid responses (167 male and 68 female respondents), reported injuries frequency was: arms and ankles injuries each affected 19.15% of respondents, knee joints: 14.47%, shoulders: 12.77%, torso: 8.51%, head: 5.1%, and neck: 0.43%. However, it is unclear over what period these occurrences were measured.⁵⁹

1.5.3 Anatomical Location

The anatomical locations of martial arts injuries vary depending on the specific style and techniques practiced. However, common sites include joints such as the waist, knees and ankles.⁶¹ Soft tissues like muscles, ligaments, and tendons in the arms, legs, and torso are also frequently affected.⁶² The nature of Sanda often results in injuries to the head, and torso due to strikes,⁶³ while Tai Chi commonly affects the knees due to emphasis on leg strength and stability.⁶⁴

1.5.4 Injury Epidemiology Studies Among Chinese Martial Arts

There are very few studies related to Chinese martial arts sports injuries available on PubMed. In the realm of martial arts, ankle injuries among athletes are a prevalent concern. In a study conducted by Ning Yu, 16 martial arts athletes were selected and underwent six weeks of ankle proprioceptive training. This research took place at the Shaanxi Police College in Xi'an,

China. The findings suggest that through ankle proprioceptive training, there is a notable improvement in the dynamic and static balance of martial arts athletes, effectively reducing the risk of ankle injuries. This provides valuable insights for athletic training and rehabilitation, emphasizing the importance of proprioceptive training in martial arts and other high-intensity sports.⁶⁵

In a study led by Jinqian Zhang and conducted at the Department of Physical Education, Jeonbuk National University in the Republic of Korea, the focus was directed towards a comprehensive understanding of martial arts sports, particularly examining the influences of sports biomechanics and neuromuscular control. The population studied primarily consisted of professional Sanda athletes. The chief objective of this research was to analyze the impact of sports biomechanics on martial arts and comprehensive neuromuscular control. However, specific details regarding location incidence, type of surgery, or medical care recommendations were not explicitly mentioned in the text provided. Nevertheless, this investigation provides insights into the intricate relationship between martial arts, neuromuscular control, and sports biomechanics, holding implications for future training methodologies and athletes' health management in the field of martial arts.⁶⁶

Meng Xue, Yan Liu, and XiaoMei Cai, affiliated with institutions in GuangDong, China, spearheaded research focusing on knee joint injuries resulting from martial arts activities. Their study was conducted across several institutions: Jiangmen Polytechnic, Department of Orthopedic Surgery at Jiangmen TCM Affiliated Hospital of Jinan University, and JiangMen Chinese Medical College. The primary goal was to devise and assess a deep learning model tailored for monitoring martial arts-induced knee injuries. To achieve this, MRI images of the knees from 1,546 patients, taken between 2015 and 2020, were collated. These images were

categorized into six types of injuries, including meniscus, tendon, ligament, and more. Upon establishing a knee MRI database, the data was segmented into training, validation, and test sets. Subsequently, a deep neural network was trained to locate and categorize injury types. The model demonstrated an average accuracy of 86.0% across all injury types. Its sensitivity and specificity were 91.3% and 87.3%, respectively. In conclusion, utilizing deep learning for diagnosing martial arts-related knee injuries can substantially enhance diagnostic efficacy, lessen diagnostic durations, cut down misdiagnosis rates, and offer valuable surgical decision support.⁶⁷

In research conducted by Di Wang, Xiao-Mei Lin, and their colleagues, the potential of the Functional Movement Screen (FMS) method in identifying previously injured Wushu athletes was evaluated. The study was carried out across various institutions, including Zhejiang University, Hangzhou, the University of Helsinki, and the South-Eastern Finland University of Applied Sciences. A total of 84 Chinese Wushu athletes, with an average age of 15.1 years and a minimum of two years of professional training in Taiji, Changquan, or Nanquan, were the subjects of this investigation. Their evaluation involved the FMS, while video recordings ensured accurate scoring. Previous injuries were determined through direct interviews. Results highlighted an optimal FMS score cut-off of less than 16 as a potential indicator of increased injury risk, with a sensitivity of 80% and specificity of 56%. Notably, the athlete's training type and levels were found to be associated with FMS scores. A significant portion of participants (58%) displayed FMS asymmetry, and 21% reported pain during the FMS exercises. This research provides a foundation for future studies, suggesting the use of an FMS cut-off of 16 points when assessing Wushu athletes for injury risk.⁶⁸ These articles provide insights into the prevention, identification, and detection of martial arts-related injuries, contributing to the understanding and improvement of athlete safety in Chinese martial arts sports.

Zhang Juanhui and Du Hongmei conducted a survey on Chinese martial arts routines in athletes in Xinjiang colleges and obtained the following conclusions: The three main locations prone to injuries among the athletes are the knee joint, accounting for 40% of the total; followed by the waist, accounting for 22%; and the ankle joint, accounting for 14%.⁶⁹ Similarly, Zhu Cheng and Zhang Feng surveyed 50 Chinese martial arts routine athletes from Shandong Normal University and found that all of them had experienced injuries. The most commonly injured areas were the waist (50%), followed by the knee joint (20%), and the ankle joint (12%).⁷⁰ In another study by Chen Fang, a survey was conducted among 60 youth male and female Chinese martial arts routines athletes from four sports schools in Jiangsu Province. The results showed that the most frequent injuries occurred in the waist (54 times), followed by the knee (38 times), thigh (25 times), ankle (20 times), neck (15 times), wrist (12 times), shoulder (9 times), and chest (8 times), and lower leg (5 times). The study didn't separate participants by sex.⁷¹ Ma Zhiming and Ji Yanyan conducted a questionnaire survey on 14 female Chinese martial arts team members in Jiangsu and found that all of them had a high injury incidence of 100%. The most common injuries were joint injuries (10 athletes), muscle injuries (6 athletes), bone injuries (5 athletes), ligament strains (3 athletes), and external injuries (2 athletes).⁷² Additionally, Xing Yachen investigated 30 Chinese martial arts routines athletes from the Shanxi Chinese Martial Arts Sports Management Center and found that most of them had experienced injuries, with joint injuries, waist muscle fatigue injuries, ligament injuries, and external injuries being the most common.⁷³ The reasons for the injuries reported by scholars varied. Zhang Juanhui and Du Hongmei found that insufficient preparation activities before training, incorrect technical movements, and lack of concentration during training were the main causes of injuries among the athletes. Ma Zhiming and Ji Yanyan identified incorrect technique and movement (35%),

unreasonable training load (24%), insufficient preparation activities (20%), and emotional and physical factors (14%) as the primary causes of injuries. Zhu cheng and Zhang Feng cited various factors such as insufficient preparation, training with existing injuries, poor self-protection awareness, excessive training load, lack of timely treatment and adjustment after injury, excessive excitement, and environmental factors. To prevent injuries, scholars recommended conducting adequate warm-up activities, proper training load management, strengthening medical supervision, and adopting appropriate rehabilitation training for chronic injuries. They also advised using physical therapy methods, such as ice and heat treatment, physiotherapy, massage, and acupuncture, to accelerate the recovery of injured tissues. Additionally, emphasizing mental focus, proper attitude, and relaxation after training to relieve muscle fatigue were suggested as preventive measures.⁷⁴

A thorough exploration was conducted by Gao Shenghao, Tao Ping, and Zhao Yue of Northeast Normal University's School of Physical Education, utilizing literature review, expert interviews, and questionnaire surveys. The study focused on a population of 30 Wuying-level athletes. It revealed that the primary types of injuries in this particular group include muscle fatigue, joint ligament injuries, and tendon strains, with muscle fatigue being the most common. A significant number of these injuries are concentrated in the lower limbs and torso. In terms of temporal and geographical distribution, injuries are more frequent during the cold dry winters and hot rainy summers, especially during specialized technical training sessions. To mitigate the risk of sports injuries, the researchers recommended enhanced medical supervision for athletes and improvements in the medical care system. Additionally, they advised organizing training activities scientifically and rationally and proposed establishing a physical training and sports rehabilitation support team to ensure the athletes' health and training effectiveness.⁷⁵

In a study conducted by Guo Weiquan and Li Ming at Shanxi Normal University, the risks associated with high-level martial arts competition athletes were explored in depth. The study's purpose was to enhance awareness among athletes, coaches, and team leaders regarding competition risks and improve performance outcomes. By understanding the general characteristics of competition risks, the research aimed to provide a theoretical basis for daily training, thus preventing unexpected events and safeguarding athlete safety. The researchers employed various methods including literature reviews, where 83 articles were consulted; expert interviews, particularly focusing on professional coaches' perspectives on risk management during competitions; and a comprehensive questionnaire distributed to 320 participants, ensuring its quality and relevance. The findings revealed multiple sources of risk for competitive athletes. Among environmental factors, competition rules and procedures, competition venues and equipment, climatic and geographical influences, coaching quality, team management, and referee decisions were identified as significant contributors. Regarding the athlete's personal factors, technical capabilities, physical fitness, psychological state, past injuries, self-management, and competition experience were all highlighted. From a holistic perspective combining both environmental and athlete-specific factors, technical risks ranked first, followed by psychological risks and competition experience. Conclusively, it was emphasized that athletes should focus on technical practice, ensure stable performance of challenging movements, prioritize post-training recovery, and be aware of potential injury risks. The importance of a clear competitive mindset, especially when dealing with injuries, was also underscored. Educating both athletes and coaches on competition risks and establishing a comprehensive risk education system were recommended. The study also highlighted the pitfalls of traditional thinking and called for more modern, proactive approaches. The need for psychological guidance concerning

risk education and further development of a comprehensive risk education system, keeping in mind the athlete's unique circumstances, was also suggested. By emphasizing these areas in daily training, the study aimed to prevent unforeseen incidents.⁷⁶

In an investigation of martial arts injuries among university students in China, researchers Ruitian and Jianjiao from Wuhan Sports University delved into the risks associated with "Sanda" or Chinese kickboxing, a prominent sport in China's university curriculum. As China propels forward with its health-centric "Healthy China" and "Sports Superpower" initiatives, understanding the causes and patterns of these injuries becomes vital. The study combined literature reviews, instructor interviews, and a survey of 565 Sanda university students from 31 Chinese institutions conducted between September to December 2020. Results revealed a significant 73% of respondents had suffered Sanda-related injuries. Chronic injuries emerged as the most predominant, representing almost 40% of the reported injuries. Soft tissue injuries, including ligament strains and abrasions, were particularly common, affecting over half of the injured participants. The lower extremities, such as the legs and feet, bore the brunt of these injuries, accounting for over 70% of the cases. A notable 85% felt their injuries hindered their technical performance. Conclusively, while Sanda holds cultural and physical significance in Chinese universities, its practice brings a host of injuries, mostly chronic and soft tissue related. The findings stress the urgency for preventive measures and better injury-awareness programs for both instructors and students.⁶³

1.5.5 Insufficiencies in Existing Research and Gaps in Knowledge

In recent years, international scholars' research on Chinese martial arts injuries mainly focuses on the prevention and treatment of specific types of the injury. For example, some studies focus on common injury-prone areas such as the knee, lower back, and ankle, and explore training and protection measures for these areas. However, the overall small number of studies may have limited a comprehensive understanding of sports injuries in Chinese martial arts. Because most studies focus on specific groups, such as competitive Chinese martial arts athletes, they may not cover broader populations, such as traditional Chinese martial arts enthusiasts or general practitioners. Therefore, the knowledge of sports injury status and prevention strategies in the broad Chinese martial arts population is still relatively limited.

In the study of Chinese martial arts in China, although many researchers have conducted investigations and studies on Chinese martial arts sports injuries, because most of the survey participants are from the same training team or training level, the research results may be limited by the characteristics of these specific groups, and it is difficult to fully represent the overall situation of Chinese Wushu athletes around the world. Therefore, it is necessary to conduct comprehensive research on a wider population to obtain more comprehensive and accurate data and conclusions.

In order to better understand the characteristics and influencing factors of Chinese Wushu sports injuries, this study will expand the scope of the survey subjects to include Wushu enthusiasts and athletes of different ages, genders, and practice levels.

1.6. Methodological Considerations

1.6.1 Self-Report Survey

The chosen methodology for this study involves utilizing a self-report survey to collect data on the injury history of participants. This approach will enable us to gather comprehensive information about injuries sustained during the training and practice of Chinese martial arts. The survey will include questions designed to cover various aspects of injuries, training practices, and competition experiences.

To ensure a diverse and representative sample, the survey will be distributed through both in-person and online channels. This approach aims to maximize efficiency and accessibility for participants, allowing them to complete the survey conveniently within a reasonable time frame. The data collection period is set to span approximately 3 months to ensure a sufficient and robust dataset for analysis.

Furthermore, the study will encompass practitioners involved in all styles of traditional and contemporary kung fu, taichi, and sparring, including both competitive and non-competitive environments. This broad inclusion criterion will enable us to gain insights into a wide range of injury patterns and factors associated with Chinese martial arts training.

To maintain participant anonymity and minimize potential biases, the study will not collect identifying data.

Self-reporting is a commonly employed method for gathering data about an individual's health condition and their engagement with healthcare services.⁷⁷ This approach has been instrumental in evaluating a variety of health behaviors, particularly in determining the frequency of health risk factors and the uptake of preventive care.⁷⁸

The use of in-person and online survey distribution will enhance participant reach and increase the likelihood of obtaining a diverse and representative sample of Chinese martial arts practitioners.

1.6.2 Problem Statement

Despite the large number of Chinese martial arts practitioners, research on the prevalence of injuries in Chinese martial arts is relatively insufficient. The unique characteristics of these Eastern traditional sports have not been fully integrated into the Western field of sports medicine. Therefore, there is currently a research gap, and it is necessary to further explore the related issues of Chinese martial arts injuries.

1.6.3. Study Purpose

The purpose of this study is to examine the epidemiology of sports injuries in Chinese martial arts practitioners.

1.6.4. Specific Aims/Hypotheses

Specific Aim 1: Describe the frequency of injuries within a sample of Chinese martial arts practitioners.

Specific Aim 2: Identify injury anatomic locations, cause, type, and nature of musculoskeletal injuries,) training factors (such as training intensity, and training technique), and competition factors (such as competition size, and competition environment) among Chinese martial arts practitioners.

Specific Aim 3: Compare the patterns of injuries by sex and age.

1.6.5. Study Significance

This study aims to strengthen the understanding of sports injuries to inform accurate, evidence-based guidance for Chinese martial arts practitioners, athletes, and coaches. The results of this study will fill in gaps in research of Chinese martial arts injuries and will provide a clear direction and focus for future research. Through an in-depth understanding of the characteristics and influencing factors of sports injuries, targeted prevention strategies and rehabilitation programs can be formulated to ensure the health and safety of Chinese martial arts practitioners.

2.0 Methods

2.1 Experimental Design

A descriptive cross-sectional survey study design was used to gather data on the injuries associated with Chinese martial arts training. The research aimed to categorize and describe injuries based on factors such as injury severity, type, and the region affected.

Independent variables include gender, age, practice time, routines, location.

Dependent variables include type, severity, location, incidence of injury, environment.

2.2 Subject Recruitment

In this research, we used a systematic recruitment strategy to maximize the number of potential participants. Our targeted demographic only included adults.

Within several key regions, we established communication with selected, representative Chinese martial arts schools, reaching out to their respective head coaches and chief instructors. They were invited to assist in forwarding the survey to all members or students of their institutions.

Our online recruitment strategy utilized social media channels and targeted email campaigns. These efforts were particularly directed towards major martial arts education and training institutions, as well as individual martial arts practitioners.

We also collaborated with various local martial arts schools and training centers, allowing us to directly distribute the survey during their classes, competitions, or specialized seminars.

To ensure optimal participation rates, we incorporated several engagement strategies, which included, but were not limited to: regular reminders to potential participants, continual encouragement for survey completion, and other participatory incentives. To further expand our participant database, considerations were also made to recruit from martial arts competitions, specific resources within the U.S., Chinese partnerships, and other relevant Chinese martial arts websites.

To safeguard privacy, the survey in this study did not collect or record any identifiable information about the participants, such as names, addresses or birthdates. While this research welcomed participation from all qualified individuals, it's imperative to clarify that, due to resource and practical constraints, we neither planned nor anticipated to reach all martial arts practitioners or schools globally.

2.3 Subject Characteristics

Subjects included individuals of various genders and diverse demographics who have practiced Chinese martial arts in numerous locations, encompassing all styles of Traditional Kung fu and Modern Wushu, Taichi, and Sanda.

Inclusion Criteria:

Chinese martial arts practitioners, covering Traditional Kungfu and Mordern Wushu, Taichi, and Sanda styles.

Exclusion Criteria:

Individuals who do not currently participate in Chinese martial arts.

Individuals who are not able to understand English or Chinese.

Individuals under 18 years old.

2.4 Power Analysis

In this descriptive study, surveys were distributed to Chinese martial arts practitioners within the specified regions, targeting Traditional Kungfu and Modern Wushu, Taichi, and Sanda. The aim was to receive approximately 200 completed questionnaires to achieve a suitable level of statistical power. Based on the number of Chinese martial arts schools and practitioners in the targeted areas, and the anticipated response rate, it was expected that around 200 responses would be collected. This sample size ensured that sufficient data was available to discern patterns by using a non-probabilistic sampling method (convenience and snowball sampling techniques).

2.5 Instrumentation*

The surveys were crafted using both open-ended and closed-ended questions to glean comprehensive insights from the participants. For the electronic version, branch logic was incorporated to seamlessly guide participants through pertinent sections and bypass those deemed irrelevant based on prior responses. The online survey, created with Qualtrics Online Software,

offered an estimated time ranging between 5 to 20 minutes. The survey questionnaire also provided a Chinese translation to facilitate its use by Mandarin-speaking participants.

2.6 Procedures

2.6.1 Survey Distribution

Collaborative efforts were initiated with Chinese martial arts schools in both the US and China to ensure the survey reached the intended participants. At the same time, participants were allowed to forward surveys to their contacts. QR codes were prominently displayed during licensed Chinese martial arts events, tournaments, or classes, granting attendees direct access to the online survey. The data collection phase spanned eight weeks, from December 21, 2023, to February 15, 2024, before being aggregated for analysis.

2.6.2 Data Collection

Participants were prompted to furnish details such as gender, age, duration of Chinese martial arts practice, and training routines. The survey also sought specifics about any injuries sustained—encompassing the type, severity, precise anatomic location of the injury, as well as the frequency of occurrence, and the environment or circumstances under which the injury transpired.

Participants were instructed to list any injuries they have sustained in reverse chronological order, starting from the most recent to the earliest.

2.6.3 Monitoring & Storage

Regular reviews of the data collection platforms were conducted to track the rate of response and ensure the consistency of incoming data. To uphold the highest standards of ethical research, all data was securely de-identified and archived, ensuring restricted access to safeguard the confidentiality of the participants.

2.7 Data Reduction

Incomplete, nonsensical, or erroneous responses were identified and discarded, appropriately. The dataset was streamlined to retain only the most pertinent and precise information, removing any superfluous details. Anomalies and inconsistencies were flagged. Based on their nature, they were either resolved, clarified, or excluded from the dataset. Any data entries from participants that did not align with the inclusion criteria were systematically removed.

2.8 Data Analysis

Descriptive statistics, such as means, medians, standard deviations, and proportions, as suitable, were used to describe data.

Absolute frequencies (counts) and relative frequencies (percentages) were calculated to describe reported injuries. Fisher's exact tests were employed to compare injury incidence across distinct groups.

Data analysis was conducted using IBM SPSS Statistics, Version 27 (IBM Inc; Armonk, NY). Significance was set a priori at $\alpha = 0.05$, two-sided.

3.0 Results

3.1 Qualtrics Survey Data

3.1.1 Survey Participants

A total of 387 questionnaire responses were received, of which 239 were complete and included in the analysis. The age of respondents was 35.35 ± 13.44 years (mean \pm SD).

3.1.2 Demographics

The first section of the questionnaire gathered demographic information. It included three questions about the respondents' age, gender, and the continent where they currently train in Chinese martial arts. Table 4 lists the gender distribution of the survey respondents. Table 5 presents the ages of the survey respondents, and Table 6 provides a detailed breakdown of the respondents' distribution across different continents.

Table 4 Gender Distribution of Survey Respondents

Gender Category	Number of Respondents (Percentage)
Women	78 (32.6%)
Men	152 (63.6%)
Non-binary	1 (0.4%)
Not specified	8 (3.4%)
Total	239

The percentage of male respondents (63.6%) exceeded that of female (32.6%) respondents.

Table 5 Age of Survey Respondents

Women (n=78)	Men (n=152)	Group comparison <i>p</i>-value
31.72 \pm 12.02	37.20 \pm 13.83	0.003

There was a statistically significant difference in age between genders; women (31.72 ± 12.02 years) were younger compared to men (37.20 ± 13.83 years, $p = 0.003$).

Table 6 Geographical Distribution of Survey Respondents

Continent	All (n=239)	Female (n=78)	Male (n=152)
Africa	3 (1.3%)	1 (1.3%)	2 (1.3%)
Asia	69 (28.9%)	22 (28.2%)	47 (30.9%)
Australia	4 (1.7%)	1 (1.3%)	3 (2.0%)
Europe	15 (6.3%)	3 (3.8%)	12 (7.9%)
North America	141 (59.0%)	51 (65.4%)	86 (56.6%)
South America	2 (0.8%)	0 (0.0%)	2 (1.3%)
Not specified	5 (2.1%)	0 (0.0%)	0 (0.0%)
Total	239	78	152

The majority of respondents resided in North America followed by Asia. This was true even after stratification by gender.

3.1.3 Training History

The second section of the questionnaire delved into the respondents' training history and consisted of eight questions. Four primary questions explored key aspects of their Chinese martial arts practice: the number of years they have been training, the number of hours they train per week, the specific styles they practice, and any other activities they participate in. Additionally, there are four conditional sub-questions tailored to four major Chinese martial arts styles. These sub-questions are presented only if the respondent selects a corresponding style in the third main question. Table 7 includes data about the duration of participation in Chinese martial arts.

Table 7 Duration of Engagement in Chinese Martial Arts Among Survey Respondents

Duration (Years)	All (n=239)	Women (n=78)	Men (n=152)
<1	10 (4.2%)	5 (6.4%)	4 (2.6%)
1-5	50 (20.9%)	21 (26.9%)	28 (18.4%)
6-10	60 (25.1%)	17 (21.8%)	42 (27.6%)
11-15	43 (18.0%)	22 (28.2%)	21 (13.8%)
16-20	20 (8.4%)	3 (3.8%)	17 (11.2%)
21+	26 (10.9%)	10 (12.8%)	16 (10.5%)
31+	12 (5.0%)	0 (0.0%)	11 (7.2%)
41+	8 (3.3%)	0 (0.0%)	8 (5.3%)
51+	6 (2.5%)	0 (0.0%)	5 (3.3%)
Not specified	4 (1.7%)	0 (0.0%)	0 (0.0%)
Total	239	78	152

Among women, the most common duration of participation was 11-15 years (28.2%), while for men it was 6-10 years (27.6%).

Table 8 categorizes survey respondents according to the weekly time they allocate to Chinese martial arts activity, with further stratification by gender.

Table 8 Weekly Training Hours of Respondents

Hour	All (n=239)	Women (n=78)	Men (n=152)
1-3	83 (34.7%)	35 (44.9%)	45 (29.6%)
4-6	72 (30.1%)	22 (28.2%)	50 (32.9%)
7-9	42 (17.6%)	14 (17.9%)	28 (18.4%)
10-12	20 (8.4%)	5 (6.4%)	15 (9.9%)
13+	17 (7.1%)	1 (1.3%)	14 (9.2%)
Not specified	5 (2.1%)	1 (1.3%)	0 (0.0%)
Total	239	78	152

The most common practice duration for women was 1-3 hours per week (44.9%), while for men, it was 4-6 hours per week (32.9%).

The survey offered four major Chinese martial arts styles as options for selection. Respondents were permitted to select one or multiple options. Table 9 outlines the distribution of survey respondents according to the style of Chinese martial arts they practice, with a breakdown by gender.

Table 9 Distribution of Chinese Martial Arts Styles Among Survey Respondents by Gender

Style	All (n=239)	Women (n=78)	Men (n=152)
Traditional Kungfu	52 (21.8%)	9 (11.5%)	42 (27.6%)
Modern Wushu	50 (20.9%)	21 (26.9%)	29 (19.1%)
TaiChi	25 (10.5%)	14 (17.9%)	10 (6.6%)
Sanda	6 (2.5%)	0 (0.0%)	6 (3.9%)
Traditional Kungfu, Modern Wushu	14 (5.9%)	6 (7.7%)	7 (4.6%)
Traditional Kungfu, TaiChi	35 (14.6%)	11 (14.1%)	24 (15.8%)
Traditional Kungfu, Sanda	4 (1.7%)	0 (0.0%)	3 (2.0%)
Modern Wushu, TaiChi	13 (5.4%)	5 (6.4%)	8 (5.3%)
Modern Wushu, Sanda	2 (0.8%)	1 (1.3%)	1 (0.7%)
Traditional Kungfu, Modern Wushu, TaiChi	18 (7.5%)	10 (12.8%)	7 (4.6%)
Traditional Kungfu, Modern Wushu, Sanda	5 (2.1%)	0 (0.0%)	5 (3.3%)
Traditional Kungfu, TaiChi, Sanda	5 (2.1%)	1 (1.3%)	4 (2.6%)
Modern Wushu, TaiChi, Sanda	1 (0.4%)	0 (0.0%)	1 (0.7%)
Traditional Kungfu, Modern Wushu, TaiChi, Sanda	5 (2.1%)	0 (0.0%)	5 (3.3%)
Not specified	4 (1.7%)	0 (0.0%)	0 (0.0%)
Total	239	78	152

The majority of female respondents (26.9%) practiced Modern Wushu, whereas the majority of male respondents (27.6%) practiced Traditional Kung fu. No participants reported practicing both Taichi and Sanda together.

3.1.3.1 Traditional Kungfu

After selecting a main style, corresponding sub-questions would appear for further selection, allowing respondents to choose either a single option or multiple options. Tables 10-13 include detailed information about Chinese martial arts participation (Traditional Kungfu, Modern Wushu, Tai Chi, and Sanda) and disciplines among survey respondents.

The greatest number of respondents (n = 138) reported participation in Traditional Kungfu. The gender distribution of the Traditional Kungfu participants was: 37 women, 97 men, one non-binary, and one not specified.

Table 10 Detailed Information about Traditional Kungfu Disciplines Those Respondents Participated in

Items	All (n=138)	Women (n=37)	Men (n=97)
Northern Hand Systems	72 (52.2%)	18 (48.6%)	52 (53.6%)
Southern Hand Systems	51 (37.0%)	7 (18.9%)	43 (44.3%)
Other Hand Systems	39 (28.3%)	9 (24.3%)	30 (30.9%)
Single Weapon	87 (63.0%)	25 (67.6%)	60 (61.9%)
Double Weapon	49 (35.5%)	8 (21.6%)	39 (40.2%)
Flexible Weapon	30 (21.7%)	6 (16.2%)	24 (24.7%)
Not specified	3 (2.2%)	1 (2.7%)	1 (1.0%)

*The number of people in each column does not add up to the total as people could choose more than one option.

Amongst Traditional Kungfu participants, when all respondents were combined, the most popular discipline was Single Weapon (63.0%), followed by Northern Hand Systems (52.2%). Among women, the Single Weapon discipline was the most popular (67.6%), followed by Northern Hand Systems (n=18, 48.6%). The highest number of male respondents participated in other Single Weapon (61.9%).

3.1.3.2 Modern Wushu

The second greatest number of respondents (n = 106) reported participation in Modern Wushu. The gender distribution of the Modern Wushu participants was: 43 women and 63 men.

Table 11 Detailed Information about Modern Wushu disciplines That Respondents Participated in

Items	All (n=106)	Women (n=43)	Men (n=63)
Changquan	78 (73.6%)	30 (69.8%)	48 (76.2%)
Nanquan	32 (30.2%)	9 (20.9%)	23 (36.5%)
Straight Sword (Jian Shu)	55 (51.9%)	25 (58.1%)	30 (47.6%)
Broad Sword (Dao Shu) Dao, Nandao	48 (45.3%)	16 (37.2%)	32 (50.8%)
Spear (Qiang Shu) Qiang	33 (31.1%)	12 (27.9%)	21 (33.3%)
Staff (Gun Shu) Gun, Nangun	37 (34.9%)	16 (37.2%)	21 (33.3%)
Partner Forms	8 (7.5%)	2 (4.7%)	6 (9.5%)
Not specified	4 (3.8%)	1 (2.3%)	3 (4.8%)

*The number of people in each column does not add up to the total as people could choose more than one option.

When all respondents were combined, the most popular Modern Wushu discipline was Changquan (73.6%), followed by Straight Sword (Jian Shu) (51.9%). This ranking holds for female respondents as well. The highest number of male practitioners was the Changquan (76.2%), followed by Broad Sword (Dao Shu) Dao, and Nandao (50.8%).

3.1.3.3 Taichi

The third greatest number of respondents (n = 100) reported participation in Tai Chi. The gender distribution of the Tai Chi participants was: 41 women and 59 men.

Table 12 Detailed Information about Tai Chi Disciplines Those Respondents Participated in

Items	All (n=100)	Women (n=41)	Men (n=59)
Traditional Hand Routine	81 (81.0%)	32 (78.0%)	49 (83.1%)
Traditional Sword Routine	43 (43.0%)	17 (41.5%)	26 (44.1%)
Competitive Taijiquan	29 (29.0%)	20 (48.8%)	9 (15.3%)
Competitive Taijijian	20 (20.0%)	10 (24.4%)	10 (16.9%)
Other Taichi Weapon	28 (28.0%)	13 (31.7%)	15 (25.4%)

* The number of people in each column does not add up to the total as people could choose more than one option.

When all respondents were combined, the most popular Tai Chi discipline was the Traditional Hand Routine (81.0%), followed by the Traditional Sword Routine (43.0%). Among women, the Traditional Hand Routine discipline was the most popular (78.0%), followed by Competitive Taijiquan (48.8%). The Traditional Hand Routine has the highest number of male practitioners (83.1%).

3.1.3.4 Sanda

The least number of respondents (n = 22) reported participation in Sanda. The gender distribution of the Sanda participants was: 2 women and 20 men.

Table 13 Detailed Information about Sanda Disciplines Those Respondents Participated in

Items	All (n=22)	Women (n=2)	Men (n=20)
60kg-69kg	4 (18.2%)	1 (50.0%)	3 (15.0%)
70kg-79kg	7 (31.8%)	0 (0.0%)	7 (35.0%)
80kg-85kg	4 (18.2%)	0 (0.0%)	4 (20.0%)
85kg above	5 (22.7%)	1 (50.0%)	4 (20.0%)
Not specified	2 (9.1%)	0 (0.0%)	2 (10.0%)

*The number of people in each column does not add up to the total as people could choose more than one option.

Apart from the "Chinese Martial Arts only" option, respondents were allowed to select either single or multiple sports activities. Table 14 presents information about participation in other activities reported by survey participants.

Table 14 Participants' Involvement in Other Activities

Items	All (n=239)	Women (n=78)	Men (n=152)
Running/Jogging	79 (33.1%)	27 (34.6%)	52 (34.2%)
Cycling	7 (2.9%)	6 (7.7%)	1 (0.7%)
Yoga	30 (12.6%)	22 (28.2%)	8 (5.3%)
Extreme Sports (e.g., Rock climbing)	13 (5.4%)	2 (2.6%)	11 (7.2%)
Team Sports	17 (7.1%)	6 (7.7%)	11 (7.2%)
Weightlifting	36 (15.1%)	14 (17.9%)	22 (14.5%)
Snow Sports	16 (6.7%)	2 (2.6%)	14 (9.2%)
Water Sports	15 (6.3%)	6 (7.7%)	9 (5.9%)
Other Martial Arts	19 (7.9%)	7 (9.0%)	12 (7.9%)
Other	32 (13.4%)	7 (9.0%)	25 (16.4%)
Not specified	5 (2.1%)	1 (1.3%)	1 (0.7%)
Chinese Martial Arts only	66 (27.6%)	20 (25.6%)	44 (28.9%)

*The number of people in each column does not add up to the total as people could choose more than one option, except Chinese martial arts only.

Most respondents reported participation only in Chinese martial arts. Among other activities, running/jogging was reported most often (33.1% of respondents). This was true even after stratification by gender (women: 34.6%, men: 34.2%).

3.1.4 Injuries as a Result of Participation in Chinese Martial Arts

After completing the first two sections, respondents were asked, "Have you ever suffered an injury as a result of participating in Chinese martial arts?" If the answer was affirmative, the questionnaire proceeded to the third section, which focused on injuries. Table 15 includes information about whether study participants had ever sustained an injury while participating in Chinese martial arts.

Table 15 History of Ever Sustaining an Injury During Participation in Chinese Martial Arts

	All	Women	Men
Yes	164/239 (68.6%)	57/78 (73.1%)	102/152 (67.1%)
No	75/239 (31.4%)	21/78 (26.9%)	50/152 (32.9%)

Approximately two-thirds of participants reported at least one injury during participation in Chinese martial arts in the past. There was no significant difference between the percentage of women (73.1%) and men (67.1%) who reported a history of injury; $p=0.353$.

There were 300 injuries reported among the 239 participants. Of these 300 injuries, 83 injuries were among women, 207 were among men, two injuries were among participants who identified as non-binary, and the remaining eight injuries were among participants who did not report their gender.

The one-year cumulative incidence of injuries was higher among women ($16/78=20.5\%$) compared to men ($26/152=17.1\%$), but this difference was not statistically significant ($p=0.589$).

The following Table 16 presents an analysis of activities that the respondents were participating in, at the time of injury. The majority of injuries occurred during training.

Table 16 Context of Injuries in Chinese Martial Arts

	All*	Women	Men
Training	253 (84.3%)	72 (86.7%)	177 (85.5%)
Competition/performance	38 (12.7)	10 (12%)	27 (13%)
Not specified	9 (3%)	1 (1.2%)	3 (1.4%)
Total	300	83	207

*All injuries include 83 injuries among women and 207 injuries among men.

The questionnaire provided respondents with 28 specific body parts to identify the location of their injury. Through data analysis, these were categorized into five main body regions. Figure 30 presents information about the anatomic location for 300 reported injuries.

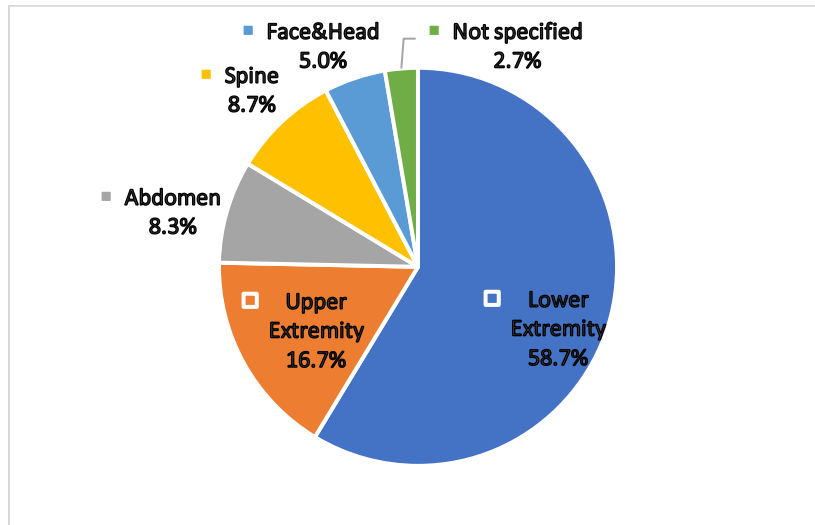


Figure 30 Distribution of Injury anatomic Locations among women and men combined

The lower extremity was the most common injury site, accounting for 58.7% (176/300) of the injuries. Upper extremity injuries were the second most reported, making up 16.7% (50/300) of the total.

Figure 31 illustrates the percentages of injury locations for the 83 injuries reported by women.

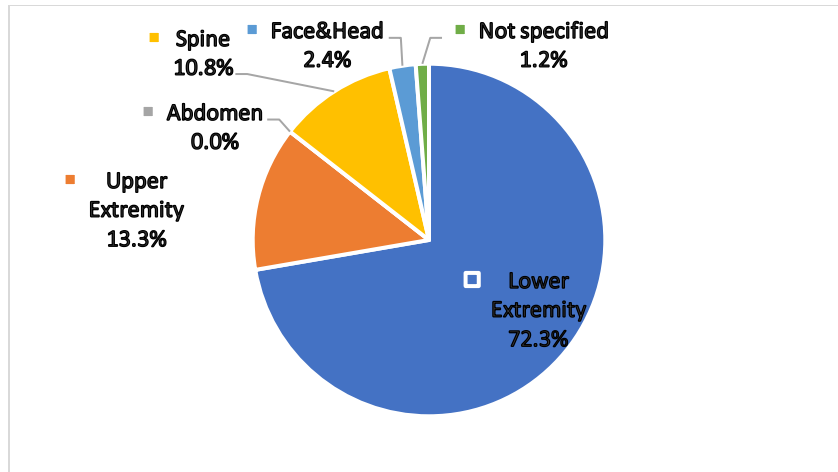


Figure 31 Injury Anatomic Location Among Women

Injuries to the lower extremity were the most prevalent, comprising 72.3% (60/83) of the reported locations. The upper extremity accounted for 13% (11/83) of injuries among women. No abdomen injuries were reported by women.

Among men, injuries to the lower extremity were the most prevalent, comprising 55.6% (115/207) of the reported locations. The upper extremity accounted for 18.4% (38/207) of injuries. Figure 32 shows the anatomic locations of 207 injuries among men.

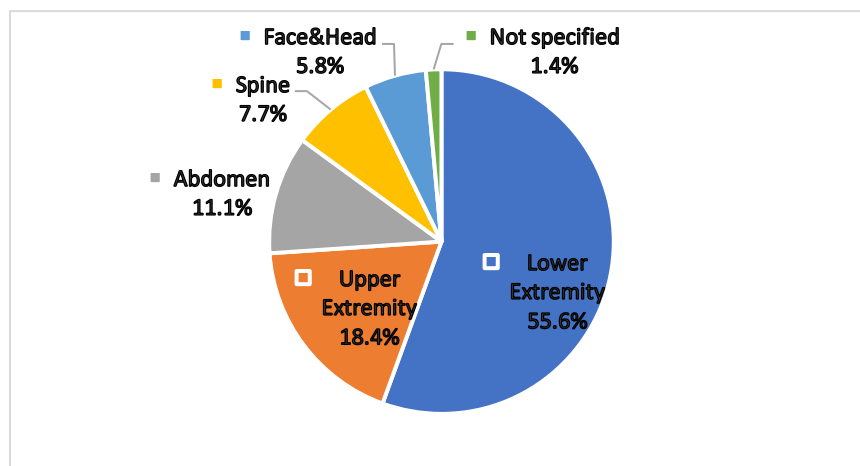


Figure 32 Injury Anatomic Location Among Men

Table 17 shows the breakdown of reported injuries by anatomic locations and sub-locations.

Table 17 Injury Location and Sub-location by Gender

Location	Sub-location	All*	Women	Men
Lower Extremity	Hip	7 (2.3%)	4 (4.8%)	3 (1.4%)
	Thigh	27 (9.0%)	7 (8.4%)	20 (9.7%)
	Knee	78 (26.0%)	27 (32.5%)	51 (24.6%)
	Lower Leg	4 (1.3%)	2 (2.4%)	2 (1.0%)
	Ankle	48 (16.0%)	20 (24.1%)	27 (13.0%)
	Foot	9 (3.0%)	0 (0.0%)	9 (4.3%)
	Toes	3 (1.0%)	0 (0.0%)	3 (1.4%)
Upper Extremity	Shoulder	15 (5.0%)	3 (3.6%)	12 (5.8%)
	Upper Arm	2 (0.7%)	0 (0.0%)	2 (1.0%)
	Elbow	12 (4.0%)	4 (4.8%)	8 (3.9%)
	Forearm	1 (0.3%)	0 (0.0%)	1 (0.5%)
	Wrist	4 (1.3%)	2 (2.4%)	2 (1.0%)
	Hand	9 (3.0%)	0 (0.0%)	8 (3.8%)
	Fingers	7 (2.3%)	2 (2.4%)	5 (2.4%)
Abdomen	Chest	1 (0.3%)	0 (0.0%)	1 (0.5%)
	Groin	14 (4.7%)	0 (0.0%)	13 (6.3%)
	Pelvis and Buttock	3 (1.0%)	0 (0.0%)	3 (1.4%)
	Ribs	7 (2.3%)	0 (0.0%)	6 (2.9%)
Spine	Spine	4 (1.3%)	2 (2.4%)	2 (1.0%)
	Lower Back	13 (4.3%)	6 (7.2%)	7 (3.4%)
	Neck	9 (3.0%)	1 (1.2%)	7 (3.4%)
Face & Head	Head	9 (3.0%)	1 (1.2%)	7 (3.4%)
	Face	2 (0.7%)	1 (1.2%)	1 (0.5%)
	Eyes	3 (1.0%)	0 (0.0%)	3 (1.4%)
	Nose	1 (0.3%)	0 (0.0%)	1 (0.5%)
Not specified		8 (2.7%)	1 (1.2%)	3 (1.4%)
Total		300	83	207

*All injuries include 83 injuries among women and 207 injuries among men

The knee was the most common site for injuries (26.0%), followed by the ankle (16.0%). This pattern of distribution by anatomic sub-location was seen even after stratification by gender.

The fourth question in the third part of the survey was the nature of the injury. It offered 10 options including a space for other supplementary options. Table 18 outlines the types of injuries reported.

Table 18 Nature of Injury by Gender

	All*	Women	Men
Elbow golfer	1 (0.3%)	0 (0.0%)	1 (0.5%)
Ganglion cyst	1 (0.3%)	0 (0.0%)	1 (0.5%)
impingement	1 (0.3%)	0 (0.0%)	1 (0.5%)
Pain	1 (0.3%)	0 (0.0%)	1 (0.5%)
Patellar tendonitis	1 (0.3%)	0 (0.0%)	1 (0.5%)
Pinched nerve	1 (0.3%)	0 (0.0%)	1 (0.5%)
Shin splints	1 (0.3%)	0 (0.0%)	1 (0.5%)
Tendinitis	1 (0.3%)	0 (0.0%)	1 (0.5%)
IT band syndrome	2 (0.7%)	2 (2.4%)	0 (0.0%)
Weapon-induced puncture or stab wound	6 (2.0%)	1 (1.2%)	5 (2.4%)
Concussion	7 (2.3%)	1 (1.2%)	5 (2.4%)
Laceration	11 (3.7%)	5 (6.0%)	6 (2.9%)
Contusion (Bruise)	14 (4.7%)	3 (3.6%)	11 (5.3%)
Dislocation	19 (6.3%)	4 (4.8%)	15 (7.2%)
Fracture (Broken bone)	30 (10.0%)	5 (6.0%)	23 (11.1%)
Joint Injury (Eg. Meniscal tear, labral tear, etc)	45 (15.0%)	17 (20.5%)	28 (13.5%)
Strain (Strain is a stretching or tearing of muscle or tendon)	64 (21.3%)	14 (16.9%)	50 (24.2%)
Sprain (Sprain is a stretching or tearing of ligaments)	80 (26.7%)	29 (34.9%)	48 (23.2%)
Not specified	14 (4.7%)	2 (2.4%)	8 (3.8%)
Total	300	83	207

*All injuries include 83 injuries among women and 207 injuries among men

A sprain was the most common nature of injury (26.7%), followed by strains (21.3%). Women had a higher percentage of sprains (34.9%), and men had a higher percentage of strains

(24.2%). Joint injuries were higher among women (20.5%). Men had a higher of fractures (11.1%) and dislocations (7.2%).

The data in Table 19 indicates whether the injured martial arts practitioners sought medical attention after their injury.

Table 19 Seeking Medical Attention for Injuries in Chinese Martial Arts

	All*	Women	Men
Yes	171 (57%)	55 (66.3%)	111 (53.6%)
No	110 (36.7%)	25 (30.1%)	84 (40.6%)
Not specified	19 (6.3%)	3 (3.6%)	12 (5.8%)
Total	300	83	207

*All injuries include 83 injuries among women and 207 injuries among men

A higher percentage of injuries among women (66.3%) resulted in seeking medical care compared to injuries among men (53.6%).

Table 20, Table 21, and Table 22 provide some relevant data after injuries in Chinese martial arts. Table 20 lists the duration of time off required for reported injuries. Table 21 shows whether these injuries were reported to teachers or Sifus. Table 22 examines if injuries prompted participants to consider quitting Chinese Martial Arts.

Table 20 Training Interruptions Due to Injury

	All*	Women	Men
No time off	90 (30.0%)	30 (36.1%)	59 (28.5%)
Less than a month	87 (29.0%)	26 (31.3%)	58 (28.5%)
1-3 months	65 (21.7%)	11 (13.3%)	54 (26.1%)
4-7 months	24 (8.0%)	7 (8.4%)	16 (7.7%)
8-12 months	11 (3.7%)	4 (4.8%)	6 (2.9%)
12+ months	6 (2.0%)	3 (3.6%)	3 (1.4%)
Not specified	17 (5.7%)	2 (2.4%)	11 (5.3%)
Total	300	83	207

*All injuries include 83 injuries among women and 207 injuries among men

A large percentage of injuries among women (36.1%) resulted in no time off. The majority of injuries resulted in less than three months off, with few taking a year or more.

Table 21 Notification of Injuries to Teachers/Sifus in Chinese Martial Arts Training

	All*	Women	Men
Yes	243 (81%)	71 (85.5%)	167 (80.7%)
No	40 (13.3%)	10 (12.0%)	29 (14.0%)
Not specified	17 (5.7%)	2 (2.4%)	11 (5.3%)
Total	300	83	207

*All injuries include 83 injuries among women and 207 injuries among men

For a majority of injuries, the teacher/sifu were informed. This was true after stratification by gender.

Table 22 Consideration of Quitting Chinese Martial Arts Due to Injury

	All*	Women	Men
Yes	32 (10.7%)	12 (14.5%)	18 (8.7 %)
No	252 (84%)	69 (83.1%)	179 (86.5%)
Not specified	16 (5.3%)	2 (2.4%)	10 (4.8%)
Total	300	83	207

*All injuries include 83 injuries among women and 207 injuries among men

Despite injuries, a vast majority of injuries did not consider quitting their martial arts practice. This remained true even after stratification by gender.

4.0 Discussion

This study fills the gap in research on the epidemiology of Chinese martial arts injuries and provides a foundation for future related research. There were more male respondents than females, and most respondents were from North America and Asia. The greatest number of respondents reported participating in Traditional Kungfu, followed by Modern Wushu. The female respondents were younger than the male respondents. At least one injury was suffered by 68.6% of respondents. During training, 84.3% of Chinese martial arts injuries occurred. Lower extremity injuries occurred most frequently, at the knee, followed by the ankles. The one-year cumulative injury incidence rate for women is higher than that for men, with no statistical difference.

4.1 Geographical Distribution of Survey Respondents

The greatest number of respondents were from North America followed by Asia. The questionnaire was distributed via email, and North American martial arts schools can easily find email addresses. Many other continents only have telephones and no email addresses. Also, the questionnaire was only provided in English and Chinese, which may be able to explain the greater number of respondents from North America and Asia. During the questionnaire survey collection, directors of several Chinese martial arts halls said that all the students in the school were under 18 years old. The owner of one Chinese martial arts studio in the United States said that they all practice traditional martial arts without any injury. The email addresses of various national Wushu associations on the official website of the International Wushu Federation are partially invalid, mostly in Africa.

4.2 Distribution of Chinese Martial Arts Styles

Practiced as a single style, Traditional Kungfu had the largest number of practitioners, followed by Modern Wushu, then Tai Chi, and finally Sanda. Traditional Kungfu was the most popular among male practitioners, while Modern Wushu was the most popular among female practitioners. A study focused on Traditional Kungfu in Anhui Province, China, shows that there are more male practitioners than females. The author suggests that the lower proportion of women practicing Traditional Kungfu is primarily influenced by the characteristics of these martial arts disciplines.⁷⁹ Some movements in Traditional Kungfu require practitioners to have good capabilities in leaping, spinning, bouncing, and jumping. If practitioners do not possess the physical qualities necessary to meet these demands, it could lead to sports injuries. This situation may cause some women to be hesitant about participating in traditional martial arts.⁷⁹ It is worth noting that Modern Wushu requires a higher level of physical fitness compared to Traditional Kungfu. Therefore, in addition to the risk of sports injuries and physical fitness considerations, the style of the Chinese martial arts itself may also contribute to this phenomenon. Practice as multiple styles, combinations of Traditional Kungfu and Tai Chi were more common among respondents. As a non-contact form of Chinese martial arts, Traditional Kungfu and Tai Chi differ from Modern Wushu, which are shaped by the aesthetics of Modern competitive sports. Traditional Kungfu and Tai Chi both have long histories and well-established systems.^{80,81} This might explain why there is a higher degree of mutual recognition and appreciation between these two styles compared to others. Women practiced Tai Chi more frequently than men, which is consistent with previous research. Studies have shown that among meditators, a higher proportion of women use Yoga, Tai chi or Qigong to meditate.⁸² The lower number of questionnaires returned for Sanda may be due to the fact that compared to internationally popular confrontation sports such as MMA, Judo, and

boxing, Sanda has a relatively low international reputation, resulting in a smaller number of practitioners.

In Traditional Kungfu, according to survey feedback, the most practiced disciplines were Single Weapon and Northern Hand Systems. Single Weapons are generally simpler compared to Double Weapons and Flexible Weapons and are often chosen as the initial training item for beginners.⁸³ Additionally, the variety of Single Weapons available exceeds that of Double and Flexible Weapons. Northern Hand Systems is known for its large, expansive forms and movements, and its popularity may be largely due to the numerous Shaolin Systems styles it encompasses. In Modern Wushu, Changquan was practiced most often by both men and women. The second most common sword for women was straight sword, and for men was broad sword. Taking the National Games of China, which are held every four years and represent the highest level of Chinese martial arts competition in the country, as an example, the distribution of events by gender might explain why more women practice straight sword, while men tend to practice broad sword. In the team events, there are men's spear technique, men's straight sword technique, and men's three-person barehand routine, as well as women's broad sword technique, women's staff technique, and women's two-person weapons (including barehand and weapons) routine.⁸⁴ The total score of these team events determines the awarding of a single gold medal. In the individual all-around events, men can compete for a gold medal in Changquan (long fist), broad technique, and staff technique all-around, while women can vie for a gold medal in Changquan, straight sword technique, and spear technique all-around. This setup not only showcases the diversity of the events but may also encourage more men to participate in saber and staff techniques, while women may be more inclined towards sword and spear techniques. The rules also state that Changquan is equally important to both genders.⁸⁴ The movements in straight sword

are smooth and elegant, resembling a swimming dragon, while the techniques in broad sword are powerful and fierce, akin to a ferocious tiger. These distinct styles have unique appeals to different genders. In the Tai Chi category, the traditional hand routine has the most practitioners. Traditional sword routine, competitive Taijiquan, Taijijian, and other practices all require traditional Tai Chi as a foundation. There were significantly fewer female participants than males in the Sanda category. It may be that the higher risk of sports injuries results in fewer women in this sport. For contact sports, female athletes had a greater risk of injury than male athletes did.⁸⁵

4.3 Duration of Training and Injuries

Women's training duration ranged from 0 to 21+ years, and males range from 0 to 51+ years. It seems that Female Chinese martial arts practitioners have shorter exercise lifespans than males. In terms of weekly practice time, the highest training frequency for women was 1-3 hours, and for men, it was 4-6 hours. The CDC recommends that adults over 18 years of age exercise at least 150 minutes per week. People over 65 years old need to improve their balance exercises.⁸⁶ Practicing Chinese martial arts meets the above conditions. Chinese martial arts practitioners have a wide age range and diverse training amounts, including various age groups and different training times. Two-thirds (68.6%) of Chinese martial arts practitioners suffered at least one injury, which is higher than track and field (64%).⁸⁷ The proportion of women injured (73.1%) was higher than that of men (67.1%). Unlike the study in which male soccer players had higher injury rates, according to the results of this study, females have higher injury rates among Chinese martial arts practitioners.⁸⁸ Women's training years and training duration were lower than men's, but women's injury rate was higher than men's. These findings contradict those of Thomas et al., who found in their systematic review, that males practicing taekwondo had a higher injury rate than females.⁸⁹ We wanted to investigate when injuries were happening to the research participants. We found that

84.3% of Chinese martial arts injuries occurred during training. The percentage is higher than the epidemiology of injuries in an Olympic sports study, in which more injuries occurred during training (58%) compared to competition (42%).⁹⁰ Chinese martial arts practitioners often require years of training before they are qualified to compete or perform. Additionally, the duration of competitions and performances is typically much shorter compared to training sessions. For example, a traditional martial arts routine usually lasts around one minute. This discrepancy may contribute to a higher injury rate during training compared to other periods. Only 10.7% of injuries had led to participants considering quitting Chinese martial arts practice after injury. Sports injuries may not be the main reason why Chinese martial arts practitioners stop practicing. Lack of time and tiredness, lack of enjoyment,⁹¹ and the mentor-mentee relationship⁹² could be the dropout reasons.

4.4 Seeking Medical Attention and Notification of Injuries to Teachers/Sifus

More than half of the injuries involved medical intervention. Two-thirds (66.3%) of female injuries chose medical intervention compared with 53.6% of male injuries. This result echoes a previous study conducted by Bertakis et al., in which women have higher medical care service utilization and higher associated charges than men.⁹³ Among training interruptions, the highest proportion, 36.1%, occurred in female injuries where no time off was taken. For male participants, both the categories of no time off and less than a month off accounted for an equal proportion of 28.5%. Multiple university studies show that in the field of sports injuries, women tend to need more time to recover than men.⁹⁴⁻⁹⁶ Only 6% of all injuries had more than a year's rest.

Four out of five sports injuries were reported to the teacher/Sifu afterward, with women (85.5%) more likely than men (80.7%). In contrast to other sports, the relationship between teachers and students in Chinese martial arts is that of a master and apprentice, or coach and

athlete.⁹⁷ Currently, no similar data studies on this topic have been found. It is worth noting that not seeking medical care can result in misdiagnosis of injury which can affect the nature of the injury reported if they are just guessing what it was. Different countries have different ways of dealing with such incidents due to their different education systems. For example, the United States has ATers. Athletic trainers (ATs) are allied health professionals who are uniquely suited to provide preventive and educational health and wellness programs to improve health outcomes across a physically active population. Athletic trainers are often the first contacts for high school athletes seeking health and wellness education, which may allow ATs to be the first intervention or prevention point for reducing or eliminating negative health behaviors and outcomes among their patients.⁹⁸ Although China has sports training majors, the course objectives are relatively narrow and are limited to the fields of training and education.⁹⁹ Sports injuries may be reported and discovered late. Chinese Martial arts schools are generally not equipped with ATs.

4.5 Other Activities

Chinese martial arts and other sports such as running, yoga, and weightlifting promote each other. The specific qualities of Chinese martial arts include flexibility,¹⁰⁰ coordination,¹⁰¹ strength,¹⁰² and agility.¹⁰⁰ Long-term practice of Chinese martial arts can improve these abilities. Conversely, if these qualities are enhanced through other forms of exercise, the level of proficiency in Chinese martial arts can also be expected to improve. This mutual enhancement indicates that cross-training in different physical disciplines can contribute positively to one's activity skills by building upon the physical and mental attributes necessary for Chinese martial arts or other sports proficiency.

4.6 Reported Injuries

Lower extremity injuries occurred most often in Chinese martial arts, with knee injuries ranking first (26.0%), followed by ankle (16.0%), across males and females. In the female injury data, no abdomen injuries were reported. Sprain was the most common type of injury reported. Among them, the most common injury in women was a sprain, and the most common injury in men was a strain. This result supports some previous studies but also has differences. In a systematic review of case reports in dancers, chronic injury was suggested to be the most common presentation, with lower extremity injuries being the most common. Foot and knee injuries were the two most commonly involved joints across injuries and groups.¹⁰³ The knee had the highest rate of injury in Olympic sports.⁹⁰ Thomas et al reported that lower extremities had the highest injury location rates with males (21.7%), and females (26.6%), followed by the head, in taekwondo injuries.⁸⁹ Unlike the high frequency of head injuries observed in Taekwondo, this study reports a head injury rate of only 3%. This low incidence may be attributed to the fact that most Chinese martial arts styles do not involve striking the head. One province research article in China concluded that the highest injury rate among Chinese martial arts athletes was the knee at 28.40%, followed by the waist at 22.02%, and the ankle at 12.46%. The research group is Modern Wushu practitioners and did not differentiate between male and female participants; it included both genders without specification.¹⁰⁴ In karate competitions, rates of injury were similar for males and females and the head was the highest injury location.¹⁰⁵ Studies have shown that gymnastics and obstacle racing, which are similar to Chinese martial arts, are the types of sports in which female athletes have a higher risk of ACL injuries than male athletes and all other sports categories.⁸⁵ A one-decade soccer injury study showed male players sustained more contusions, fractures, joint dislocations, and musculotendinous injuries than female players.⁸⁸ Upper extremities are the most

common injury locations in wrestling.¹⁰⁶ The injury rate for hands and fingers is higher in males than in females. Additionally, males are more likely to sustain weapon-induced puncture or stab wounds compared to females.

4.7 Limitations

There are several limitations of the present study that need to be recognized. The first is sample size and diversity. The study's sample size may not be large or diverse enough to generalize the results to all Chinese martial arts practitioners. Given the variety of Chinese martial arts styles around the world and the diverse demographics of practitioners, study results may not represent all groups equally. The second is that reliance on self-reported data may introduce bias, particularly recall bias. Participants may not remember accurately or may choose not to disclose previous injuries or the severity of those injuries, which may affect the accuracy of the data collected. At the same time, there is the possibility of reporting bias, with those who have experienced serious injury may be more likely to participate in the study, while those who have not been injured may not see the relevance of the contribution. This may bias the results toward higher rates of perceived harm. The cross-sectional nature of the study limits the ability to conclude causal relationships between training practices and injuries. Longitudinal studies are better suited to assess how injuries develop over time and the impact of continued training. The study may not have considered variability in training intensity, frequency, and environment, which can significantly affect injury rates. Different teachers, schools, or venues may have different safety protocols and training techniques, which may affect the incidence and type of injuries. Finally, the study lacked medical validation of the reported injuries, relying instead on participants' descriptions. This absence may result in differences in injury classification and perceived severity. The lack of Athletic Trainers

in the field of martial arts, therefore, cannot rule out the phenomenon of self-diagnosis errors in injuries.

4.8 Future Research

Future research should use random sampling methods to enhance the representativeness and validity of the study, and the use of medical records may provide more accurate and detailed data than questionnaire surveys. The research design will consider increasing the sample size and diversifying the sample to ensure that Chinese martial arts practitioners of different ages, genders, cultural backgrounds, and languages are included. There is a need to gain insights into the long-term effects of injury on continued participation in Chinese martial arts practitioners through longitudinal studies and long-term follow-up. At the same time, studies should focus on injury prevention strategies, best practices in recovery, and the differences in risk and type of injuries among different martial arts styles. Research on mental health cannot be ignored, especially the psychological process of trauma and recovery after Chinese martial arts injuries. In addition, the research will extend to socioeconomic dimensions, including the impact of Chinese martial arts practitioners' income level and health insurance on treatment options and the recovery process. How Chinese martial arts training methods and conditions affect injury risk will also be a key part of the study. Ultimately, these studies will focus on current social needs and practical implications, to propose insights and recommendations that are most valuable to the Chinese martial arts practicing community. In future research, it is necessary to actively improve China's sports training profession to draw more on the experience and concepts of Western medicine.

4.9 Conclusion

The prevalence of knee and ankle injuries among Chinese martial arts practitioners highlights the importance of preventive training. To minimize sports injuries and extend athletic

careers, Chinese martial arts practitioners, coaches, and physical trainers should work together to implement specialized plyometric training programs. Research shows that gender plays a significant role in sports injuries, with women more likely to suffer ligament and joint sprains and men more likely to suffer muscle and tendon strains. Additionally, women are injured at a higher rate than men over the same time period, suggesting that gender differences should be considered when developing training programs. The investigation also revealed that some practitioners failed to report injuries to coaches, which requires coaches to observe students more carefully during classes to prevent injuries from worsening. Through scientific and targeted training methods, sports injuries related to Chinese martial arts can be effectively reduced and the resulting interruption of sports careers can be avoided. It is our common goal to carry forward the positive influence of Chinese martial arts and encourage more people to participate in it.

Appendix A Qualtrics Survey Questions

PART A: DEMOGRAPHICS

Please select only one response for each question.

1. What is your age?
 years old (Drop down menu, pick a number between 4 and 100)
2. What is your gender?
 - a. Male
 - b. Female
 - c. Prefer not to say
 - d. Other: _____
3. In which continent are you currently receiving your training?
 - a. Asia
 - b. Europe
 - c. Africa
 - d. South America
 - e. North America
 - f. Australia
 - g. Antarctica

PART B: TRAINING HISTORY

1. How many years have you been training?(Drop down menu)
 - a. Less than one-year
 - b. 2
 - c. 3
 - d. 4
 - e. 5
 - f. 6
 - g. 7
 - h. 8
 - i. 9
 - j. 10
 - k. 11
 - l. 12
 - m. 13
 - n. 14
 - o. 15
 - p. 16
 - q. 17
 - r. 18
 - s. 19
 - t. 20
 - u. 21+

v. 31+

w. 41+

x. 51+

2. How many hours per week do you currently train? Drop down menu

a. 1-3 hrs

b. 4-6hrs

c. 7-9 hrs

d. 10-12 hrs

e. 13+ hrs

3. Which style(s) do you practice?

Traditional Kungfu Northern hand Systems

Southern hand Systems

Other hand Systems: _____

Single weapon

Double weapon

Flexible weapon

Modern Wushu

Changquan

Nanquan

Straight Sword (Jian Shu):

Broad Sword (Dao Shu) Dao; Nandao

Spear (Qiang Shu) Qiang

Staff (Gun Shu) Gun; Nangun

Partner Forms 武术对练

Taichi

Traditional Hand Routine

Traditional Sword Routine

Competitive Taijiquan

Competitive Taijijian

Other Taichi Weapon

b. Sanda (weight category)

48kg and below

49-59kg

60-69kg

70-79kg

79-85kg

85kg above

4. Which other activities do you currently participate in? (Check all that apply.)

Chinese martial arts only

Running/Jogging

Cycling

Yoga

Extreme Sports (e.g., Rock climbing)

Team Sports

Weightlifting

- Snow Sports
- Water Sports
- Other martial arts
- Other: _____

Part C: INJURY

1. Have you ever suffered an injury as a result of participating in Chinese martial arts?

- a. Yes
- b. No (the window closes); Thank you for your participation.

2. When did the injury happen [MM/YY] ? Use a separate form for each injury. List injuries from the most recent to the oldest.

[MM/YY[]

3. Did this injury happen during training or competition?

- a. Training
- b. Competition

4. What was the location of this injury?

- Head
- Face
- Eyes
- Ears
- Nose
- Mouth
- Neck
- Shoulder
- Upper Arm
- Elbow
- Forearm
- Wrist
- Hand – Palm
- Hand – Fingers
- Chest
- Abdomen
- Ribs
- Spine
- Pelvis and Buttock
- Hip
- Groin
- Thigh
- Knee
- Lower leg
- Ankle
- Foot
- Toes

5. What was the nature of this injury?

- Sprain (Sprain is a stretching or tearing of ligaments)
- Strain (Strain is a stretching or tearing of muscle or tendon)
- Contusion (Bruise)

- Fracture (Broken bone)
 - Dislocation
 - Concussion
 - Laceration
 - Joint Injury (Eg. Meniscal tear, labral tear, etc)
 - Weapon-induced puncture or stab wound
 - Other
6. Did you seek medical attention for this injury?
- a. Yes
 - b. No
7. How much time off from training did you take due to this injury?
- a. No time off
 - b. Less than a month
 - c. 1-3 months
 - d. 4-6 months
 - e. 8-12 months
 - f. 12+ months
8. Did you inform your teacher/Sifu of this injury?
- a. Yes
 - b. No
9. Did you consider quitting Chinese martial arts because of this injury?
- a. Yes
 - b. No
10. Do you have another injury as a result of participating in Chinese martial arts?
- a. Yes (repeat all injury questions).
 - b. No (close survey)

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