



# Literature Review: Development of Methods for Measurement of Burn Area in Children

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## ABSTRACT

Argo Bibit is a local business in Magelang District which is engaged in selling fruit seeds by providing various types of durian fruit. Currently, the process of buying and selling seeds is carried out conventionally, prospective buyers must come to the nursery to select seeds to buy and make transactions. During a pandemic, the transaction and marketing processes experience obstacles and limitations, so that a medium used for transactions is needed. This research uses object-oriented programming method. The result of this research is an E-commerce website which is used for selling durian seeds. This system is used to facilitate interaction between managers and customers in placing orders and making transactions without having to meet in person. In addition, customers can order customized seeds according to their wishes. Based on the results of tests that have been done, 0.79 customers state that this website is easy to use and understand, can help customize fruit seeds, the information is clear and makes it easy to be merciful. Measurement of wound area is important in the management of treating burns, especially in children. There are various methods of measuring surface area burns in children. Some of these methods have their own advantages and disadvantages. This article was created to find out from literature sources how the measurement method burns area in children. Purpose: the purpose of this literature study is to find out how the development of methods for measuring burn area in children. This study literature was done by analysing the articles that have been found using critical appraisal with a checklist of questions to assess the quality of each study design in the article. Articles used as literature sources with the year of publication last 10 years. Was from searching on several databases including PubMed and ScienceDirect. Journal search is done using the keywords "Measurement and Burn wound area or Paediatric method", "Assessment and Burn injury area or Children method". In this literature study, 3 (three) articles were obtained that matched the research criteria have been determined. search results found 6 (six) methods of measuring burn area in children including 3D Photography, VisitrakTM Method, Artec MHTTM 3D Scanner, Lund and techniques Browser charts, technical E-burn, and Mersey Burn mobile apps. The measurement technique with the three-dimensional method is the right technique used in children. It was found that 3D Photography techniques and Artec MHTTM 3D Scanner are effective methods as techniques measurement of burn area in children because it is non-invasive and does not involve direct contact with the wound.

**Keywords:** *Children; Burn Area; Measurement*

## 1. INTRODUCTION

Burns have a high prevalence rate in the world. According to the WHO (World Health Organization) in 2018, around 180,000 people died of burns worldwide, according to the WHO (World Health Organization). Most cases of burns occur in low, middle-income countries and almost two-thirds of them occur in African and Southeast Asian countries. This incident is related to the lack of supervision, vigilance, and education about

basic safety prevention of the risk of burn injury in the area concerned field[1].

Burns can occur at any age, including children. Children are at high risk for burns, at the age of growth children move a lot so they are vulnerable to injury. Children will be more at risk for deeper burns because the dermis layer of children's skin is thinner than adults [2]. Some cases of burns in children occur as accidents caused by negligence or lack of attention from parents and the surrounding environment. Accidental burns in children almost 80% occur at home [3].

Burns that are not treated immediately can lead to several complications such as infection, shock, and electrolyte imbalance [4]. Skin damage caused by burns can occur in the skin layers of the epidermis, dermis, or subcutaneous tissue, depending on the causative factor and the duration of the skin with the heat source [5]. The skin, apart from being a mechanical barrier, also functions as an important self-defence mechanism from organisms that may enter. Damage to the skin can allow microorganisms to enter the body and infection can occur so that it will slow down the healing process of the wound [5].

Age is one of the main factors that can affect the reaction to illness, the process of treatment and healing. Other things are also usually influenced by the hospitalization factor. Child care in hospitals is a major crisis, in children there will be changes in health status and also the environment such as treatment rooms, health workers wearing room uniforms, and medical equipment. As a result of the hospitalization process that occurs, children can refuse to eat and cry, even the most difficult is the child is not cooperative with the officers and medical actions are taken which cause various obstacles that affect the process of care and healing in children [6].

Burn wound management in children and adults is carried out in the same way, the difference is only in the method. Management of burn care includes various activities such as debridement, dressing changes, topical administration and the basic step of wound assessment. Assessment of burns includes observation, asking questions, performing a physical examination and supporting the patient. This information will be used in the subsequent nursing process of assessment, diagnosis, planning, implementation, and evaluation [7].

The initial step in the treatment is done by assessing the wound such as whether there is trauma or not, how the condition of the wound is, how wide and deep the wound is and others, some of this can be done by various methods of measuring the area of the appropriate wound. Children will need special methods or strategies in their measurement. Medical personnel as caregivers must understand how the current method of measuring wound area is developing so that they can provide the right service and treatment so that they can avoid wrong treatment. Sufficient knowledge can assist in prevention programs, development of management and referral systems that can be carried out effectively so as to reduce morbidity and mortality [8].

Measuring the area of the wound is an important aspect of the assessment. This is the initial stage for collecting data regarding the condition of the patient to

be treated. Correct measurement of wound area has a good impact on the next stage of the nursing process. Measuring the area of burns in children faces various obstacles because this will be a painful and troublesome experience for children. So it is very necessary to develop a method for measuring the area of burns in children that is effective, valid, and has a minimal negative impact [9].

In the searching results that I got there are several methods that are said to be effective in measuring the area of burns in children. Some of these methods are 3D photography techniques, which are techniques that analyse images taken with the LifeVizQuantificare™ 3D camera which will then load the images into a specialist computer software program Dermapix™. Next to the Visitrak™ method, this measurement technique involves mapping the wound on a tissue tracing sheet, which is then traced back to the Visitrak™ digital pad which automatically calculates the wound area calculation [10]. Artec MHT™ 3D Scanner, this technique is a non-invasive handheld device that works by projecting a structured flash of light on the burn wound which then reconstructs a three-dimensional view of the scanned area [11]. Lund and Browder chart technique, this technique is still done manually based on a two-dimensional model, this method is said to be accurate but more complex in its calculations than the previous methods [12]. The mobile application technique, namely E-burn and Mersey Burn, is carried out by downloading an application on the user's smartphone which then calculates the wound surface area automatically on the smartphone, the features of this application take into account the three-dimensional nature of the calculation [12].

Based on literature studies, there are no articles that discuss the development of methods for measuring burn area in children with the above methods including 3D Photography, Visitrak™ Method, Artec MHT™ 3D Scanner, Lund and Browder chart techniques, E-burn and Mersey Burn mobile application techniques. So, we researchers are interested in conducting research with the study literature review method in order to realize a better, more efficient, and reliable service.

## 2. METHOD

This research was carried out using the Review method. This literature study was carried out by analyzing the articles that had been found using critical appraisal with a checklist of questions to assess the quality of each study design in the article. The databases used include PubMed and ScienceDirect. The results of the study search are described by Prism Flow Diagrams on Figure 1 (processed by authors).

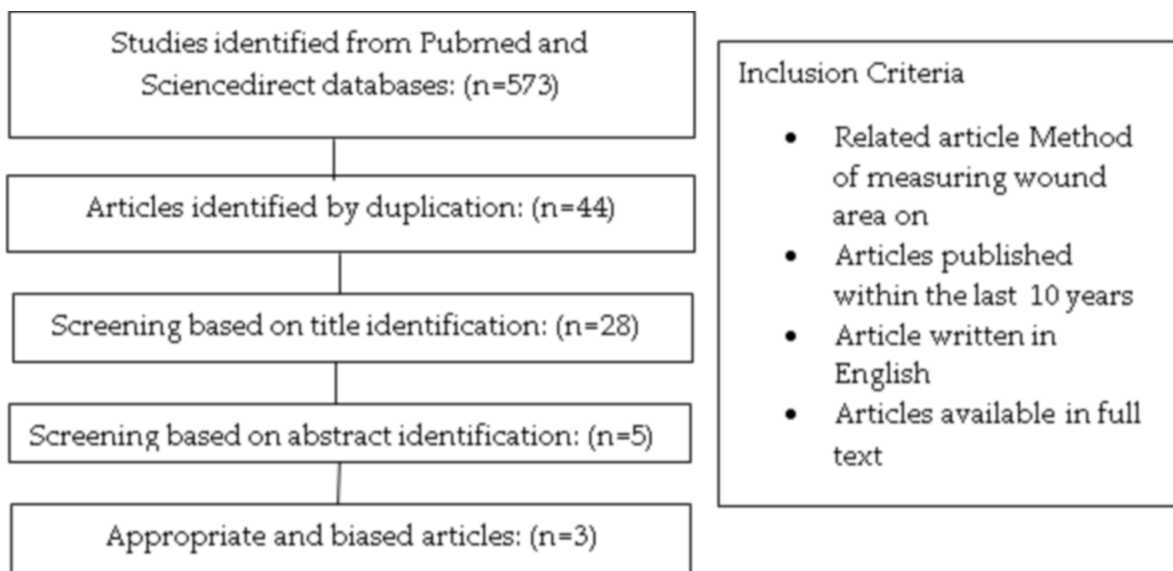


Figure 1 Prisma Flow Diagram

### 3. RESULT AND DISCUSSION

The number of articles that can be used from the results of a literature review searching is 3 (three) articles. The survey is in the form of a table containing a description of each article will be described in a narrative **Table 1** Literature review

and summary way based on the content that from a unity that can be seen in Table 1.

#### 3.1. Presenting the Results

No	Author	Research design	Research Respondents	Wound Measurement Method	Burn Measurement Time	Results Study	Conclusion
11	EL Gee Kee, RM Kimble, KA Stockton. (2015)	Quantitative <i>Randomized Controlled Trial</i> (RCT)	96 child respondents (55 boys / 41 girls).	3D Photography  Visitrak™ Planimetry	NA (Not Access)  NA (Not Access)	The level of conformity of the two methods is very good, the number of ICC is 0.96	The contact time with the patient and the image capture process only takes a few minutes. Cannot be used on curved areas  Can be used on wounds that extend to the area of the areas
22	ZM Rashaan, AM Euser, PPM van Zuijlen, RS Breederveld. (2018)	Quantitative	Respondents were 48 patients with burns. A total of 34 adults and 4 children aged <18 years.	Artec MHT™ 3D Scanner	15 minutes to 1 hour	ICC Result 0.99	Able to display color images and can reach curved areas.
3	Hsu Phie Chong, Linda Quinn, Amy Jeeves et al. (2019)	Quantitative IBM SPSS Statistical Analysis version 21 (Two-way ANOVA)	A total of 45 participants participated in this validation study (49% doctors, 33% nurses, 11% nursing	Lund and Browder (LB)	NA (Not Access)	The highest average and greater variance were obtained with TBSA (Total Body Surface	Done manually or in direct contact with the wound

No	Author	Research design	Research Respondents	Wound Measurement Method	Burn Measurement Time	Results Study	Conclusion
			students and medical students (7%).			Area) 28.8%, in the range of 14-40.5% and an average of 37.4%, in the range of 20-52.3% in patients A and B.	
33				Mersey Burn (MB)	NA (Not Access)	Obtained the highest yield value: Group A - Mean = 24.54 - Std. dev = 1.98 Group B: - Mean = 28.74 - Std. dev = 2.73	Done through access from a smartphone, with automatic calculations.
				<i>E-burn</i> (EB)	NA (Not Access)	Obtained the highest yield value: Group A - Mean = 24.51 - Std. dev = 1.66 Group B: - Mean = 25.58 - Std. dev = 1.41	Accessed by smartphone but not yet officially documented.

Source : [10]., [11]., [12].

### 3.2. Create a Discussion

There are various techniques or methods of measuring the area of burns in children during the last 10 years, obtained from the results of the analysis of the literature review above. The results of the analysis of the literature review above say that the Artec MHT™ 3D Scanner is the most appropriate method as a technique for measuring burn area in children. This technique is declared to be more valid than the 3D photography technique which can be seen from the ICC (Interclass Correlation Coefficient) results of the two techniques. Artec MHT™ 3D Scanner got ICC (Interclass Correlation Coefficient) results of 0.99 [11]. While the ICC (Interclass Correlation Coefficient) 3D photography results are 0.96, but both techniques are equally effective as a technique for measuring burn area in children [10]. ICC (Interclass Correlation Coefficient) is a statistical parameter that is commonly used for interobserver reliability analysis or as a reliability test statistic for the

same variable with a continuous scale that is measured with two or more different measuring instruments [13]. ICC statistical criteria (Interclass Correlation Coefficient) if the ICC value < 0.4 then it is declared bad, ICC < 0.75 is declared moderate to good, if ICC 0.75 then the measurement results are declared very good or valid [14].

Artec MHT™ 3D Scanner and 3D Photography is a reliable digital planimetry, both techniques are based on three dimensions. The three-dimensional method is a technique that is more profitable, especially for children. This technique is a non-invasive or non-contact technique so as to produce clean wounds without the risk of wound contamination, wound damage, and discomfort to the child [8]. The limitation of 3D photography techniques is that on special surfaces curved areas such as the ankles and wrists will be difficult to visualize in 3D, because the fingers and toes in children are so small that it does not allow for accurate measurements [15].

Both contact and non-contact techniques have their advantages and disadvantages, but after analysing the non-contact methods, they are more beneficial, especially for children. The Visitrak™ method and the Lund and Browder method in the above study are said to be inaccurate because they are still done manually and must involve direct contact with the wound, causing pain or anxiety and requiring the child to remain still for a long time. Measurement techniques with direct contact on the wound will pose a greater risk of contamination and cause discomfort to the child. Therefore, the use of wound measurement methods that involve direct wound contact or require a long time, such as the Visitrak™ system and Lund and Browder should be avoided in the children's [10].

As for other methods in the medical field, currently, many programs have been developed, one of which is a smartphone application program as an addition to medical care. The burn measurement technique with the mobile device application in the above study is said to be more user-friendly, easy to use, time-efficient and the features of this application take into account the three-dimensional nature of the calculation. However, this technique requires the user to have a high level of understanding of the existing technology [12].

A limitation of the application technique is the TBSA (Total Body Surface Area) estimation, based on photographs there may be a degree of inconsistency in the estimates as a result of the limited opportunity to examine the burn closely [16]. This app has been designed by the burn's unit at the Saint Joseph Saint Luc Hospital, France. There are only two languages available in the application including English and French, so a deeper understanding of the use of the application is needed [12]. Another limitation of this application is its quality and safety due to the lack of evidence and peer review that generally accompanies its development. So far only one study has investigated the reliability of the applications used so there are significant concerns regarding evidence-based content, peer review, and even the lack of involvement of medical professionals in the development of some applications [16].

#### 4. CONCLUSION

Based on the results of data analysis and discussion in this literature review study, 6 (six) methods of measuring the area of burns in children were obtained, including 3D Photography, Visitrak™ Method, Artec MHTTM 3D Scanner, Lund and Browder chart techniques, Mersey Burn mobile application techniques and E-burn. Of the 6 (six) methods, the advantages and disadvantages of each method have been discussed in the discussion. After the analysis, the three-dimensional

technique showed high potential as a method of measuring burn areas in children.

The results of the literature review study that we have done, it is found that the 3D photography technique and the Artec MHTTM 3D Scanner are effective methods as techniques for measuring burn area in children. Both of these methods have non-invasive properties and do not involve direct contact with the wound so that it will produce a clean wound without any risk of contamination and can minimize the risk of complications such as infection, wound damage, and discomfort in children.

Artec MHTTM 3D Scanner was found to be superior to 3D photography methods. Artec MHTTM 3D Scanner is able to measure wound size and assess burn characteristics more effectively. The added value of the Artec MHTTM 3D Scanner is that it is suitable for curved body parts (ankles and wrists) and larger wounds and a colour three-dimensional reconstruction is obtained directly from the wound. The three-dimensional technique has been determined to be more clinically suitable for use by children because of its rapid and non-invasive nature.

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