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EDITORIAL

MORE THAN EIGHT DEATHS PER DAY ON OUR ROADS ..... AND RISING

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Road Traffic Accidents (RTA) are a significant cause of global morbidity and mortality. According to the World Health Organization (WHO), road traffic injuries (RTI) was the 10th leading cause of death worldwide in 2002, 9th in 2012 and is expected to become the 8th by the year 2030, and is estimated to cost between 1% and 1.5 % of gross national product in low-income and middle-income countries[1,2]

While high income countries like USA, France and Italy have undergone a reduction of RTA fatalities over time, low income countries like Sri Lanka and India are facing higher numbers of RTA fatalities over the years. In 2017, RTA resulted in 8.5 deaths per day.[3] A World Bank report speculates that RTA fatalities in Sri Lanka will increase by almost 150% from 2000 to 2020.[4]

A WHO fact sheet on RTI published in December 2018, gives the following startling facts.[5]

- Of the 1.35 million people who die each year as a result of road traffic crashes, more than half are among vulnerable road users: pedestrians, cyclists, and motorcyclists.
- Road traffic injuries are the leading cause of death for children and young adults aged 5-29 years.
- About three quarters (73%) of all road traffic deaths occur among young males under the age of 25 years.
- 93% of the world's fatalities on the roads occur in low- and middle-income countries, even though these countries have only 60% of the world's vehicles.
- Between 20 and 50 million more people suffer non-fatal injuries, with many incurring a disability as a result of their injury.

In a five year study done on non-fatal injuries in the central province of Sri Lanka, the highest number of casualties were on motor cycles (36.6%) followed by 28.2% in motorized three wheeled vehicles while, 11.1% were in buses and 12.9% in dual purpose vehicles (vans, pick-up trucks, jeeps).[6]

The highest percentage of casualties on motorcycles may be due to the high number of motor cycles on the roads. However, vehicle and rider related factors, such as the small size of the vehicle, the fact that the riders are relatively more exposed and tend to weave in and out of traffic, are more prone to toppling, would be contributory factors. Motorcyclists are a vulnerable due to the relatively small size compared to other vehicles and therefore, they are often missed, not noticed, or fall in the blind spot of other drivers.[7]

More than half the vehicles registered in Sri Lanka are motor cycles, and is about four times the number of three-wheelers. Given this fact, and that the motor-cycle offers even lesser protection to its occupants than a three-wheeler, one would expect there to be a considerably higher percentage of casualties travelling in motor-cycles than in three-wheelers. However, surprisingly, the percentage of casualties in three-wheelers was approximately 75% of those travelling on motor cycles. The fact that a motor-cycle could accommodate only two people while a three-wheeler can accommodate a maximum of four, may have contributed to this figure. The high percentage of casualties travelling in a particular type of vehicle could be contributed to by three factors. Firstly, it could be because there is a high number of that particular type of vehicle on the roads. Secondly, the particular type of vehicle may carry a higher number of passengers (buses *vs* three-wheelers or motorcycles). Thirdly, factors related to the particular type of vehicle may contribute to a higher number of casualties.

Three-wheelers are often used to travel short distances, especially in city roads congested with traffic. Three-wheeler accidents contributes significantly to RTA morbidity. The absence of safety features in three-wheelers such as seat belts, air bags, collapsible steering wheels plays an important role. Some other reasons are carrying more than three passengers, older three-wheelers and drivers' flouting traffic laws.[8]

Three-wheelers are light, relatively unstable vehicles, and are especially prone to toppling during sudden deceleration and application of brakes. Toppling due to sudden turning is commonly caused by the drivers tampering with the vehicle's handle bar (steering) lock in order to decrease the vehicle's turning circle.[9]

Several legislative measures have been taken by law-enforcement authorities in Sri Lanka to make three-wheelers safer. A law was introduced by the Sri Lanka police in 2012 limiting the number of passengers travelling in a three-wheeler to three. Furthermore, drivers are now encouraged to use three-wheelers that have the right side boarded up, so that the vehicle can be accessed only from the left side and would therefore help prevent passengers being thrown out of the vehicle. However, I recommend three-wheelers to have doors adjacent to the front and back seats on both sides. In 2018, the age limit to obtain a licence to drive a three wheeled vehicle was raised to 35 years. In addition, the introduction of seat belts in three-wheelers and laws requiring the driver and passengers to use them should be implemented. Educating the drivers on the danger of tampering with the handle bar lock, the instability of a three wheeled vehicle compared with four wheeled vehicles also needs to be done. There are 1.2 million three wheelers for hire today. The number of three wheelers being registered should be limited or completely halted and only electric powered three wheelers should be imported.

Road traffic injuries can be prevented. Governments need to take action to address road safety in a holistic manner. This requires involvement from multiple sectors such as transport, police, health, education, and actions that address the safety of roads, vehicles, and road users. The WHO Save LIVES road safety technical package includes evidence-based measures that can significantly reduce road traffic fatalities and injuries. It focuses on Speed management, Leadership, Infrastructure design and improvement, Vehicle safety standards, Enforcement of traffic laws and post-crash Survival.

Effective interventions include designing safer infrastructure and incorporating road safety features into land-use and transport planning, improving the safety features of vehicles, improving post-crash care for victims of road crashes, setting and enforcing laws relating to key risks, and raising public awareness.

REFERENCES

1. The top 10 causes of death. World Health Organization [Internet]. 2018. [updated 2019; cited 2019 Feb 5]. Available from: http://www.who.int/mediacentre/factsheets/fs310/en/

2. Magnitude and impact of road traffic injuries, RTI prevention training manual. World Health Organization [Internet]. 2008; 11-14. [cited 2019 Feb 5]. Available from: http://www.who.int/violence_injury_prevention/road_traffic/activities/roadsafety_training_manual_unit_1.pdf

3. Statistics: Road Accidents -The way they are taking place. Ministry of Transport and Civil Aviation [Internet]. Sri Lanka; 2016-2017. [updated 2019 Feb 01; cited 2019 Feb 5]. Available from: http://www.transport.gov.lk/web/index.php/statistics/national-council-for-road-safety.html

4. Kopits E, Cropper M. Traffic fatalities and Economic Growth. Policy research working paper No 3035. The World Bank development research group [Internet]. 2003. Available from: http://www.youthforroadsafety.org/uploads/tekstblokken/traffic_fatalities_and_economicgrowth.pdf

5. Road Traffic Injuries. World Health Organization [Internet]. 2018. [updated 2019; cited 2019 Feb 05]. Available from: https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries.

6. Fernando DM, Tennakoon SU, Samaranayake AN, Wickramasinghe M. Characteristics of road traffic accident casualties admitted to a tertiary care hospital in Sri Lanka. Forensic science, medicine, and pathology. 2017; 13(1): 44-51.

7. Lateef F. Riding motorcycles: is it a lower limb hazard?. Singapore medical journal. 2002; 43(11): 566-9.

8. Jayatilleke AU, Poudel KC, Dharmaratne SD, Jayatilleke AC, Jimba M. Factors associated with RTCs among for-hire three-wheeler drivers in Sri Lanka: a case–control study. Injury prevention. 2015; 21(6): 374-80.

9. de Silva M, Nellihala LP, Fernando D. Pattern of accidents and injuries involving three-wheelers. Ceylon medical journal. 2014; 46(1).

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POINT OF VIEW

LIBERALIZING ABORTION LAWS IN SRI LANKA; PROSPECTS AND CHALLENGES

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Abortion is legally defined as the removal of the fetus from the uterus any time before its gestation is completed. The law governing abortions in Sri Lanka is contained in the Penal Code Ordinance No 02 of 1883. According to section 303 of the code, abortion is only permitted when carried out to save the mother's life. Sri Lanka is a country with the most restrictive laws on abortions in the south Asian region along with Afghanistan. However, even with these restrictions it is estimated that, Sri Lanka has one of the highest abortion rates in the world. Many attempts have been made to reform the penal laws relating to abortions which were enacted in colonial times. This includes the initiative taken by the law commission of Sri Lanka in 2013 when they proposed rape and foetal impairment as grounds for legal abortion. However, no actions have been taken regarding the liberalization of the provisions pertaining to abortions.

A qualitative approach was used to identify the prospects and challenges that lie ahead in liberalizing the laws of abortions. Initial inquiry revealed that religious and cultural reasons account for the strict opposition towards liberalization which has negatively affected the political will of the rulers in bringing about changes. The greatest fear has been that liberalization would result in a sudden increase in the number of abortions. However, studies have revealed that, liberalization does not increase abortion rates but helps reduce the number of fatalities resulting from unsafe illegal abortions. The liberalization of the abortion laws has become both a contemporary and a necessary change for the protection and enhancement of the rights of women and their autonomy.

Abortion which is universally practiced by no means has a universally approved procedure. The legitimacy of the act varies according to religious and scientific evaluations of foetal life, sexual mores, state population policies, the circumstances of conception, and the status of the woman involved.[1] The moral question of abortion is difficult because it is unique. It is because the human fetus is so unique to other individuals and because the relationship between fetus and pregnant woman is so unlike other relationships.[2] In the Sri Lankan context, according to the penal code, abortion is allowed only to save the mother's life.[3] According to the Penal Code of Sri Lanka, any person performing an illegal abortion is liable to be punished with imprisonment up to three years and where it results in death of such a woman, the person performing an illegal abortion would be punished with imprisonment for up to 20 years.

In spite of strict laws, illegal abortions are frequently performed in Sri Lanka. Induced abortion in Sri Lanka is a problem that has been conveniently ignored for too long. The laws pertaining to abortions have remained unchanged for nearly one and a half centuries. Over time and throughout cultures, women have responded in different ways to abortion. Self-help practices, alternative medicine or clandestine professional practice are some of the most commonly practiced methods of abortion.[4] While most countries have relaxed abortion laws, Sri Lanka has not amended its laws from its inception in the late 19th century.

Even as a developing country Sri Lanka has been able to maintain high standards with regard to its health sector. However, the issue of abortions has somewhat undermined this achievement as Sri Lanka is ranked as a country with a high rate of abortions. While the social, cultural and religious background of the country has on many occasions stood in the way of liberalizing the grounds on which abortions can be permitted the number of illegal abortions and the deaths resulting from those have increased. While some fear that, with the liberalization of abortion laws the number of abortions may increase, research has shown that liberalization has in most part resulted in the decline in the number of deaths associated with abortions. The world is moving towards liberalizing abortion laws. In order for the Sri Lankan woman to enjoy the rights enjoyed by other women worldwide with regard to abortions a reevaluation of the existing laws and policies is a major requirement.

The significant of this research lies in providing an analytical perspective on the respective challenges and prospects Sri Lanka faces in liberalizing its abortion laws. The main objectives of this paper is to discuss the existing law regarding abortions in Sri Lanka, explore the correlation between the existing law and the number of abortions, compare and contrast the accepted grounds for abortions in other countries and critically evaluate the prospects and challenges that Sri Lanka faces in liberalizing its laws.

This research was carried out primarily by using qualitative methods. Primary sources of existing legislations, International treaties and declarations, committee reports and decided case law was perused. Furthermore, secondary data was gathered by governmental and non- governmental organizations on the issue of abortions. A quantitative approach was used in a supplementary manner in analyzing the secondary data gathered by various parties.

Schur observes that, 'perhaps since the very beginnings of civilization women have engaged in the practice of abortion; the destruction or expulsion from the womb of the unborn child/fetus, before it attains viability, to free themselves from unwanted childbearing.[5] According to Russell 'abortion is legally defined as the expulsion of the fetus from the uterus (womb) at any time before its term of gestation is complete.[6] For medico-legal purposes,

abortions may be grouped into three classes as spontaneous, therapeutic, and criminal.[6] Spontaneous abortions are due to abnormal development or death of the ovum or its membranes; while the remainder are caused by maternal disease, either systemic or involving the womb or its accessories. It is the natural death of an embryo or fetus before it is able to survive independently. A therapeutic abortion is an interruption of pregnancy performed to safeguard the health or save the life of the mother. If one were to perform such an abortion, it has to be performed by a qualified physician, acting in the honest belief that the life of the pregnant woman will be endangered by the continued presence of the pregnancy. On the other hand, criminal abortions are unlawful abortions which are illegally induced (which are not justified by circumstances).

In the Sri Lankan context abortions are allowed only to save the life of the mother if it is threatened from furthering the pregnancy. Section 303 of the Penal Code stipulates that, an abortion is only permissible 'if such miscarriage be caused in good faith for the purpose of saving the life of the woman'.[3] In all other instances an abortion would fall under the category of criminal abortions and the former would fall under therapeutic, that is to say an abortion carried out in order to safeguard the health or save the life of the mother. Therefore, reasons such as rape, incest and foetal impairment, will not per se be a reason for carrying a legal abortion unless such is done in good faith for the purpose of saving the life of the woman.

Even with these strict laws on illegal abortions, Sri Lanka has seen dramatic increase in the number of abortions. In 1984, the Minister of Health estimated that over 500 abortions are done in Colombo daily.[7] It has been estimated that around 125,000-175,000 abortions per year have taken place in the 1990s and the figure has escalated to 650 abortions per day by the year 2016.[8] The significance of illegal abortion in the health context is evident from the fact that it contributes to 12.5% of all maternal deaths and is the third most common cause of maternal death. It has been found that abortion has become a means of fertility regulation.[8]

The existing law, a legacy of colonial rule, permits abortion only to save a woman's life. This archaic piece of legislation has not been revised since 1883.[9] Opinions of Sri Lankans became evident during attempts made in 1970s' and 1990s' to change the law to include rape, incest and fetal abnormalities as indications for legal abortion through a private member's bill and a cabinet paper respectively. An amendment to the law sponsored by interested groups to liberalize abortion in cases of lethal congenital anomalies, incest, rape and contraceptive failure was presented to the National State Assembly in 1995. It was abandoned after the debate that followed its very first reading.[10] The most recent effort in liberalizing the abortion laws came in 2013 with law commission's proposal on medical termination of pregnancy.[10] However, the proposal has not been seriously considered still and even after five years the report remains a forgotten piece of documentation.

The 2013 the law commissions proposal on medical termination of pregnancy has suggested that the law relating to abortions be liberalized. It has identified rape and foetal abnormality as two grounds on which legal abortions could be allowed provided that, the necessary criteria of establishing rape and foetal abnormality are met. However, the proposal has rejected inclusion of incest as a separate ground for allowing an abortion, and has pointed out that incest be allowed if it was a rape or there is a foetal abnormality that justifies an abortion.

Table 1: Regulations governing abortion worldwide

Country	Grounds on which abortion is permitted						
	Save life of the woman	Preserve physical health	Preserve mental health	Rape/ incest	Foetal impairment	Economic/ social reasons	On request
Sri Lanka	√	x	x	x	x	x	x
India	√	√	√	√	√	√	x
Pakistan	√	√	√	x	x	x	x
South Africa	√	√	√	√	√	√	√
United Kingdom	√	√	√	x	√	√	x
United States	√	√	√	√	√	√	√
Qatar	√	√	√	x	√	x	x
Austria	√	√	√	√	√	√	√
Afghanistan	√	x	x	x	x	x	x
Bangladesh	√	x	x	x	x	x	x
Total (Yes)	**10**	**7**	**7**	**4**	**6**	**5**	**3**

Source: UN country profile on abortions

These recommendations were made by the commission by looking into several jurisdictions of the world which has liberalized their abortion laws.[10] Table 1 shows the grounds on which some countries allow abortions. It is evident that many countries, including Qatar and Pakistan have liberalized their abortion laws. Out of the above only 3 countries allow abortions on request while 5 countries allow abortions on socio-economical ground. Sri Lanka, Afghanistan and Bangladesh have the most restrictive abortion laws which only permits abortion on the sole ground of health and safety of the mother.

The socio-legal reasons for the reluctance in amending the existing laws on abortion are mainly based in religious, cultural and social factors that strictly rejects the liberalizing of abortion laws. Sri Lanka being a country where the majority of people are Buddhist reject killing of beings based on the five basic precepts of Buddhism. According to the American Theravadin Buddhist, '[a] bortion is the intentional taking of human life, an extremely bad and unwholesome act which is not to be done. For the devout, traditional Buddhist, that is the end of the matter.[11] Other religions such as Catholicism and Islamism also prohibits abortions. Both the religions opine that, sexual intercourse is for procreation and that such procreations should not be interfered with.

The most significant issue faced by Sri Lanka is the increase in the number of unsafe and illegal abortions that are performed by unskilled persons which has a high tendency of resulting in deaths. It is estimated that nearly 15-40 deaths occur as a result of these abortions.[12] Women who seek illegal abortions are mostly those who have unwanted pregnancies. This group includes both married and unmarried women. Even among married women abortions may be carried out due to low level of income with inability to provide for a child. On the other-hand when unmarried women seek abortions due to economic and social reasons. The stigma attached to single motherhood with many social issues such as isolation and condemnation is a significant reason for unmarried women to seek abortion. It is observed that women from high economic backgrounds find it easy to get an abortion with the help of private practitioners on the recommendation that the pregnancy is a threat to the life of the mother.[12]

The problem relating to abortions in Sri Lanka lies in the voluntary abortions that are carried out without any justifiable reason such as danger to the life of the mother, rape and foetal impairment. Even if the law is liberalized to include rape and foetal impairment as grounds for abortions, it will not result in reducing the number of illegal abortions as they are on request. Rosana Peiro,[4] who has done a study in Spain on the correlation of liberalizing abortion laws and the number of abortions finds that, liberalizing abortions have not resulted in an increase in the number of abortions. However, it has resulted in reduction of the number of deaths resulting from backdoor abortions. Furthermore it has also resulted in women being able to access safer and good quality services regarding abortions.

The abortion laws in Sri Lanka, should be liberalized to include rape and foetal impairment with the additional requirement of medical certification as grounds for abortion. This could result in a decrease in the number of deaths that occur due to back-door abortions.

The current laws relating to abortion which were enacted in the colonial era has long become outdated. With the recognition of the autonomy and the independence of women, they have been granted with the power of decision making when it comes to their body and general well-being. Even when less liberalized countries such as Pakistan and Qatar have been able to liberalize or allow for such grounds as mental and physical condition of the women being considered in allowing for abortions has gone beyond the permissible grounds in Sri Lanka, which only recognizes the threat of life to the women as the only ground for an abortion. While some have raised concerns on the possibility of number of abortions being increased with the liberalization of abortion laws, research has proven that, liberalization does not necessarily mean an increase on the rate of abortions but a decrease in the number of deaths from the abortions.

In the global health indexes even as a developing country, Sri Lanka has performed well and has been appreciated for its health standards. However, figures relating to illegal abortions and the deaths which have resulted from such have put a negative impact on the overall health standards in the country. Liberalizing the existing abortion laws therefore, could have a positive impact on the number of deaths resulting from abortions. However, as illegal abortions are mostly done to get rid of unwanted pregnancies, liberalizing of the abortion laws will not help to reduce the number of these kind of abortions. Instead, in order to combat these issues awareness among people with regard to family planning and contraceptive methods should be increased and awareness programmes at the grass-root level should be conducted.

REFERENCES

1. Brookes B. Abortion in England 1900-1967. 1st ed. London: Routledge; 2012.

2. Boonin D. A defense of abortion. Cambridge, UK: Cambridge University Press; 2003.

3. Penal Code of Sri Lanka, Ordinance No 02 of 1883, Section 303.

4. Peirö RO, Colomer C, Alvarez-Dardet C, Ashton JR. Does the liberalization of abortion laws increase the number of abortions? The case study of Spain. The European Journal of Public Health. 2001; 11(2): 190-4.
   DOI: https://doi.org/10.1093/eurpub/11.2.190

5. Schur EM. Abortion and the social system. Social Problems. 1955; 3(2): 94-9.
   DOI: https://doi.org/10.2307/798708

6. Fisher RS. Criminal abortion. The Journal of Criminal Law, Criminology, and Police Science. 1951; 42(2): 242-9.
   DOI: https://doi.org/10.2307/1140800

7. Senanayake H. Induced abortion in Sri Lanka. Ceylon Medical Journal. 2004; 1; 49(1): 1-4.
   DOI: http://dx.doi.org/10.4038/cmj.v49i1.3274

8. Suranga MS, Silva KT, Senanayake L. Perception on the abortion laws in Sri Lanka: A community based study in the city of Colombo. Ceylon Medical Journal. 2016; 61(4).
   DOI: https://doi.org/10.4038/cmj. v61i4. 8384

9. Kumar R. Abortion in Sri Lanka: the double standard. American journal of public health. 2013; 103(3): 400-4.
   DOI: https://dx.doi.org/10.2105%2FAJPH.2012.301154

10. Sri Lanka Law Commission, 'Medical Termination of Pregnancy - Proposals of the Law Commission of Sri Lanka' (Sri Lanka Law Commission 2013). Available from: https://lawcom.gov.lk / web/images/stories/reports/medical_termination_of_pregnancy_proposals_of_the_law_commission_of_sri_lanka.pdf

11. Keown D. Buddhism and Abortion. In: Contemporary Buddhist Ethics. Ist ed. London: Routledge; 2013. 145-76 p.
   DOI: https://doi.org/10.4324/9780203037072

12. Abeykoon ATPL. Estimates of Abortion Rate in Sri Lanka using Bongaarts Model of Proximate Determinants of Fertility. Colombo: UNFPA, the United Nations Population Fund; 2012. Available from: http://www.ihp.lk/publications/docs/EOASL.pdf.

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DEATHS ON RAIL ROADS: A STUDY FROM COLOMBO NORTH TEACHING HOSPITAL, SRI LANKA

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ABSTRACT

In Sri Lanka railway related deaths are reported throughout the year. Most accidental deaths occur due to negligent behaviour of pedestrians and drivers. Fatal train impacts cause extensive visceral and musculoskeletal injuries due to the nature of the object as well as the amount of force transmitted during impact. A study of this nature would help ascertain demographic details of victims, characteristics of the incident of fatal train crashes and recognize the injury profile. An autopsy based retrospective study was done using postmortem reports of 10 years. Seventy autopsy reports from Colombo North Teaching Hospital between July 2006 and July 2016 were analyzed. Data regarding demographic details of victim and incident, external and internal injury distribution, cause and manner of death as determined at autopsy were extracted. Majority of victims were males between 20-39 years (43.7%, n=32) of age and were married (64.3%, n=45). Most victims of accidents were trespassers 68.8% (n=33). 68.6% (n= 48) and 31.4% (n=22) respectively were due to accidents and suicide. The highest number of fatalities 64.3% (n=45) were observed between 2 pm to 10 pm. The number of external injuries were more in accidents than suicides. The most common cause of death was multiple injuries. Majority of the deaths were accidental. Transections of neck, chest and traumatic amputations of extremities were common in suicides than accidents.

***Key words**: death; railroad; accident; suicide*

INTRODUCTION

Sri Lanka has a railroad transport system which consist of 1,567.62 kilometers of rail track with 360 railway stations. The Sri Lankan railway system operates 396 trains and transports around 3.72 million passengers daily and more than 92 million passengers annually.[1] Traffic related deaths and injuries are an identified problem in Sri Lanka. Statistics reveal that approximately 250 people have died in train accidents during the year 2016.

No comprehensive studies have been carried out on railroad accidents in the recent past in Sri Lanka to provide reliable statistics. However, reports of incidents in the national newspapers indicate that most deaths that occur on railway tracks are not due to factors related to the train itself (derailment, mechanical errors of the train or track) but the result of careless use of rail crossings in places without barrier or signaling, attempting suicide or usage of rail track by trespassers. Vehicular-train crashes as well as pedestrian-train crashes are seen at unsafe crossings, creating public turmoil. In some instances, accidents occur at the crossings as well as on the track because of lack of attention to train signals by the level crossers or the "pedestrians" on the rail track.

Based on published information, fatalities are rare among train passengers while travelling or employees of the railway department.[2,3]

Fatal train impacts cause severe injuries on the victims due to the nature of the object as well as the amount of force transmitted during the impact. Extensive visceral and musculoskeletal injuries are evident due to the dynamic nature of the incident and due to run over by wheels. Injuries such as decapitations, transection of the body and amputations are observed mostly in rail road deaths than on regular roads. However, the published literature does not reveal recent studies related to epidemiology and injury profile related to train crashes in Sri Lanka.[4] It is envisaged that this study will help to recognize the injury pattern and trends in rail road fatalities.

OBJECTIVES

With regard to deaths on rail roads to determine;

- the socio-demographic profiles of the victims
- characteristics of the incident
- injury profile

METHODOLOGY

An autopsy based retrospective study was undertaken using postmortem reports of 10 consecutive years. Postmortem reports of deaths following collision with a train, which were referred to the Colombo North Teaching hospital, Ragama, Sri Lanka, for medico legal autopsy, between 2006 July to 2016 July were perused. Cases included those who had fatal injuries following impact with a train while travelling in the train or other vehicle, while using rail track for walking or crossing or attempted suicide on track. Information including demographic details of victim, nature of incident, physical disabilities, reasons for collision with a train, time and month of incident, place of collision, external and internal injury distribution and cause and manner of death as determined by autopsy were extracted, maintaining confidentiality.

RESULTS

Seventy reports of rail road fatalities were identified.

Socio-demographic profile

Seventy nine percent were male.

Table 1: Age of victims

Age (yrs.)	Number (%)
<19	01(1%)
20- 39	32(46%)
40-59	18(26%)
>60	18(26%)
Not known	01(1%)

The average age at death was 43 years. The age of males ranged from 19 to 75 years and females from 21 to 78 years. Majority of victims were males between 20-39 years of age.

Characteristics of the incident

There were 48 (69%) accidental deaths and 22 (31%) suicidal deaths. Among them six were train-vehicular collisions causing 9 (13%) fatalities and 61 (87%) were train-person collisions. Victims accidental train vehicular collisions includes 3 (6%) motor cycle riders, 2 (4%) motor cycle occupants, 1 (2%) bicycle rider, 1 (2%) truck driver, and 2 (4%) occupants of a three wheeler.

All suicides were of pedestrians. Collision occurred on the rail track away from the station in 20 (91%) cases and close to the rail crossing in 2(9%) cases.

Two commuters (4%) had fatal injuries; one slipping while getting into a moving train and the other falling on to the rail track while running on the platform to catch a moving train. A single blind person sustained injuries while getting down from the train before it had stopped.

Possible contributory factors relating to victim

Among the accidental deaths there was a history of consumption of alcohol prior to the incident in 14 (29%) fatalities, physical disability (blindness, hearing impairment and difficulty in walking) in 4 (8%) cases, engaging in unsafe practices such as getting into a moving train in 2 (4%) cases and improper use of level crossing by pedestrians, driver and a rider in 5 (10%) cases.

Among the victims of suicide five (23%) had been diagnosed with psychiatric disease and 6 (27%) had a history of alcohol abuse.

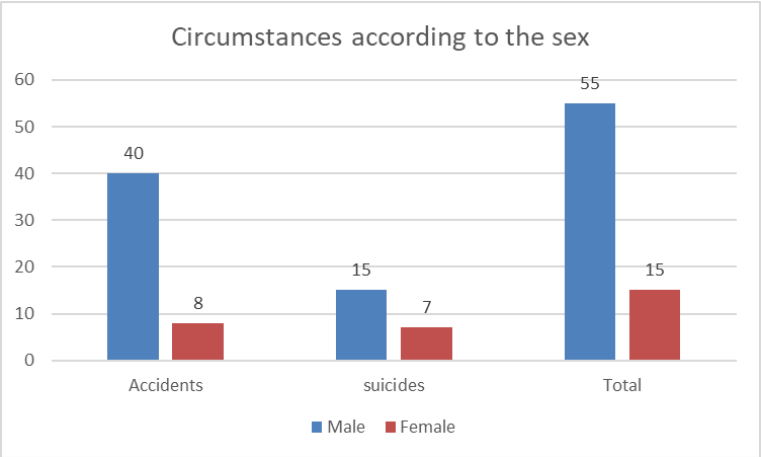
Survival period of victim

Sixty three (90%) victims were dead on admission to the Hospital. Seven (10%) were alive with injuries and were admitted to the primary care unit of the hospital. Five (7%) died during resuscitation, 2 (3%) survived, 1-4 days. There were no long term survivals.

Identity of victim

The identity of a majority (79%) of victims was established at the time of admission to hospital by a known person or using identification documents such as national identity cards, ATM cards, credits cards or driving licenses. Fifteen (21%) dead bodies were brought to hospital without proper identification. Necessary action was taken by the police to establish identity of these persons. Eight (11%) were identified within 48 hours while 6 (9%) took 2- 4 days. Relatives of a deceased were contacted by using a visiting card of a lawyer which was found in an inner pocket of the deceased during the autopsy which was conducted after 3 months. One body was disposed of after the autopsy without establishing the identity which was not included in the study sample.

The following figure illustrates the different circumstances of death.



Sixty nine percent (n= 48) were accidental while the rest were suicidal. Homicidal deaths or post mortem disposal was not observed. Accident was the foremost apparent manner of death among males 73% (n=40) (Figure 1).

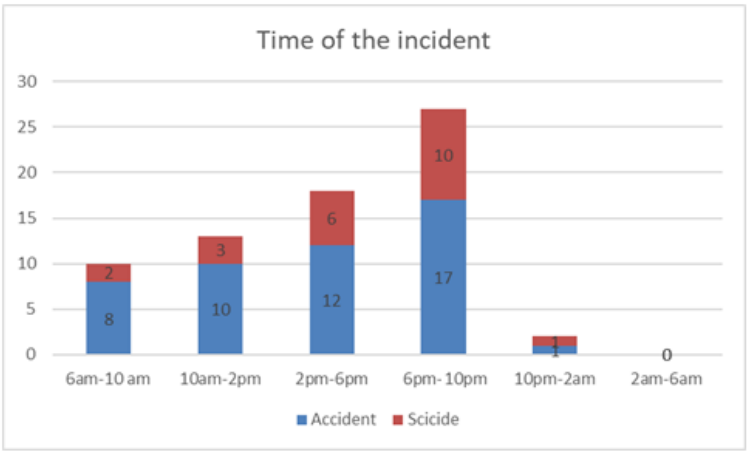
Figure 1: Circumstances of death

Table 2: Circumstances of death with age

Age (years)	Accidents	Suicides	Total
19	01 (2%)	-	01 (1%)
20-39	18 (38%)	14 (64%)	32 (46%)
40-59	15 (31%)	03 (14%)	18 (26%)
>60	14 (29%)	04 (18%)	18 (26%)
Not known	-	01 (5%)	01 (1%)
Total	**48**	**22**	**70**

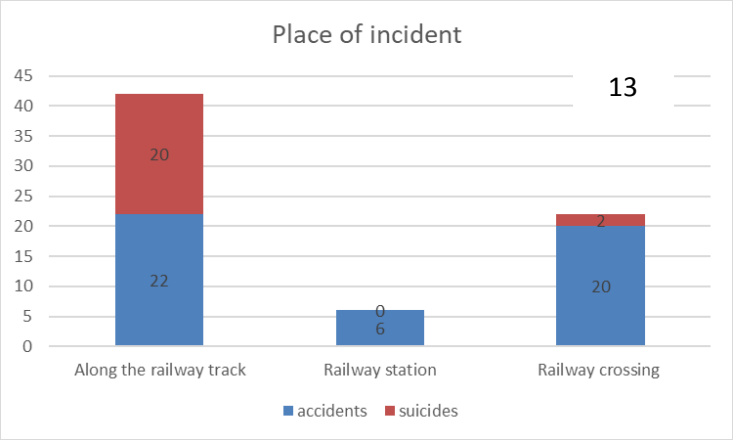
Accidents are distributed between different age groups while suicidal tendencies were mostly apparent in those between ages of 20-39 years (Table2).

Police investigation related to the incident revealed a history of jumping in front of the train, lying down or standing on the rail track as modes of suicidal.



The highest number of fatalities 64% (n=45) were observed between 2 pm to 10 pm. Sixty three percent (n =30) of accidents occurred during day light (6 am to 6 pm) whilst suicides showed a higher frequency 77% (n=17) in the evening and night. This was statistically significant (Figure 2).

Figure 2: Time of day vs circumstances



The place of incident included railway station (and surrounding), rail track away from station, protected/ unprotected level crossings or close to the level crossing. (Figure 3) Rail track, railway station or the rail crossings are not safe for the users showing 22 (45.8%), 6 (12.5%) and 20 (41.7%) accidental fatalities respectively in these locations.

Figure 3: Place of incident and circumstance

Histories revealed that victims used the rail track as a short cut to reach their destinations or crossed the path in hurry without proper attention to approaching trains. One person was using a mobile phone with ear phones at the time of impact with train. In two (4%) cases the rail track was the only path home.

Of the incidents at railway crossings, there were nine fatalities (19%) due to the direct impact of a vehicle and 11 (22.9%) pedestrians fatalities by the train at the level crossing. In 3 (6%) instances the level crossings were unprotected and there were no signal lights. Five (10%) incidents were due to the unsafe practices of persons, crossing the rail track while the gate was closed or while the signal light was on. In 2 cases (4%) the signal lights did not indicate an oncoming train. Another impact was due inadequate visibility of rail road due to trees and a bend. Records were inadequate to identify reasons for crash in other instances.

Most suicide attempts (n=20) (91%) were at lonely places of rail track and only 2 (9%) occurred close to the rail crossing. There were no suicide attempts at or near the railway station.

Injury profile

Types of injuries

The following indicates the injury distribution following accidents and suicides.

Table 3 : Head and neck injuries

Type of Injury	Number of cases					
	Accidents			Suicides		
	Scalp	Face	Neck	Scalp	Face	Neck
Abrasion	6 (16%)	18 (47%)	7 (64%)	6 (27%)	5 (24%)	4 (33%)
Contusion	11 (29%)	2 (5%)	2 (18%)	2 (10%)	2 (10%)	2 (17%)
Laceration	18 (47%)	17 (45%)	2 (18%)	13 (60%)	10 (48%)	3 (25%)
Degloving injury	3 (8%)					
Eye avulsion		1 (3%)			2 (10%)	
Facial mutilation					2 (10%)	
Decapitation						3 (25%)
Total	**38**	**38**	**11**	**21**	**21**	**12**

The occurrence of scalp lacerations were more in suicides (60.2.7%) than accidents. (47.4%). Decapitations were observed in 25% of suicidal cases.

Table 4: External chest injuries

Type of Injury	Number of cases			
	Accidents		Suicides	
	Anterior	Posterior	Anterior	Posterior
Abrasion	19 (58%)	27 (79%)	10 (83%)	06 (75%)
Contusion	07 (21%)	03 (9%)	01 (8%)	01 (13%)
Laceration	07 (21%)	04 (12%)	01 (8%)	01 (13%)
Total	**33**	**34**	**12**	**08**

In the chest both anteriorly and posteriorly abrasion was the commonest injury.
Transection at the level of chest were observed in 9% of cases which were suicides.

Internal injuries consisted of haemothorax in 6 (13%) accidents and 01 (5%) suicide and pneumothorax in 01 (2%) accident.

Table 5 : External abdominal injuries

	Number of cases			
	Accidents		Suicides	
	Anterior	Posterior	Anterior	Posterior
Abrasion	15 (58%)	08 (89%)	05 (71%)	05 (63%)
Contusion	04 (15%)	-	01 (14%)	01 (13%)
Laceration	07 (27%)	01 (11%)	01 (14%)	02 (25%)
Total	**26**	**09**	**07**	**08**

In the abdominal region abrasions and lacerations were the commonest injuries both in accidents and suicides.

Haemoperitoneum was observed only in cases of accidents (6.3%).

Table 6 : Upper limbs and lower limbs

			Number of cases			
			Accident		Suicide	
			Anterior	Posterior	Anterior	Posterior
Upper Limb	External injury	Abrasion	25 (45%)	11 (46%)	12 (55%)	03 (38%)
		Contusion	04 (7%)	04 (17%)	01 (5%)	01 (13%)
		Laceration	26 (46%)	09 (38%)	09 (41%)	04 (50%)
		Degloving laceration	01 (2%)	-	-	-
	Total		**56**	**24**	**22**	**08**
	Other injuries	Traumatic amputation	02 (4%)		05 (23%)	
Lower Limb	External injury	Abrasion	25 (46%)	11 (50%)	12 (52%)	03 (38%)
		Contusion	04 (7%)	04 (18%)	01 (4%)	01 (13%)
		Laceration	26 (47%)	09 (41%)	09 (39%)	04 (50%)
		Degloving laceration	-		01 (4%)	
	Total		**55**	**22**	**23**	**08**
	Other injuries	Traumatic amputation	03 (6%)		06 (27%)	

Abrasions and lacerations were the commonest injuries in both upper and lower extremities. Traumatic amputations were common in suicides than accidents. In suicides traumatic amputation in the upper limbs amounted to 22.7%. Whereas in the lower extremities it was 27.3%. The proportions of lacerations in accidents and suicides involving both upper and lower extremities denote no significant differences.

Table 7 : Brain and spinal cord injury

	Number of cases	
	Accident	Suicide
Cerebral laceration	10 (56%)	06 (67%)
Cerebral contusion	04 (22%)	01 (11%)
Brain stem injury	02 (11%)	02 (22%)
Cerebellar injury	02 (11%)	-
Brain injury	**18**	**09**
Extradural haemorrhage	04 (11%)	01 (13%)
Subdural haemorrhage	08 (22%)	01 (13%)
Subarachnoid haemorrhage	20 (54%)	06 (75%)
Intracerebral haemorrhage	05 (14%)	-
Intracranial haemorrhages	**37**	**08**
Spinal Contusion	06 (60%)	-
Spinal Laceration	04 (40%)	02 (100%)
Spinal cord Injury	**10**	**02**
Transection	05 (10%)	05 (23%)

In the intracranial injuries subarachnoid hemorrhages shows 54.1% in accidents and 75% in suicides. Cerebral lacerations were frequently observed in both accidents (55.6%) and suicides. (66.7%). Transactions were observed in 10.4% of accidents and 22.7% of suicides.

Table 8 : Visceral injuries

	Accident		**Suicide**	
	Contusion	**Laceration**	**Contusion**	**Laceration**
Heart and Great vessels	05 (21%)	11 (20%)	01 (9%)	03 (14%)
Lungs	09 (38%)	10 (18%)	05 (46%)	06 (26%)
Liver	03 (13%)	19 (35%)	02 (18%)	07 (30%)
Gastro intestinal track	02 (8%)	02 (4%)	01 (9%)	02 (9%)
Spleen	03 (13%)	09 (16%)	01 (9%)	03 (14%)
Pelvic organs	02 (8%)	04 (7%)	01 (9%)	02 (9%)
Total	**24**	**55**	**11**	**23**

In the visceral injuries the lacerations were predominating in the liver (34.5%) in accidents. Whereas contusions were more in the lungs. (37.5%). In suicides also contusions were more in the lungs (45.5%) and lacerations in the liver.

Table 9 : Skeletal injuries

	Number of cases	
	Accident	**Suicide**
Skull	34 (25%)	17 (28%)
Cervical Spine	17 (13)	08 (13%)
Thoracic Spine	07 (5%)	04 (7%)
Lumbar Spine	01 (1%)	01 (2%)
Pelvis	07 (5%)	03 (5%)
Ribs	35 (26%)	09 (15%)
Upper Limb	14 (10%)	08 (13%)
Lower Limb	21 (15%)	10 (2%)
Total	136	60

Skull fracture is the commonest fracture involving 25% of accidents and 28.3% of suicides. This illustrates the vulnerability of the head region in succumbing to injuries.

The analysis of cause of death revealed that multiple injuries (49.1%) was the commonest in accidents followed by head injuries. (27.3%) The same phenomenon was observed in suicides also where it amounted to 73.3% and 49.1% respectively (Table 10).

Table 10: Cause and manner of death

Cause of death	**Number of cases**	
	Accident	**Suicide**
Related to head injury	15 (27%)	05 (33%)
Multiple injuries	27 (49%)	11 (73%)
Multiple injuries in two regions	04 (7%)	02 (13%)
Chest injury	01 (2%)	-
Abdominal injury	01 (2%)	-
Decapitation	-	03 (20%)
Transection	-	01 (7%)
Total	48	22

DISCUSSION

Research of this nature is vital in Sri Lanka considering the fact that not many rail roads related studies had been done in the recent past. The analysis of deaths from railway related incidents gives an overall understanding of the main circumstances and other contributory factors. The interpretation of regional injuries helps to solidify the different circumstances.

The literature review reveals several studies from the neighboring country in relation to railway track deaths.[5,6,7]

In most instances the most reliable history comes from the train driver himself. Unfortunately, due to practical difficulties the history is often obtained from by standers and other eyewitnesses related to the incident. Therefore, the reliability of the

correct history is an issue in relation to railroad accidents and suicides.

Identifying the circumstance by corroborating the injury pattern with the given history is one of the main issues that needs to be addressed with great caution. In selected situations when the injuries are mutilating the body the identification also becomes a problem. Meticulous external and internal examination, documentation and interpretation of injuries would circumvent most of the medico-legal issues. Though scene visit is an important component of autopsy examination none of the cases in this study necessitated such a retrospective visit.

Majority of the victims were male and in the age group of 20-39 years. Male predominance has been shown in several studies.[5,6,7] The young adults are more prone to collision with trains and could be due to several reasons. In cases of accidents mobile phone usage, carelessness of the motor vehicle drivers, travelling through the railway crossing when the gates are closed, try to climb or get down from a moving train are some of the identified factors. The deaths can be reduced due to awareness campaigns among public, strict enforcement of law and enhancement of protective mechanisms. The scarcity of studies related to railroad deaths in Sri Lanka and lack of enthusiasm to carry out major studies, less funding in forensic related research are some of the hindrances. In cases of suicides the exact reasons for selecting the railway track, anticipating a collision with a moving train could not be identified with the available samples.

Most of the incidents took place at the railway crossing and along the railway track away from the railway stations. Though the majority of accidents took place during the early night hours (6-10 pm) and late evenings (2-6 pm) there are no reasons to correlate this observation. One of the factor could be the afterward rush hours and the hurriedness to break through the signals and closed doors before an approaching train. The carelessness of the pedestrian would always be the leading factor unless proven otherwise. Interestingly a recent study revealed that the speed of the train is an important deciding factor in the severity of injuries rather than the day, time and place. Although poor illumination may be a contributory factor but it is not a major determinant according to this study.[8] In contrast a German study revealed marked seasonal, weekly and diurnal peaks of railway suicide intensity. Differences between men and women indicate sex-specific processes underlying their suicidal behaviour.[9]

A study involving the New York city found suicides were more common than accidents. The important message is in railroad fatalities is that the injury interpretation involves mostly accidents and suicides. The deaths related to other circumstances are few.[10]

There were several injuries in both external and internal examination. In the head and neck region the external injuries such as abrasion, and laceration were relatively more in comparison to contusions. But the decapitation injuries were significantly observed in suicides only. Therefore, decapitation injuries may be commonly associated with suicides provided no other suspicious injuries caused by infliction.[4] In Sri Lanka it is a known factor that individuals keep their head in the railway track to be run over by the moving train.

The analysis of chest injuries also follows a pattern where the abrasions were the commonest injury in comparison to lacerations and contusions. However, transection at the chest level is typical for suicides when a person decides to end his life by lying across a railway track to be transected by a speeding train.[5,7] This injury pattern will promote the interpretation of the circumstances in the absence of a definite or reliable history. In this study transection were only observed in suicides.

In the external injuries abrasions were comparatively more in the abdomen in both accidents and suicides. The proportion of traumatic amputation of extremities was significantly higher in suicides. This again explains the relative position of a victim in committing suicide by lying across the track and thus the involvement of extremities.

In this study the analysis of visceral injuries especially with relation to brain revealed the brain lacerations (66.7%) and other types of haemorrhages more specifically the subarachnoid haemorrhage (75%) is more common with suicides than accidents. It implies that the relative involvement of head is more common with suicides than accidents. In contrast there is no difference in the percentage of skull fractures showing 25% in accidents and 28.3% in suicides. Unlike external injuries there is no specific type of internal injuries that could be identified with suicides. In summary considering the external injuries transections and traumatic amputations are more common in suicides. Though there were several studies related to railway deaths similar observations in selected situations were present in the neighboring country.[4,5,7,10]

In most of the deaths taking place at rail roads more than the cause of death, identifying the correct circumstances is the main challenging medico-legal issue. Careful interpretation of the external and internal injuries will prevent human errors in deciding the exact circumstance. Finally, a ten year study from Turkey revealed a mortality rate of 16% and morbidity rate of 37% further highlighting the relevance of rail road injuries in clinical patients.[11]

The most common cause of death in both accidents and suicides were due to multiple injuries. It is acceptable considering the speed, impact and heavy metal involvement in collision with human subjects. Further head injuries alone were accounted in several deaths.

The most common circumstance was accident (68.6%) and in most instances it was preventable. The next common was suicide. Though the death would be traumatic and painful or may end up with lifelong disabilities several choose collision with a moving train as a mode of death to end their lives. The suicides took place in areas away from the crossings and railway stations. The victims made sure of a death from fatal injuries. This further emphasizes the role of railway authorities to be vigilant to minimize these deaths even though trespassing into or along the railway track is not permitted in Sri Lanka. A systematic review reported in the BMC public health revealed 'empirical evidence for socio environmental factors for railway suicide is limited and inconsistent." The same observations made in this study as well with limited data available to determine the exact reasons to choose this mode of death and thus limiting the preventive measures.[12,13]

CONCLUSION

Majority of rail road deaths were accidental. Transections of neck, chest and traumatic amputations of extremities were commoner in suicides than in accidents.

RECOMMENDATION

Rail road deaths could be reduced with increased public awareness, enhanced protective mechanism at rail crossings and strict enforcement of the law. In relation to suicides in depth analysis must be done to identify the factors which prompt the victims to choose rail roads to end their lives.

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REFERENCE

1. Sri Lanka Railways [Internet]. Sri Lanka: Sri Lanka Railways; 2011 [updated 2011; Available from: http://www.railway.gov.lk/

2. Performance Report- 2016 [Internet]. Sri Lanka: Parliament of Sri Lanka, Department of Sri Lanka Railway; 2016 [updated 2018 May 10; Available from: http://www.parliament.lk/uploads/documents/paperspresented/performance-report-department-of-srilanka-railway-2016.pdf

3. Ministry of Transport and Civil Aviation [Internet]. Sri Lanka; Ministry of Transport and Civil Aviation; 2018 [updated 2018 Jul 12; Available from: http://www.transport.gov.lk

4. Byard RW, Gilbert JD. Characteristic features of deaths due to decapitation. The American Journal of Forensic Medicine and Pathology. 2004; 25(2): 129-30. DOI: https://doi.org/10.1097/01.paf.0000127400.12824.f9

5. Sheikh MI, Shah JV, Patel R. Study of death due to railway accident. Journal of Indian Academy of Forensic Medicine. 2008; 30(3): 122-7.

6. Valsala K, Sreedevi CS, Sreelekshmi J. Analysis of railway track deaths-an autopsy based study. International Journal of Research in Medical Sciences. 2017; 5(3): 935-9. DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20170639

7. Kumar PR. A study of deaths due to railway fatalities at a tertiary care hospital mortury 2015-16. International Journal of Research in Medical Sciences. 2017; 6(1): 264-7. DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20175731

8. Ghomi H, Bagheri M, Fu L, Miranda-Moreno LF. Analyzing injury severity factors at highway railway grade crossing accidents involving vulnerable road users: A comparative study. Traffic Injury Prevention. 2016; 17(8): 833-41. DOI: https://doi.org/10.1080/15389588.2016.1151011

9. Erazo N, Baumert J, Ladwig KH. Sex-specific time patterns of suicidal acts on the German railway system. An analysis of 4003 cases. Journal of Affective Disorders. 2004; 83(1): 1-9. DOI: https://doi.org/10.1016/j.jad.2004.04.012

10. Lin PT, Gill JR. Subway Train-Related Fatalities in New York City: Accident versus Suicide. Journal of Forensic Sciences. 2009; 54(6): 1414-8. DOI: https://doi.org/10.1111/j.1556-4029.2009.01165.x

11. Akkaş M, Ay D, Metin Aksu N, Günalp M. 10-year evaluation of train accidents. Ulus Travma Acil Cerrahi Derg. 2011; 17(5): 440-4. DOI: https://doi.org/10.5505/tjtes.2011.66750

12. San Too L, Milner A, Bugeja L, McClure R. The socio-environmental determinants of railway suicide: a systematic review. BMC Public Health. 2014; 14(1): 20. DOI: https://doi.org/10.1186/1471-2458-14-20

13. Taylor AK, Knipe DW, Thomas KH. Railway suicide in England and Wales 2000–2013: a time-trends analysis. BMC Public Health. 2016; 16(1): 270. DOI: https://doi.org/10.1186/s12889-016-2944-x

DOI: http://doi.org/10.4038/sljfmsl.v9i2.7810

USAGE OF DIGITAL PHOTOGRAPHS IN FORENSIC WORK IN SRI LANKA

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ABSTRACT

Forensic photography refers to making of images to record objects, scenes and events to be used in the legal process. With popularization of digital cameras, forensic photography is being increasingly used as a tool in record keeping as well as evidence. The objective of this study was to evaluate available facilities and current practice of using digital photographs in forensic work by medico-legal doctors in Sri Lanka. A cross sectional descriptive study was conducted using a self-administered questionnaire among doctors engaged in forensic work in Sri Lanka. The study was conducted as an on-line survey from October 2018. Out of 102 doctors who participated in the survey, 51% (n=52) used camera-phones instead of DSLR cameras to take forensic photographs, although 72% (73) had a DSLR camera in the institution. The majority (96%) used a measuring scale in their photographs, but only 43% used a colour scale. 66% took more than two photographs for a single injury but only 26% used an external light source. 80% took photographs in all magisterial autopsies but only 48% incorporated them in their reports. Majority (74%) knew that forensic photographs are admissible in courts. Basic technical knowledge of functions of a camera was poor in a majority (85%) of doctors. Although basic technical knowledge of photography was poor in doctors engaged in medicolegal practice, many use photographs to compliment autopsy reports. Since comprehension of events using visual images is better than verbal descriptions, improving the quality of photographs submitted to courts should be the way forward. Therefore, forensic photography training should be encouraged.

Key words: Digital Photography; Practice; Medico-Legal Doctors; Sri Lanka

INTRODUCTION

Forensic photography refers to making of images to record objects, scenes and events to be used in the legal process. Forensic photographs may be taken specifically for documentation, analysis, intelligence as a part of the process of evidence collecting or for court presentations.[1] Therefore, the photographs must be accurate and detailed, and of use in court. The photographer not only should have an understanding of the technical requirements but also the related medical and legal requirements.[2]

Autopsy photography causes minimum delay to the autopsy. It is also extremely reliable, as images are not repeatable.[2] At the scene of crime it will produce an accurate reproduction of the crime scene which provides the benefit to the court.[3] A photograph can transfer more information than subjective descriptions, which are open to misinterpretation.[4] Therefore, judges and lawyers will get clear understanding regarding the situation or the condition to arrive at a correct conclusion.

Photography is used in virtually every aspect in the forensic field. Crime scene recording, recording of injuries, identification, interpretation of injuries and detecting clandestine grave sites are few.[5,6] In many parts of the world, forensic photography is a part of police investigation conducted by trained police officers/ trained photographers. However, it is not uncommon to see many forensic medicine experts develop skills of taking photographs related to injuries of living and dead as part of the job, because it is accepted tool of better record keeping. Therefore, the doctor who conducts the postmortem or the clinical examination to take necessary forensic photographs by him or herself has been the common practice in Sri Lanka.

Forensic photography requires a combination of easily portable equipment and additional technical support which is necessary to minimize distortion and misleading information.[2] Further data need to be stored in a manner that are easily retrievable. In this digital era, smartphones have become an essential in person's life because of its multi-purpose use. Therefore, phone cameras are being increasingly used by people and forensic doctors have not escaped the trend. Thus forensic photos by cameras are being increasingly replaced with those from smart phone cameras.

OBJECTIVE

To evaluate available facilities and current practice of using digital photographs in forensic work by medico-legal doctors in Sri Lanka.

METHODOLOGY

A cross sectional descriptive study was conducted using a self-administered questionnaire among doctors who engage in forensic work in all provinces of Sri Lanka. The study was conducted mainly as an on-line survey from October 2018, using a Google form. However, to capture doctors who are not internet user's a postal survey was also employed. Ethical clearance to conduct the study was obtained from the Ethical Review Committee- DGH Trincomalee, Eastern Province.

RESULTS

Out of 102 doctors who participated the survey 52% (n=53,) were Medical Officers Medico-legal in the country with basic medical degree, while the rest were those with postgraduate qualifications. There were 27% Board Certified specialists in Forensic Medicine attached to the Ministry of Health and Departments of Forensic Medicine of state universities. Majority were males (n= 81, 80%) with less than 5 years of experience (62%) in the medico-legal field while 45% (n=46) were from base hospitals. There were 35% from the Western Province while 15% were from Southern and 13% from the Central Province.

The analysis of the type of the camera used to take forensic photographs revealed that just above half of the sample used a phone camera while 39% used a digital SLR camera (Table 1).

Table 1: Type of camera used most to take forensic photographs

Type of camera	Frequency	Percentage
Digital SLR	39	38
Camera phones	52	51
Non DSLR	11	11
Total	**102**	**100**

Although half of the doctors used camera phones to take forensic photographs, majority (71% n= 73) had a DSLR camera in their institutions. Further, 26% used an external light source to take photographs. Analysis of basic features of the forensic photographs revealed that although 96% of doctors incooperated a measuring scale in the forensic photographs only 43% used a colour scale. Two thirds of our sample took more than two photograph to document a single injury (Table 2) while 70% used a flexible measuring tape.

Table 2: Number of photos taken on a single injury

Number of photos taken on a single injury	Frequency	Percentage
One	6	5
Two	30	30
More than two	66	65
Total	**102**	**100**

Forensic photography includes autopsy photographs as well as photographs related to injuries of the living. Analysis of the practice of forensic photography revealed that 84% of doctors take forensic photographs related to clinical situations while 28% take only whenever it is necessary. However, 28% (n=29) of them take photographs in all routine autopsies, 68% takes photos whenever necessary. In contrast, 79% (n=81) of doctors take photographs in all magisterial postmortem (Table 3).

Table 3: Frequency of taking photographs in magisterial autopsies.

Photographs in magisterial autopsies	Frequency	Percentage
Never	2	2
Sometimes	1	1
Occasionally	1	1
Whenever necessary	**17**	17
All cases	**81**	**79**
Total	**102**	**100**

96% of doctors stated that the reason to take forensic photographs is for recording injuries for later usage. 48% (n=49) of doctors incooperated photos in their reports. 74 % (n=74) agrees that annexed printed photographs along with reports are admissible in the courts. Out of 102 doctors only 27% had a formal knowledge of photography, therefore it is no surprise to see that only 15% gave correct answers to the questions regarding the basic technical knowledge of a camera function.

DISCUSSION

Forensic photography is a unique discipline conducted by trained people mostly in the police or investigative services in many parts of the world. They use sophisticated camera and light sources with the main objective of producing them as evidence in a court of law. In developed countries forensic photographs especially those of injuries taken by police are used by the pathologists to describe the injuries to the courts for better comprehension. Even though such a practice is not seen in Sri Lanka, use as complimentary to the

description of injuries has been practiced by many doctors over the years. Except the two institutions designated professional forensic photographers are not found in Sri Lankan Hospitals where medico-legal services are provided. Therefore, forensic doctors tend to take their own photographs both in the living and dead with their limited capabilities. The trend seems increasing with young doctors coming to the field more.

Forensic photographs almost always need the clarity and sharpness, since it is used to generate comprehension of an injury in another persons' mind. For a sharp quality photograph, a high end camera is needed. The study showed that most doctors (51%) prefer to use camera phones instead of DSLR to take their forensic photos even though majority (72% n=73) stated that they have a DSLR camera in their institution. This finding clearly show that use of DSLR camera is largely replaced by camera phone nowadays. Although we have not addressed the reason for the preference of the camera phone by the doctors in this study we clearly understand the user friendliness coupled with availability as well as its ability to generate fairly good quality photographs may be the reason. Moreover, these cameras are easily operable by anyone, because they have inbuilt auto-focusing ability, as well as many enhancing features. Further, the facility to delete poor quality photographs may be another reason for the preference. Therefore, this phenomenon needs further study.

All forensic photos should include the entire piece of evidence and a scale to indicate size.[7] It is important to use colour scale in forensic photographs in order to determine the true colour of the injury, which may give evidence of timing.[8] According to our study, almost all doctors (96%) use measuring scale in their forensic photographs. In contrast only 43% used a colour scale. Therefore, incooperating a colour scale in forensic photography should be emphasized more if we use them more frequently for injury interpretation. Another technical aspect of forensic photography especially on injury interpretation is the number of photos taken of a single injury. This is very important to get a comprehensive idea, especially from different distances. Further, the close up photographs may tell more details. This study showed that 66% took more than two photographs for a single injury showing that the majority understood the relevance.

Flashes as an external light source make it easy and quick to take photos in digital photography. It is also demonstrated with other applications like de-noising, white balance and removal of red eye can synthesize new images that are of higher quality than originals.[9] According to the study, 83% of institutes in Sri Lanaka did not have external light sources. This could be the reason why most doctors (74%) never use external light source while taking their photographs.

Most doctors (74%) who participated in the study agreed, that printed forensic photographs are admissible in the court of law. Although 80% took photographs in all magisterial autopsies only 48% incooperated the photos in their reports. The reasons may be multiple; such as not having enough funds to print them to having the notion of including photographs causing unnecessary questioning from the defense. Thus, this too need further evaluation as well as research.

Exposure is the process of recording light on to the digital sensor. It is controlled by the aperture setting (size of the hole which allow light to pass through), speed of the shutter and sensitivity of the camera sensor. These three setting are called exposure triangle.[10] The understanding of exposure triangle is important. Optimally exposed images give more detail than over- or underexposure images.[11] In this study only 14% knew the exposure triangle correctly.

Another area that we studied was the understanding of the image quality. A

camera with a larger sensor will produce sharp images with less noise. Therefore, size of the sensor is a matter for a better quality image.[12] With a small sensor, the pixels can't capture as much light, so a pocket camera will produce images that have less dynamic range and never as clean as a DSLR. The study showed only 15% knows that the sensor size is the most important factor for a better quality photograph. Therefore, above findings of the study were compatible with poor basic technical knowledge of a camera function among forensic doctors and need to be addressed.

CONCLUSION

Although basic technical knowledge of photography was poor in forensic doctors, increasingly many used photographs to compliment autopsy reports. Since comprehensions of events using visual images are better than verbal descriptions, improving the quality of photographs submitted to courts should be the way forward. Therefore, forensic photography training should be encouraged.

REFERENCES

1. Forensic Photography - Analysis, Considerations for Defining a Forensic Photograph and Photographer, Final Words, Organizations. [Cited 02 July 2018]. Available from: http://encyclopedia.jrank.org/articles/pages/1135/Forensic-Photography.html

2. Henham AP, Lee KA. Photography in forensic medicine. Journal of Audiovisual Media in Medicine. 1994; 17(1): 15-20. DOI: https://doi.org/10.3109/1745305 940 9018372

3. Rost T, Wittig H. Photo documentation during autopsy. Arch Kriminol. 2014; 233: 57-66.

4. Melhuish J. Know how. A guide to medical photography. Nursing Times. 1997; 93(7): 64-5.

5. Evers R, Masters P. The application of low-altitude near-infrared aerial photography for detecting clandestine burials using a UAV and low-cost unmodified digital camera. Forensic Science International. 2018; 289: 408-18. DOI: https://doi.org/10.1016/j.forsciint. 2018.06.020

6. Trefan L, Harris C, Evans S, Nuttall D, Maguire S, Kemp AM. A comparison of four different imaging modalities–Conventional, cross polarized, infra-red and ultra-violet in the assessment of childhood bruising. Journal of forensic and legal medicine. 2018; 59: 30-5. DOI: https://doi.org/10.1016/j.jflm. 2018. 07.015

7. A Simplified Guide To Crime Scene Photography. [Cited 12 November 2018]. Available from: http://www. forensicsciencesimplified.org/photo/Photography.pdf

8. Virea. Presented at Symposium of examination of touture victim; 2018 Nov 01; Gall Face Hotel, Sri Lanka.

9. Petschnigg G, Szeliski R, Agrawala M, Cohen M, Hoppe H, Toyama K. Digital photography with flash and no-flash image pairs. In ACM transactions on graphics (TOG) 2004; 23(3): 664-72. DOI: https://doi.org/10.1145/1186562. 1015777

10. Lowe E. Digital photography: the AACD series—part one. The journal of cosmetic dentistry. 2010; 26(1): 25.

11. Langmann S, Pick D. Photography as a Social Research Method. Singapore: Springer; 2018. pp. 85-102. DOI: https://doi.org/10.1007/978-981-10-7279-6

12. Sue L. Why small sensor size may leave your photos feeling inadequate [Internet]. [Cited 12 November 2018]. Available from: https://www.digitaltrends.com/photography/image-sensor-size-matters.

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HYDROGEN SULFIDE TOXICITY: TWO CASE REPORTS

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ABSTRACT

Hydrogen sulfide (H_2S) toxicity is a known occupational/industrial hazard in organic decaying disposal, sulfur springs, natural gas well and coal pits. We report two deaths due to acute accidental hydrogen sulfide poisoning. Two males 40 and 36 years old were found dead in two different water treatment plants after spilling of sewage. Autopsy revealed greenish discoloration of skin and brain in one individual and pulmonary oedema in both. Toxicology revealed lethal levels of thiosulfate which is a metabolite of H_2S. Death investigation concluded that both fatalities were due to toxicity of H_2S in an accidental manner. Toxicological investigations are important in cases where occupational hazards are suspected.

Keywords: Thiosulfate, H_2S, Occupational hazard, Water treatment plant

INTRODUCTION

Hydrogen sulfide (H_2S) inhalation is not a rare presentation in routine forensic practice. Majority are accidental[1-4] but rarely could be intentional.[5-7] H_2S is a colorless gas with the smell of rotten eggs, commonly generated by degrading of protein waste. It is also identified in sewers and is known commonly as "sewers gas".[8] It is flammable at ambient temperature and pressure is irritant and causes asphyxiation.[9,10] We report two fatal cases of H_2S toxicity where toxicological analysis played a vital role in addressing important medico-legal issues.

CASE REPORT

Case 01:

A previously healthy 40–year–old male was working in a water treatment plant which was almost closed. His body was recovered submerged in spilled sewage hours later. The body was refrigerated till autopsy. Autopsy revealed early stage putrefaction including foul odour, swelling of body, marbling, peeling of epidermis and greenish color skin (Figure 01). Upper and lower airways showed a small amount of dark colored semisolid substance with retention of patency of air passage. Mild frothy fluid was noted on cut surface of lungs. Brain was greenish in color but otherwise normal. Other organs were normal macroscopically and microscopically except for early putrefactive changes. Femoral blood was positive for thiosulfate with a level of 10 µg/mL by GC/MS.

Fig. 01: Body showed early stage of putrefaction with green color hypostasis

Case 02:

A 34–year –old male working in a water treatment plant was trapped in a closed space due to sudden spillage of sewage. He died prior to initiating resuscitation.

He was an adult of average build. There was no evidence of putrefaction or greenish discoloration of skin (Figure 02). Respiratory passages were normal with no evidence of sewage within. Cut surface of the lungs showed mild frothy fluid. Mild atherosclerosis of the left coronary and mild fatty changes of the liver were noted. Other organs appeared normal macroscopically and microscopically. Toxicology revealed a thiosulfate level of 10 µg/mL by GC/MS.

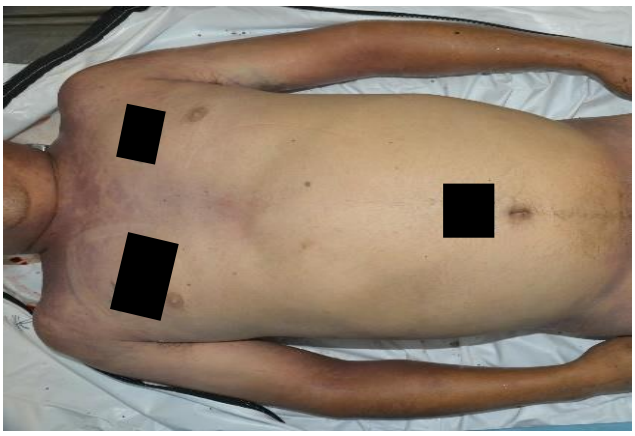

Fig. 02: No evidence of putrefaction and normal skin color

The cause of death in both cases was confirmed as hydrogen sulfide gas toxicity. The manner of death was concluded as accidental.

DISCUSSION

H_2S toxicity is not commonly seen in forensic practice. H_2S is very unstable and rapidly converts to its main metabolite: thiosulfate which remains stable in the body.[11-13] Therefore the level of thiosulfate is considered as a reliable marker of H_2S poisoning.[3,14] However thiosulfate is naturally present in very low levels in blood and urine even in healthy individuals.[15-17] In both cases, the blood levels of thiosulfate was above the toxic level[1,2,5,18,19] and was sufficient to cause death.

It is well known that H_2S is produced naturally during putrefaction.[20] Absorption of H_2S via the skin is also reported if body is exposed to high concentration of hydrogen sulfide.[19] However there is a no huge influence on concentration of blood levels in our cases which showed very high level of toxicity.[19] The mechanism of action of H_2S is almost similar to the action of cyanide where there is prevention of oxygen utilization at cellular level which is postulated as the mechanism of death in this case.[21]

Low and moderate exposure to hydrogen sulfide mainly causes local tissue irritation with cyanosis, coma and rapid death in severe exposure.[22-25] Minimal local reaction due to H_2S in these two individuals indicated that victims were exposed to high level of H_2S than lower level. Mild frothy fluid seen on cut sections of lungs in both the diseased indicates the possibility of asphyxia due to rapid exposure to high concentrations than local irritation which occurs in low and moderate exposure.[26-28] Greenish discoloration of skin seen in one case is a recognized feature of H_2S poisoning.[29-31] Similar discoloration was seen in the brain at autopsy of the same case which is consistent with previous fatal case reports.[24]

Findings at scene investigation and autopsy concluded that the manner was accidental in both instances. This assists the next of kin to claim insurance, compensation or any other benefits.

CONCLUSION

Toxicological investigation is vital where there is a suspicion of H_2S toxicity. Scene investigation with autopsy assisted in addressing possible issues which could arise in cases of H_2S toxicity especially in the working environment.

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REFERENCES

1. Osbern LN, Crapo RO. Dung lung: a report of toxic exposure to liquid manure. Annals of internal medicine. 1981; 95(3): 312-4. DOI: 10.7326/0003-4819-95-3-312

2. Kimura K, Hasegawa M, Matsubara K, Maseda C, Kagawa M, Takahashi S, Tanabe KI. A fatal disaster case based on exposure to hydrogen sulfide–an estimation of the hydrogen sulfide concentration at the scene. Forensic science international. 1994; 66(2): 111-6.

3. Kage S, Takekawa K, Kurosaki K, Imamura T, Kudo K. The usefulness of thiosulfate as an indicator of hydrogen sulfide poisoning: three cases. International journal of legal medicine. 1997;110(4):220-2. DOI:https://doi.org/10.1007/s004140050071

4. Chaturvedi AK, Smith DR, Canfield DV. A fatality caused by accidental production of hydrogen sulfide. Forensic science international. 2001; 123(2-3): 211-4. DOI: https://doi.org/10.1016/S0379-0738(01)00552-7

5. Winek C, Collom W, Wecht C. Death from hydrogen-sulphide fumes. The Lancet. 1968; 291(7551): 1096.

6. Kobayashi K, Fukushima H. Suicidal poisoning due to hydrogen sulfide produced by mixing a liquid bath essence containing sulfur and a toilet bowl cleaner containing hydrochloric acid. Chudoku kenkyu: Chudoku Kenkyukai jun kikanshi= The Japanese journal of toxicology. 2008; 21(2):183-8.

7. Hatake K, Morimura Y, Kudo R, Ishitani A, Kusatani M, Fukudome A, Kasuda S. An autopsy case of death due to hydrogen sulfide poisoning. Hoigaku No Jissai To Kenkyu. 2007; 50: 171-4.

8. Schneider JS, Tobe EH, Mozley Jr PD, Barniskis L, Lidsky TI. Persistent cognitive and motor deficits following acute hydrogen sulphide poisoning. Occupational medicine. 1998; 48(4): 255-60.
DOI: https://doi.org/10.1093/occmed/48.4.255

9. NIOSH (National Institute of Occupational Safety and Health). 1977. Criteria for a Recommended Standard Occupational Exposure to Hydrogen Sulfide. DHEW (NIOSH) Publ No 77-158. Centers for Disease Control and Prevention Public Health Service, US Department of Health Education and Welfare. Washington, DC: US Government Printing Office.

10. Marshall T, Dorman D, Gardner D, Adeshina F. Provisional advisory levels (PALs) for hydrogen sulfide (H_2S). Inhalation toxicology. 2009; 21(sup3):56-72.
DOI: https://www.tandfonline.com/doi/abs/10.3109/08958370903202812.

11. Bartholomew TC, Powell GM, Dodgson KS, Curtis CG. Oxidation of sodium sulphide by rat liver, lungs and kidney. Biochemical pharmacology. 1980; 29(18): 2431-7.
DOI: https://doi.org/10.1016/0006-2952(80) 90346-9

12. Beauchamp RO, Bus JS, Popp JA, Boreiko CJ, Andjelkovich DA, Leber P. A critical review of the literature on hydrogen sulfide toxicity. CRC Critical Reviews in Toxicology. 1984; 13(1):25-97.
DOI: https://doi.org/10.3109/10408448409029321

13. Shih VE, Carney MM, Mandell R. A simple screening test for sulfite oxidase deficiency: detection of urinary thiosulfate by a modification of Sörbo's method. Clinica Chimica Acta; international journal of clinical chemistry. 1979; 95(1):143-5.
DOI: https://doi.org/10.1016/0009-8981(79)90348-6

14. Kage S. Usefulness of thiosulfate as an indicator of hydrogen sulfide poisoning in forensic toxicological examination: a study with animal experiments. Japanese Journal of Forensic Toxicology.1992; 10: 223-7.

15. Kage S, Kudo K, Ikeda N. Determination of sulfide, thiosulfate and polysulfides in biological materials for diagnosis of sulfide poisoning. Japanese Journal of Forensic Toxicology. 1998; 16(3):179-89.

16. Kagedal B, Kallberg M, Martensson J, Sorbo B. Reversed-phase ion-pair liquid chromatographic procedure with electrochemical detection for the analysis of urinary thiosulphate. Journal of chromatography. 1983; 274:95-102.
DOI: https://doi.org/10.1016/S0378-4347(00)84412-6.

17. Kawanishi T, Togawa T, Ishigami A, Tanabe S, Imanari T. Determination of thiosulfate in human urine and plasma by high performance liquid chromatography with a dual electrochemical detector. Bunseki Kagaku. 1984; 33(7):E295-300.
DOI:https://doi.org/10.2116/bunsekikagaku.33.7_E295

18. McAnalley BH, Lowry WT, Oliver RD, Garriott JC. Determination of inorganic sulfide and cyanide in blood using specific ion electrodes: application to the investigation of hydrogen sulfide and cyanide poisoning. Journal of Analytical Toxicology. 1979; 3(3): 111-4.

19. Maebashi K, Iwadate K, Sakai K, Takatsu A, Fukui K, Aoyagi M, Ochiai E, Nagai T. Toxicological analysis of 17 autopsy cases of hydrogen sulfide poisoning resulting from the inhalation of intentionally generated hydrogen sulfide gas. Forensic science international. 2011; 207(1-3): 91-5.
DOI: https://doi.org/10.1016/ j.forsciint.2010.09.008.

20. Nagata T, Kage S, Kimura K, Kudo K, Noda M. Sulfide concentrations in postmortem mammalian tissues. Journal of Forensic Science. 1990; 35(3): 706-12. DOI: 10.1520/JFS12876J

21. Smith, R.P. and Gosselin, R.E., 1979. Hydrogen sulfide poisoning. Journal of occupational medicine: official publication of the Industrial Medical Association; 21(2): 93-97.

22. National Institute for Occupational Safety and Health: Criteria for a recommended standard for occupational exposure to hydrogen sulfide. Cincinnati, OH (USA): National Institute for Occupational Safety and Health, 1977 [DHEW (NIOSH) Publ. No. 77-168].

23. Peters JW. Hydrogen sulfide poisoning in a hospital setting. Jama. 1981; 246(14): 1558-89. DOI: 10.1001/jama.1981.033201400 76038

24. Adelson L, Sunshine I. Fatal hydrogen sulfide intoxication. Report of three cases occurring in a sewer. Archives of Pathology & Laboratory Medicine. 1966; 81(5): 375-80.

25. Snyder JW, Safir EF, Summerville GP, Middleberg RA. Occupational fatality and persistent neurological sequelae after mass exposure to hydrogen sulfide. The American journal of emergency medicine. 1995; 13(2): 199-203. DOI: https://doi.org/10.1016/0735-6757 (95)90094-2

26. Knight LD, Presnell SE. Death by sewer gas: case report of a double fatality and review of the literature. The American journal of forensic medicine and pathology. 2005; 26(2): 181-5. DOI:10.1097/01.paf.0000163834.87968. 08

27. Gabbay DS, De Roos F, Perrone J. Twenty-foot fall averts fatality from massive hydrogen sulfide exposure. J Emerg Med 2001; 20: 141-4

28. Tanaka S, Fujimoto S, Tamagaki Y, Wakayama K, Shimada K, Yoshikawa J. Bronchial injury and pulmonary edema caused by hydrogen sulfide poisoning. The American journal of emergency medicine. 1999; 17(4): 427-9. DOI: https://doi.org/10.1016/S0735-6757 (99)90102-X

29. Kage S, Ito S, Kishida T, Kudo K, Ikeda N. A fatal case of hydrogen sulfide poisoning in a geothermal power plant. Journal of Forensic Sciences. 1998; 43: 908–10.

30. Milby TH, Baselt RC. Hydrogen sulfide poisoning: clarification of some controversial issues. American journal of industrial medicine. 1999; 35(2): 192-5. DOI: https://doi.org/10.1002/(SICI) 1097-0274(199902)35:2%3C192::AID-AJIM11%3E3.0.CO;2-C

31. Ago M, Ago K, Ogata M. Two fatalities by hydrogen sulfide poisoning: variation of pathological and toxicological findings. Legal Medicine. 2008; 10(3): 148-52. DOI: https://doi.org/10.1016/j.legalmed. 2007.11.005.

DOI: http://doi.org/10.4038/sljfmsl.v9i2.7812

A RETROSPECTIVE ANALYSIS OF FACIAL INJURIES IN VICTIMS OF ROAD TRAFFIC FATALITIES

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ABSTRACT

Facial injuries play a significant role when it comes to medico-legal interpretation, category of hurt, cause of death and for compensation purposes. Road traffic accidents had been identified as a major contributor towards facial injuries. The main objectives were to identify the different facial injuries such as abrasions, contusions, lacerations and fractures, injury pattern, the distribution and to correlate the facial injuries with vulnerable road users.

A pre-prepared questionnaire was used to extract information from the autopsy reports of road traffic accidents involving 59 victims covering a period from 2005 to 2014. Majority of the victims were males (79.7%) and belonging to the age group of 21-30 (22%) and 41-50 (22%). The vulnerable road users were mostly pedestrians (39%), followed by motorcycle riders (28.8%). Only few (6.8%) of the victims had teeth injuries. Most of the victims had injuries on the right forehead (44%) and right peri-orbital area (37.3%). The commonest type of facial injuries were abrasions which were 44 (grazed abrasions 30.5% and other types of abrasions 44.1%) followed by lacerations 38 (64.4%). The most common injuries on the right forehead were abrasions (20.3%) and lacerations (16.9%) while on the right peri-orbital area it was contusions (18.6 %). Majority of the victims were pedestrians and motor cycle riders. Most of the injuries were observed on the right forehead and right peri-orbital region and the commonest facial injury type was abrasions. A specific type of injury pattern was not identified to retrospectively suggest the involvement of a pedestrian or others.

Key words: facial injuries; regional injuries; road traffic injuries; victims

INTRODUCTION

The interpretation of facial injuries following road traffic injuries will greatly enhance the work of a forensic pathologist. The literature review reveals majority of the studies were done in clinical patients with the view of giving a better management with multidisciplinary teams. However, research studies done in forensic context especially with the deceased are scarce[1,2,4,6]. This study attempts to explore the different injuries on the face in victims of road traffic fatalities and to identify any correlation between the injuries and the type of road user. Furthermore, an attempt is made to identify any causal links between injuries and the mechanisms of causation. Though evidence was not available regarding the exact human and environmental factors which could have contributed to the collision, a sincere attempt was made to look for factors which could have contributed or modified the injury pattern. The value of facial injuries in forensic practice can be further explained by mandatory keeping a profile of face with or without injuries corroborating the facial injuries with the given history and in certain instances the pathologist may be requested to give an opinion regarding the circumstances with no available history. It should be borne in mind that the overall interpretation of injuries involves the whole-body examination and final opinions are made after carefully interpreting the external and internal injuries in the whole body regions. This study is again an attempt to see whether the pattern of facial injuries give a reflection or a cue regarding other bodily injuries.

Facial injuries play a significant role when it comes to injury interpretation, category of hurt, cause of death and for compensation purposes. Road traffic accidents had been identified as a major contributor towards facial injuries[1,2]. In the day to day practice of a Judicial Medical Officer (JMO), one has to deal with autopsies, scene visits and clinical cases involving road traffic injuries. Most often the first anatomical region which attracts attention is the face. Therefore, interpretation of facial injuries deserves a special expertise to corroborate with the available history. At the time of pre-autopsy briefing, most often the history regarding the circumstance, type of incident, type of vehicle and involvement of the vulnerable road user is provided by the attending police officer and eye witnesses. It is only a matter of analyzing the injury pattern and confirming whether the injury pattern is compatible with the given history. However, there are situations when autopsies and scene visits are performed without any valid information. Sometimes, bodies are brought with no available personal information (unknown bodies) where the performing pathologist may need to conclude with the available injuries. At times he may need to request a special order from a magistrate if the injuries are suspicious.

Careful interpretation of facial injuries and previous familiarization of facial injuries following road traffic injuries will help a forensic pathologist to make correct judgments regarding the mechanism of causation of those injuries. A study of this nature which carefully analyzes facial injuries following road traffic fatalities involving different types of vulnerable road users will give some insight regarding the interpretation of facial injuries. Though the sample size is minimum and limited to a particular anatomical region, still there may be observations which could be utilized in the day to day work and for future research purposes.

The available literature regarding facial injuries reveal that road traffic accidents has been one of the major contributors for it and the injuries involve both soft tissues and bones[3,4]. Some studies reveal it was characteristic of the involvement of frontal bone followed by nasal bone or the nasal bone was most often the site of fracture[5]. In contradiction, some other studies reveal that mandible followed by maxillary bone involvement[1].

However, there were no studies which were elaborating on all types of facial injuries, injury pattern and different mechanisms of causation for forensic purposes. A study of this nature which was done on the decedents following road traffic accidents with an extensive analysis of facial injuries with an intention to mainly to identify the possible mechanisms of causation may pave way for future projects.

OBJECTIVES

With regard to fatal road traffic accidents to identify the types, injury pattern and distribution of facial injuries

STUDY DESIGN SETTING AND METHODS

Information regarding gender, age and facial injuries (pattern, type and distribution) was extracted from autopsy reports of persons who met with road traffic accidents during the period from 2005 to 2014. Data were analyzed using SPSS version 20.

RESULTS

Fifty nine cases were identified. Majority were male (80%). Twenty two percent (22%) were in the age groups 21-30 and 41-50 (Table 1)

Table 1: Age distribution

Years	Frequency	%
<10	1	2
11-20	-	-
21 - 30	13	22
31 - 40	6	10
41 - 50	13	22
51 - 60	12	20
61- 70	8	14
>71	6	10
Total	59	100

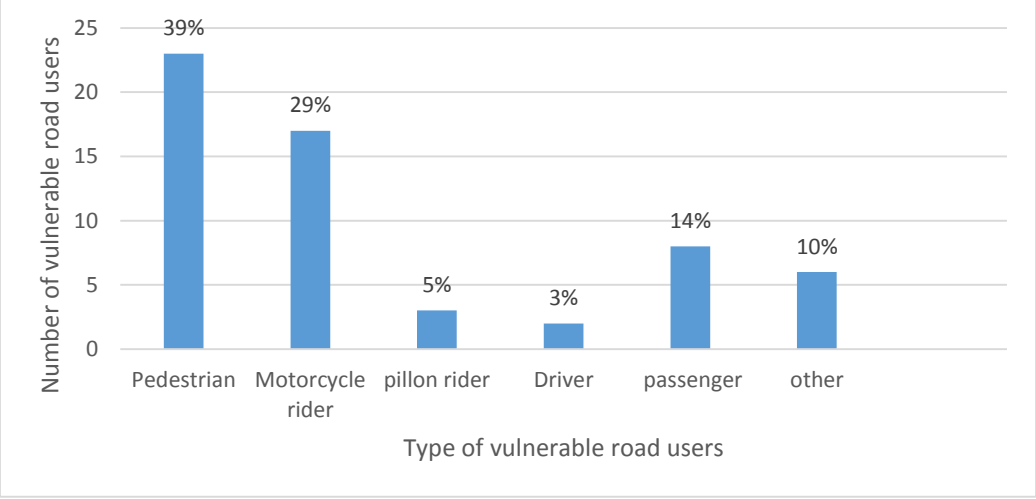

Figure 1: Types of vulnerable road users

Majority were pedestrians (39%), followed by motorcyclists (29%).

Table 2: Circumstances of impact among pedestrians

Circumstance	Number
Standing by the road	3 (13%)
Crossing (on zebra crossing)	6 (26%)
Crossing (not on a zebra crossing)	9 (39%)
Walking on the right side of the road	3 (13%)
Walking on the left side of the road	1 (4%)
Details not available	1 (4%)
Total	23 (100%)

Majority of pedestrians sustained impacts while crossing the road (not on a zebra crossing).

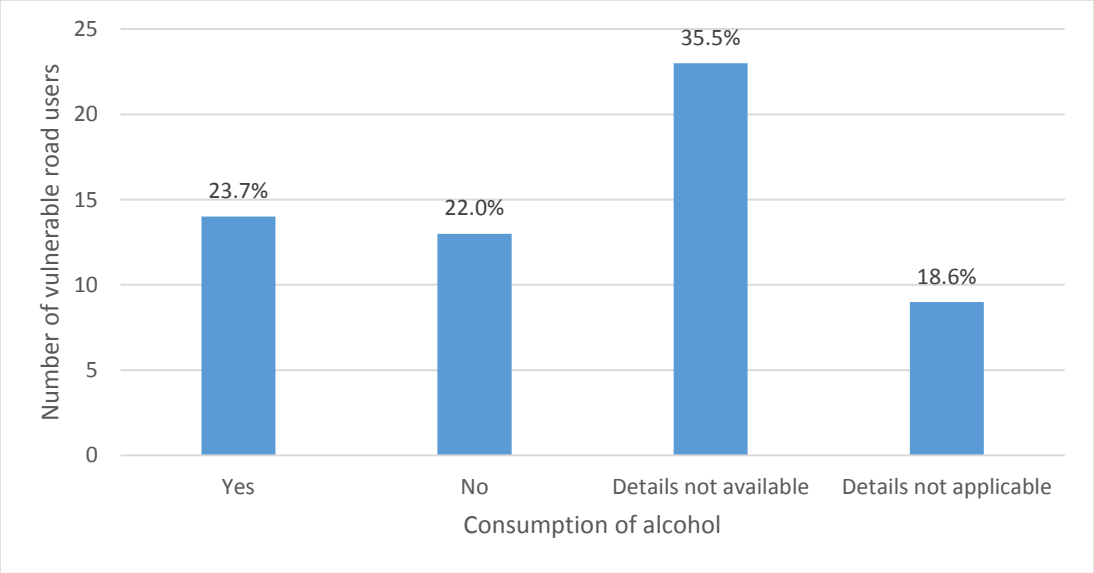

Figure 2: Consumption of alcohol

Blood alcohol concentration revealed that 24% were under the influence of alcohol.

Table 3: Time of incident

Time	Number
0000 - 0600	8 (14%)
0601 - 1200	16 (27%)
1201 - 1800	15 (25%)
1801 - 2359	20 (34%)
Total	59 (100%)

Majority of incidents occurred at night (1801 to 2359).

Table 4: Facial injuries

Type	Number
Grazed abrasions	18 (31%)
Other abrasions	26 (44%)
Lacerations	38 (64%)
Contusions	19 (32%)
Fractures	17 (29%)
Others	02 (3%)

The commonest type of facial injuries were abrasions followed by lacerations, contusions and fractures.

Table 5: Injuries on right side of forehead

Type	Number
Fractures only	03 (5%)
Abrasions only	12 (20%)
Lacerations only	10 (17%)
Contusions only	01 (2%)
Multiple minor injuries	00 (0%)
No injuries	33 (56%)
Total	59 (100%)

The commonest injuries on right side of forehead were abrasions and lacerations.

Table 6: Injuries on right peri-orbital area

Type	Number
Fractures only	0 (0%)
Abrasions only	4 (7%)
Lacerations only	6 (10%)
Contusion only	11 (19%)
Multiple minor injuries	1 (2%)
No injuries	37 (63%)
Total	59 (100%)

The commonest injury on right peri-orbital area were contusions

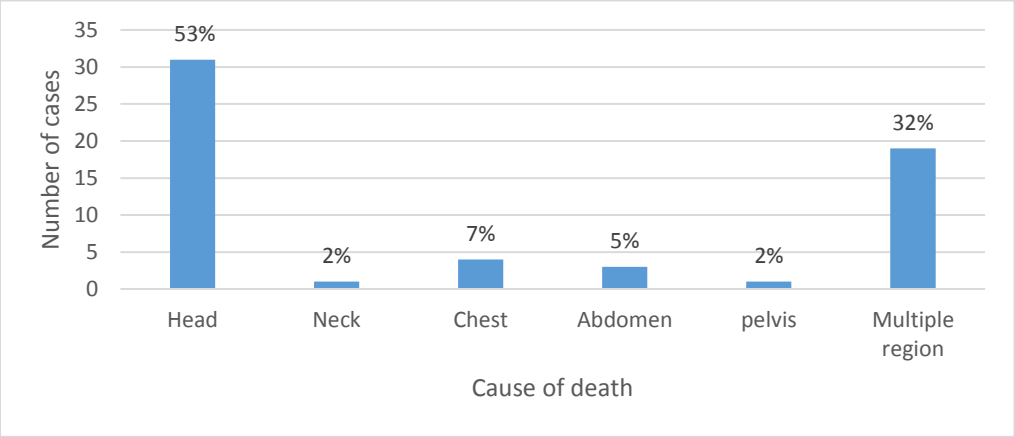

Figure 3: Cause of death

The cause of death in a majority was head injury, followed by injury to multiple regions. There were no deaths related to facial injuries alone (Figure 4)

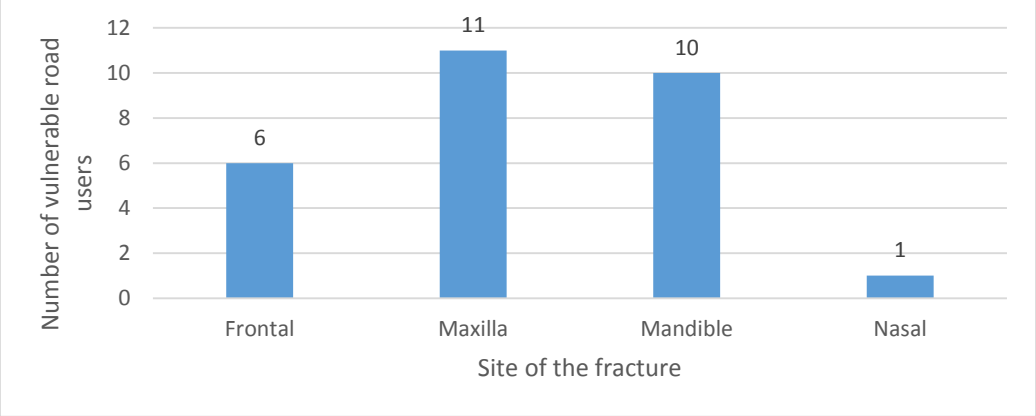

Figure 4: Site of fracture

The majority of fractures were in the maxilla followed by mandible and frontal bone.

Table 7: Anatomical site involved

Site	Number
Forehead	49 (83%)
Nose	11(18.6%)
Orbital area	43 (72.9%)
Cheeks	31(52.5%)
Chin	26 (44.1%)
Ears	9 (15.3%)
Lips	13 (22%)
Philtrum	1 (1.7%)

Table 8: Side of face involved

Right side of face	Middle of face	Left side of face
49.7%	21.9%	28.4%

The forehead is the most commonly involved area followed by orbital area, cheeks, chin, lips and nose with most of the injuries on right side (Tables 8, 9).

DISCUSSION

The study revealed that majority of the victims were in the age ranges of 21 to 30 and 41 to 60 years with a male predominance. This observation reconfirms the findings expressed at other studies.[4,5,7] The involvement of young adults, especially males could be due to the adventurous nature/life style and trying out new things, therefore increasing their vulnerability.[1,6] However other studies have shown that injuries are commoner in the aged due to impairment in vision and hearing and diminished reflexes.[8,12] The pedestrians were the mostly affected due to road traffic injuries. They were followed by motor cyclists and passengers from different vehicles.[3,9,10,13]

The pedestrians were mostly involved while using the zebra lines or crossing the road at a non-identified place. The accidents have a preference during night hours. This susceptibility of victims could be explained by the presence of minimal protection during the time of collision. Most of the victims were under the influence of alcohol and there were a sizable number of individuals where the alcohol results were not available. In some individuals who belongs to the category of passengers, the available results were not included in the study. Alcohol consumption is a known contributory factor towards the involvement in a road traffic accidents.[14] Though in Sri Lanka strict laws regarding drink driving are prevailing, still alcohol is detected in many victims. The main reason for lack of alcohol results could be due to the reason that majority of the victims are pedestrians and alcohol analysis may not have been requested.

The analysis of the distribution of the facial injuries reveal, most of the injuries had a preference over the right forehead and right peri-orbital region followed by right cheek and the injuries were common on right side of the face in comparison to left side. The commonest type of injury in the face was abrasions which included grazed and other types of abrasions. The severest type of injury was the fractures which were found in maxillae, mandible, frontal and nasal bones.[6,11,16] In selected cases there were fractures to the teeth as well. Almost all the injuries including contusions and lacerations were caused by blunt force trauma. When considering the face as a whole and different anatomical regions, the distribution reveals the forehead is the area that has been most commonly involved in victims followed by the orbital area. Also most of the injuries were on right side (49.7%) compared to mid face and left side. According to the injury pattern and the distribution of injuries it was not possible to identify the involved road user (considering a hypothetical situation where there is no available history). However, a plausible opinion can be given about the mechanism of causation after observing facial injuries.

The presence of facial injuries more on the right side with the involvement of right forehead, right peri- orbital and right cheek may be most likely due to victims coming into contact with the road surface following a right sided fall. This observation is further supported by the presence of abrasions and other injuries following blunt force trauma since the severity was less and in most instances the death was not due to the facial injuries alone. This finding may exempt other types of impacts such as primary and secondary impacts following a collision of a vehicle to a minimum. Anyhow facial injuries alone will not allow a Forensic Pathologist to come to definite conclusions without considering other regional injuries. One must admit that the careful study of facial injuries including the pattern and distribution may strengthen the interpretation of other regional injuries. The cause of death in majority were due to head injuries followed by multiple trauma in different regions.[6,8,15] Importantly there were no deaths related to facial injuries alone.

A study of this nature regarding facial injuries following road traffic injuries is very valuable. Since it will strengthen the early observations during routine autopsies, scene visits and examination of clinical patients where the given history is doubtful. The population with the advent of better communication and internet facilities is more knowledgeable about the different ways of seeking compensation. Therefore, it is imperative for a forensic practitioner to be more knowledgeable and practical with regard to different types of facial injuries. This study could be used as a prelude to confirm the similar findings in a larger population. In addition, the clinical patients who are admitted to tertiary care hospitals with facial injuries following road traffic injuries can also be included in a larger research study. Further the facial injuries can be co-related with other regional injuries for better interpretation.

CONCLUSIONS

Majority of victims were pedestrians and motorcyclists. Most injuries were on the right side of the forehead and right peri-orbital region with the commonest injury type being abrasions. Facial injuries alone did not contribute to death. There was no significant injury pattern suggestive of the involvement of a pedestrian or other types of road users. However, the facial injuries were highly suggestive of road traffic injuries. The injury pattern and distribution did not contradict the given history in any instance.

LIMITATIONS

This study involved a selected group of victims following road traffic fatalities. A larger sample size from different provinces would have enabled generalization of results.

The paucity of information regarding human and environmental factors and confirmatory evidence such as CCTV footage were a drawback. The comparison of facial injuries with other regional injuries would have further strengthened the study.

REFERENCES

1. Adebayo ET, Ajike OS, Adekeye EO. Analysis of the pattern of maxillofacial fractures in Kaduna, Nigeria. British Journal of Oral and Maxillofacial Surgery. 2003; 41(6): 396-400.
DOI: https://doi.org/10.1016/S0266-4356(03)00165-7.

2. Batstone MD, Monsour FN, Pattel P, Lynham A . The patterns of facial injury suffered by patients in road traffic accidents: A case controlled study. International Journal Surgery. 2007; 5(4): 250-4.
DOI: https://doi.org/10.1016/j.ijsu. 2006. 10.002

3. Fernando D, Tennakoon S, Samaranayake A, Wickramasinghe M. Characteristics of road traffic accident casualties admitted to a tertiary care hospital in Sri Lanka. Forensic Science, Medicine, and Pathology. 2017; 13(1): 44-51.
DOI: https://doi.org/10.1007/s12024-016-9828-3

4. Kumar AV, Javvadi S. Facial bone fractures in road traffic accident: A post mortem study. Medico-Legal Update. 2016; 16(2): 217-9.

5. Agnihotri A, Galfat D, Agnihotri D . Incidence and pattern of maxillofacial trauma due to road traffic accidents: a prospective study. Joournal of Maxillofacial and Oral Surgery. 2014; 13(2): 184–8.
DOI: https://doi.org/10.1007/s12663-013-0502-y

6. Xu D, Guo S, Li Z. Characteristics of death cases caused by road traffic accident in Shenzhen. Journal of Forensic Medicine. 2008; 24(5): 342-8.

7. Fasola AO, Lawoyin JO, Obiechina AE, Arotiba JT. Inner city maxillofacial fractures due to road traffic accidents. Dental Traumatology. 2003; 19(1): 2-5.
DOI: https://doi/10.1034/j.1600-9657.2003.00073.

8. Cunningham C, Howard D, Walsh J, Coakley D, O'Neill D. The effects of age on accident severity and outcome in Irish road traffic accident patients. Irish Medical Journal. 2001; 94(6): 169-71.

9. Mayou R, Bryant B. Consequences of road traffic accidents for different types of road user. Injury. 2003; 34(3): 197-202.
DOI: https://doi.org/10.1016/S0020-1383(02)00285-1

10. Bhalla K, Navaratne K, Shahraz S, Bartels D, Abraham J, Dharmaratne S. Estimating the incidence of road traffic fatalities and injuries in Sri Lanka using multiple data sources. International Journal of Injury Control and Safety Promotion. 2010; 17(4): 239-46.
DOI: https://doi.org/10.1080/17457300.2010.490919

11. Singhal R, Singh V, Bhagol A, Agrawal A, Kumar P. Pediatric maxillofacial injuries - If a new look is required?. International Journal of Pediatric Otorhinolaryngology. 2013; 77(8):1333-6.
DOI: https://doi.org/10.1016/j.ijporl.2013.05.028

12. Vadysinghe AN, Senasinghe P, Sivasubramanium M, Jayasooriya P, Premarathna BG, Rathnayake RMISD, Wickramasinghe WMMHP. Unnatural Deaths of the Elderly Population of Sri Lanka: A Descriptive Analysis. The American Journal of Forensic Medicine and Pathology. 2018; 39(2): 148-51.
DOI: https://doi.org/10.1097/PAF.0000000000000383.

13. Vadysinghe AN, Katugaha BHMD, Priyarathna CH, Colambage SM. Injury patterns and caused of death among occupants of three wheelers succumbed to their injuries from road traffic accidents in Sri Lanka. International Journal of Medical Toxicology and Forensic Medicine.2018; 8(2): 55-64.
DOI: http://dx.doi.org/10.22037/ijmtfm.v0i0.20803

14. Nakhgevany KB, LiBassi M, Esposito B. Facial trauma in motor vehicle accidents etiological factors. The American Journal of Emergency Medicine. 1994; 12(2): 160-3.
DOI: https:/doi.org/10.1016/0735-6757(94)90237-2

15. Rao D, Mukerjee S. A study of pattern of injuries in road traffic collisions. Journal of Punjab Academy of Forensic Medicine & Toxicology. 2010; 10: 14-6.

16. Yamamoto K, Matsusue Y, Horita S, Murakami K, Ueyama Y, Sugiura T, Kirita T. Maxillofacial Fractures of Pedestrians Injured in a Motor Vehicle Accident. Craniomaxillofacial Trauma & Reconstruction. 2013; 6(1):37–42.
DOI: https://dx.doi.org/10.1055%2Fs-0033-1333881.

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DOI: 10.1056/NEJMc063492

Electronic Journal article
Stockhausen L, Turale S. An explorative study of Australian nursing scholars and contemporary scholarship. J Nurs Scholarsh [Internet]. 2011 Mar [cited 2013 Feb 19];43(1):89-96. Available from: http://search.proquest.com.ezproxy.lib.monash.edu.au/
docview/858241255?accountid=12528

Book
Saukko P, Knight B. Knight's forensic pathology. 4th ed. New York (NY): CRC Press; 2016. 402 p.

Chapter in a book
Blaxter PS, Farnsworth TP. Social health and class inequalities. In: Carter C, Peel JR, editors. Equalities and inequalities in health. 2nd ed. London: Academic Press; 1976. p. 165-78.

Report
Rowe IL, Carson NE. Medical manpower in Victoria. East Bentleigh (AU): Monash University, Department of Community Practice; 1981. 35 p. Report No.: 4.

Web page
Diabetes Australia. Diabetes globally [Internet]. Canberra ACT: Diabetes Australia; 2012 [updated 2012 June 15; cited 2012 Nov 5]. Available from:
http://www.diabetesaustralia.com.au/en/
Understanding-Diabetes/Diabetes-Globally/

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