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Factors associated with challenges in skin wound length and depth prediction of physicians in forensic cases

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ABSTRACT

Aim: We aimed to display factors associated with error rates in identifying skin lesions with subjective methods and determine potential effectiveness of objective and metric measurements on judicial processes which may result in unwanted social and legal outcomes and raise the awareness of physicians.

Material and Method: We made an incision on a piece of sponge with a lencet in order to model a skin lesion. The length and depth of the lesion was measured by compass device. Then, a face to face interview was planned with the physicians working in the hospital and they were asked to estimate the length and depth of the lesion. Estimations of the physicians were recorded.

Results: Total of 146 physicians were involved into the study. Of these, 41.8% (n=61) were female and 58.2% (n=85) were male. Mean age of the physicians was 33.46±7.94 (24-61) years. Of the physicians, 7.5% (n=11) were a member of basic medical sciences, 26% (n=38) were a member of surgical medical sciences and 21.9% (n=32) were practitioner physician. When titles of the physicians were investigated, it was found that 21.9% (n=32) were practitioners, 34.9% (n=51) were residents, 34.9% (n=51) were specialists, 8.2% (n=12) were lecturers. The rate of the participants who estimated the incision more than 8 cm was higher than those who estimated less than 8 cm. Standart deviation of the depth estimation was 1.35 cm. Thirty-nine (26.7%) participants made an exact estimation of the depth of the incision.

Conclusion: The measurement accuracy without a device is not associated with experience and errors of both inexperienced physicians and experienced physicians of any grade do similar mistakes during judicial report preparation process. These high error levels reveal that use of devices may avoid errors of physicians at any grade and protect physicians from possible judicial challenges.

Keywords: Forensic, skin lesions, measurement

INTRODUCTION

Any damage caused by a physical or chemical agent on the skin, all other tissues and internal organs is considered as "wound". The wounds need to be described with a full disclosure during or shortly after the examination. This description is to help determine how the injury occurred later in the legal process. If the wounds are not defined correctly, a process that puts the clinician in a difficult situation will occur (1). It is the responsibility of all physicians to report patients and their lesions to judicial authorities. This responsibility of physicians comes from their expert and wittness titles (2-6). It is a known fact that physicians have some difficulties in forensic report process (2). However physicians may not be aware of their responsibility as required or have enough experience due to negligence during and post-medical education period (3). Hence, it is inevitable to make mistakes and deficiencies in forensic reports and face juidicial processes.

Accuracy rate in defining penetrating and visible wounds affects all juidical processes in terms of National Penal Laws. When preparing a forensic report, wound must be defined correctly; depth, width and length of the wound must be measured and registered correctly (7).

Determining the extent of a wound is perhaps the easiest step in wound identification. However, measurement of wound dimensions is the most frequently neglected detection method in medical records. The measurement of wound dimensions should be determined using a ruler or caliper and recorded in centimeters or millimeters. The concept of depth is important for some wounds, but it is often not possible to determine this in living persons (1).

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In this study, we aimed to display factors associated with error rates in identifying skin lesions with subjective methods. We also aimed to determine potential effectiveness of objective and metric measurements on judicial processes which may result in unwanted social and legal outcomes and raise the awareness of physicians.

MATERIAL AND METHOD

The study was carried out with the permission of Hitit University Non-interventional Researches Ethics Committee (Date: 31.05.2022, Decision No: 2022-13). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

This study was conducted with face to face interviews with physicians actively working in Hitit University Training and Research Hospital between 01.07.2022 and 01.10.2022. We made an incision on a piece of sponge (30 cm of length, 30 cm width, 5 cm depth) with a lencet in order to model a skin lesion (**Figure 1**). The length and depth of the lesion was measured by compass device. Then, a face to face interview was planned with the physicians working in the hospital and they were asked to estimate the length and depth of the lesion as if they were writing a forensic report. The physicians were allowed to evaluate the lesion by palpation. Length and depth estimations of the physicians were recorded. Estimations showing full agreement with the compass device measurements were accepted as correct. All other estimations were considered estimation errors. Also; demographical characteristics of the physicians (age, gender, speciality), titles and whether they actively edit forensic reports or not were recorded. Lately, metric measurements by compass device were compared with the palpational measurements of the physicians.

Compass device: A compass device is used for accurate measurement. With it, an accurate measurement of length, width, depth, internal and external diameter measurements can be performed. It has digital and mechanical types. In our study a device which has a sensitivity of 0.1 mm was used (Trademark: Piranha, Digital Compass, Model: PDC1850) (**Figure 2**).

Statistical Analysis

Data were statistically analyzed using the SPSS package program (Version 22, SPSS Inc., Chicago, IL, USA). For categorical variables, number (n) and percentage (%) were used in reporting data. Descriptive statistics of numerical variables collected through measurement were reported using the mean±standard deviation or median (min-max), depending on the distribution of the data. The normal distribution of data checked using the Shapiro-Wilk test. The Mann Whitney U test was used to compare non-normally distributed data between two independent groups. The Kruskal-Wallis test was used to compare non-normally distributed data between more than two independent groups. Statistical significance level was accepted as $p<0.05$ in all comparisons.

Figure 1. Incision on a piece of sponge with a lencet in order to model a skin lesion

Figure 2. The compass device that is used for accurate measurement

Table 1. Comparison of estimation errors of incision length and depth among sociodemographic characteristics (n=146)

	n	Estimation errors of incision length	P	Estimation errors of incision depth	P
Gender			0.090[a]		0.822[a]
Male	85	1.5 (0-7) (1.71±1.44)		1 (0-4) (0.96±0.89)	
Female	61	2 (0-12) (2.55±2.57)		1 (0-8) (1.29±1.59)	
Speciality			0.535[b]		0.579[b]
Basic Medical Sciences	11	1 (0-5) (1.68±1.55)		0.5 (0-3) (0.86±0.92)	
Surgical Medical Sciences	38	2 (0-7) (1.97±1.77)		1 (0-4) (1.17±1.07)	
Internal Medical Sciences	65	2 (0-12) (2.42±2.5)		0.5 (0-8) (1.23±1.51)	
General Practitioner	32	1 (0-5) (1.59±1.13)		1 (0-3) (0.82±0.82)	
Degree			0.160[b]		0.637[b]
General Practitioner	32	1 (0-5) (1.59±1.13)		1 (0-3) (0.82±0.82)	
Assistant Doctor	51	2 (0-12) (2.17±2.08)		0.5 (0-6) (1.16±1.31)	
Specialist Doctor	51	2 (0-12) (2.41±2.37)		1 (0-8) (1.18±1.43)	
Faculty Member / Academician	12	1 (0-7) (1.41±1.91)		1 (0-3) (1.20±0.96)	
Department			0.517[a]		0.601[a]
Clinic	135	2 (0-12) (2.1±2.06)		1 (0-8) (1.12±1.26)	
Basic Medical Sciences	11	1 (0-5) (1.68±1.55)		0.5 (0-3) (0.86±0.92)	
Do physicians actively write forensic reports?			0.681[a]		0.591[a]
Physicians writing	92	2 (0-7) (1.97±1.75)		1 (0-6) (1.03±1.10)	
Physicians not writing	54	2 (0-12) (2.23±2.43)		1 (0-8) (1.22±1.44)	

[a]Mann-Whitney test with median (min-max) (mean±standard deviation), [b]Kruskal-Wallis test with median (min-max) (mean±standard deviation)

RESULTS

Total of 146 physicians were involved into the study. Of these, 41.8% (n=61) were female and 58.2% (n=85) were male. Mean age of the physicians was 33.46±7.94 (24-61) years. While 92.5% (n=135) were active in the clinics, 7.5% (n=11) were involved in basic sciences. Of the physicians, 63% (n=92) were actively editing forensic reports, 37% (n=54) were not.

Table 1 represents the comparison of estimation errors with socio-demographical characteristics. Any statistical significance could not be determined in terms of gender, branches, title, department, actively editing forensic reports and prediction of length and depth of the incisions (P>0.05).

In **Table 2**, correlation between estimation errors on length and depth estimations and age-occupational experience are represented. There was not any statistical significance between length and depth estimation errors of the lesion and age and occupational experience of the participants (P>0.05).

Table 2. Correlation analysis results between the length and depth estimation errors of the incision, and age and professional experience (n =146)

		Age	Vocational experience (year)
Estimation errors of incision length	r	-0.015	-0.009
	p	0.856	0.917
Estimation errors of incision depth	r	-0.020	0.007
	p	0.808	0.929

Spearman correlation coefficient

Standart deviation of the length was 2.61 cm. Twenty participants (13.7%) could make the exact estimation. Length estimation varied between 6 and 10 cm. The rate of the participants who estimated the incision more than 8 cm was higher than those who estimated less than 8 cm.

Standart deviation of the depth estimation was 1.35 cm. Thirty-nine (26.7%) participants made an exact estimation of the depth of the incision.

Figure 3 represents box plots of the distribution of estimation errors of depth and lenght according to different properties and status; **Figure 4** represents Scatter plots showing the errors between the estimated length-depth and the actual length-depth without using a measuring instrument and **Figure 5** represents Scatterplots showing the relationship between length-depth estimated error values and diffefent properties.

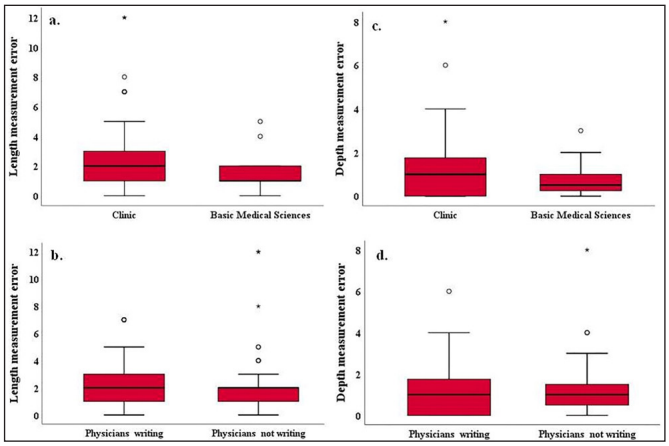

Figure 3.
a. Box plot of the distribution of estimation errors of length according to clinic or basic medical sciences groups
b. Box plot of the distribution of estimation errors of length according to their active forensic report writing status
c. Box plot of the distribution of estimation errors of depth according to clinic or basic medical sciences groups
d. Box plot of the distribution of estimation errors of depth according to their active forensic report writing status

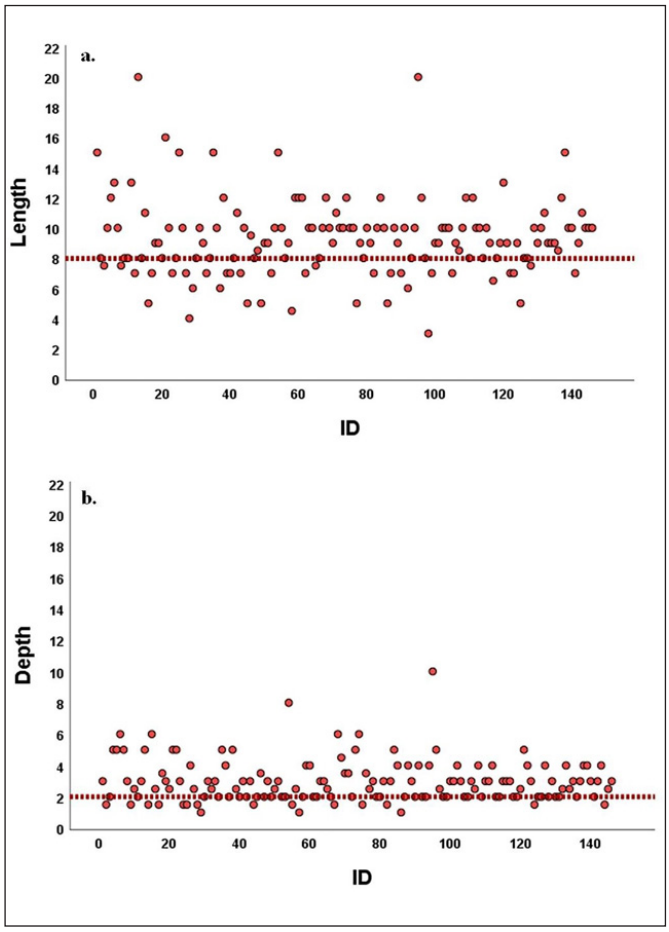

Figure 4.
a. Scatter plot showing the errors between the estimated length and the actual length without using a measuring instrument
b. Scatter plot showing the errors between the estimated depth and the actual depth without using a measuring instrument

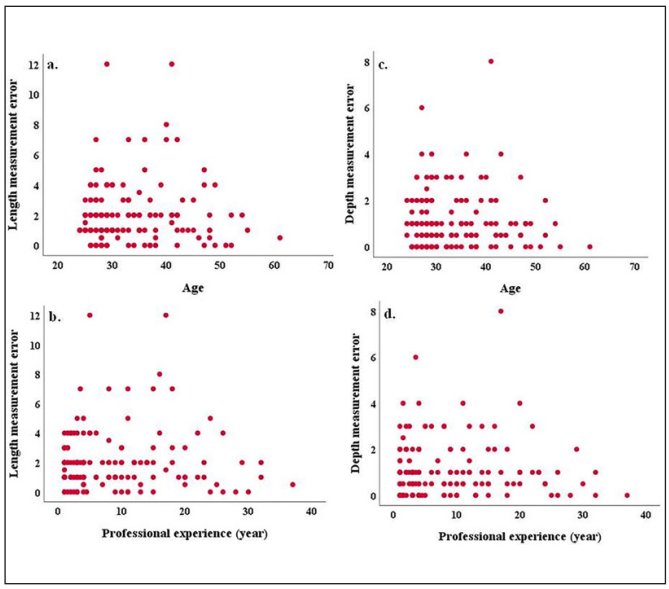

Figure 5.
a. Scatterplot showing the relationship between length estimation errors values and age
b. Scatterplot showing the relationship between length estimation errors values and professional experience (year)
c. Scatterplot showing the relationship between depth estimation errors values and age
d. Scatterplot showing the relationship between depth estimation errors values and professional experience (year)

DISCUSSION

Physicians have the responsibility to recognize forensic cases and report these cases to judicial authorities besides responsibility to examine and treat the patient. In Turkey, there is a seperate law (Turkish Penal Code Number 5237, item 280) for healthcare providers (8).

Physicians must prepare a forensic report about severity level of lesion (11). These reports are essential for criminal and civil cases and they must meet the requirements in Turkish Penal Code. In every forensic case, "life threatening" condition must be sought and length, width and depth of all the wounds must be written in details (12,13).

Emergency departments are of greater importance since first examination of forensic cases are performed in these settings. The physicians in the ED are the only ones who observe the wound before and after the treatment. The characteristics of the wound must be reported correctly. It must be kept in mind that the characteristics of the wound may alter following treatment. Methods of wound description should be chosen carefully. Nevertheless, a universal method for wound description has not been developed so far (14). Techniques for measurement vary from simple to complex. The most common method is measurement by a ruler (15). In order to avoid infections, use of disposable rulers are recommended.

It is suggested that all wound measurements should be recorded as length (L), width (W) and depth (D) in centimeters. A standardized system is required for wound description. This is essential for avoiding inconsistencies in reports. It must be assured that the incision is measured in maximum diameter to determine the exact size. The ruler must be placed in the maximum width of the wound. The diameter of the wound must be determined if the wound is round If the wound is round, the widest part is measured as diameter. For depth measurement, a cotton bud may be used. The cotton bud may gently be placed into the deepest part of the wound and the depth of the wound is measured. A brief description of the wound must be recorded (rough, smooth, puffy or flowing) (16).

Studies have shown that the most common error in wound description is made in wound borders (17). It must be kept in mind that palpations and manupilations during examination may alter the morphology and size of the wound. Even gentle interventions may change the appearance of the wound and size of a wound on a curved part of the body (such as heel) is difficult to measure. Additionally a wound may be highly damaged and measurement of its volume may be challenging (14). We aimed to investigate factors associated with

observational incision measurement of wound length and depth without use of any device, which is performed by many physicians in Turkey, and propose an accurate method of measurement to be helpful to constitute an equitable judicial process.

For the participants; there was not any statistical significance between gender, speciality, department, and forensic report preparation and errors in length and depth estimations of the wound. Accordingly, there was not any relationship between age and experience, and length and depth estimation of the physician. These results reveal that measurement accuracy without a device is not associated with experience and errors of both inexperienced physicians and experienced physicians of any grade do similar mistakes during forensic report preparation process.

In the literature, errors in patient identity, timing of the event, signature of the physician, consciousness level of the patient, systemic examination findings, threathening of life, and alcohol level are well-defined (3, 18). In a study involving forensic reports of 2478 patients, it was revealed that external wounds were not reported in details in 46.1%, threathening of life was not stated in 7.6%, and whether the injury required simple medical intervention or not was not recorded in 8.9% by Emergency Medicine residents (18). Whereas, physicians should report if the injury required simple medical intervention according to "Forensic Evaluation Guide of Injury Crimes" defined in Turkish Penal Code. According to this guide, single lesion <5 cm on scalp or face with a total of 10 cm and cutaneous or subcutaneous lesions with a total of <20 cm are defined as simple lesions requiring simple medical intervention. Lesions larger than above-metioned ones are defined as complex wounds requiring more than simple medical intervention (19). In our study, the rate of correct estimation of wound length and depth was 13.7% and 26.7%, respectively. These low correct estimation levels reveal that use of devices may avoid errors of physicians at any grade, help settling justice in judicial processes and protect physicians from possible judicial challenges.

One study demonstrated high interobserver variability and inaccuracy in wound size estimation. It has been reported that this condition is related to gender. Generally, it has been reported that male doctors are more likely to overestimate the size of wounds, while their female colleagues are more likely to underestimate the size. In the description of traumatic wounds, it has been suggested to measure accurately using ruler measurement (20). In our study, no difference was observed between the genders, but the rate of accurate estimation of wound size was found low.

In another study on forensic reports, it was shown that external wounds were not described in 30.5% of the patients and in almost half of them, external wounds were not described properly in details in forensic reports. (3). In the study, besides, it was shown that in approximately 1/3 of the patients, lesions were not marked on the body diagram in the forensic report. (21). Our study is of importance since it reveals the importance of recording forensic wounds accurately. However, studies in the literature state that it is also important to record lesions accurately as well as accurate measurements. There is a lack of information on their judicial and medical responsibilities about forensic reports among physicians in Turkey (8, 22). This study may contribute to awareness of physicians about forensic report preparation.

In future studies; inaccuracies in the description of wounds in different body parts and their effects on judicial processes should be examined. For this purpose, quantitative identification methods should be proposed for each body region and for each injury pattern. In this way, it should be demonstrated with larger cohort studies that the legal problems that may be caused by subjective decisions can be avoided.

CONCLUSION

The measurement accuracy without a device is not associated with experience and errors of both inexperienced physicians and experienced physicians of any grade do similar mistakes during judicial report preparation process. These high error levels reveal that use of devices may avoid errors of physicians at any grade and protect physicians from possible judicial challenges.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Hitit University Non-interventional Researches Ethics Committee (Date: 31.05.2022, Decision No: 2022-13).

Informed Consent: All participants signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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