

# Cost-effectiveness of wound treatment with cyanoacrylate topical adhesive in primary health care units in a region of Portugal

### Authors

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The study focuses on the cost-effectiveness analysis of wound treatment with cyanoacrylate topical adhesive, skin glue. A descriptive, exploratory, cross-sectional study with a convenience sample was used to analyse the effectiveness and annual direct cost of using N-butyl-2-cyanoacrylate topical adhesive in simple wounds in primary health care units in the Algarve region of Portugal. These results were compared to the use of surgical sutures for the same type of wounds. Wound care studies are important for a number of reasons, including improving the quality of care, as well as for patient safety, accessibility and equity of access to healthcare and resource management.

**T**he definition of patient safety includes the collective notion of reducing the risk of unnecessary healthcare-related harm, in the light of current knowledge, available resources and the context in which care is delivered, as opposed to the risk of no treatment or other alternative treatment (World Health Organization, 2010).

This article considers the cost-effectiveness of wound care with two alternative treatments, which depend on the availability of resources: wound care with topical N-butyl-2-cyanoacrylate adhesive or with surgical sutures.

As shown in the literature, the results of treating traumatic or surgical wounds with cyanoacrylate topical adhesives are comparable to the results obtained with traditional methods with sutures (Martín-Ballester et al, 2013).

The advantages include the simplicity and speed of the procedure, which is painless and therefore does not require the use of anaesthesia (Beam, 2008). The probable antibacterial action of some cyanoacrylate adhesives, the good aesthetic result of the scar (Pawar et al, 2017) and the elimination of occupational hazards associated with needlesticks and sharps-related injuries are also noted (Oliveira et al, 2010).

There is no need for dressings or procedures

for product removal, so contact with health services is reduced (Eaglstein et al, 2005), which reduces costs.

The disadvantages of this treatment are related to possible allergic reactions and to the higher cost of the topical adhesive compared to conventional suture materials (Martín-Ballester et al, 2013).

The treatment of people with wounds is primarily the responsibility of nurses, who work in conjunction with other members of a multidisciplinary team.

In Portugal, this practice is being developed in treatment rooms across all functional units of the primary care system of the national health service (Serviço Nacional de Saúde; SNS). To that end, in addition to the technical and theoretical skills of professionals, based on the best up-to-date scientific evidence, adequate physical and material resources are needed because the treatment's effectiveness often depends on them.

In the functional units of the Algarve region where the study was conducted, the choice, distribution and management of wound care supplies is the responsibility of the Regional Health Administration. However, items are often out of stock, or the quantities supplied are insufficient for the requirements.

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**Figure 1.** Examples of different wound types: child's face (a); hand (b); child's lip (c). Application of N-butyl-2-cyanoacrylate adhesive to fingers (d) and forearm (e).

Table 1: Anatomical location of wounds.			
Anatomical location	2–18 years	22–65 years	Total
Head/skull	0	2	2
Face/supraciliary	2	0	2
Face/mento	1	0	1
Face/perioral	1	0	1
Hand/fingers	0	5	5
Arm and forearm	0	3	3
Leg	1	1	2
Knee	1	0	1
<b>Total</b>	<b>6</b>	<b>11</b>	<b>17</b>

This has frequently occurred with cyanoacrylate topical adhesive; and this lack of availability may compromise the quality of care provided, as well as patient safety, accessibility and equity in the access to care for wounds.

When there is no topical adhesive in stock, patients with simple lacerations who attend a primary healthcare centre must be referred to acute care, including emergency departments, where these types of wounds are mostly sutured.

### Aims

This study aims to assess the cost-effectiveness of using topical N-butyl-2-cyanoacrylate adhesive in simple wounds in primary health care units in one region of Portugal. A comparative analysis of the results of skin glue with the use of surgical sutures for the same type of wounds in emergency services was also

carried out, with an examination of the costs of both types of treatments, both for patients and for the SNS. The aims are:

- To evaluate the effectiveness of using N-butyl-2-cyanoacrylate topical adhesive in wound healing.
- To calculate and compare the direct cost of wound treatment with N-butyl-2-cyanoacrylate topical adhesive with silk sutures for the patient.
- To calculate and to compare the direct cost of wound treatment with N-butyl-2-cyanoacrylate topical adhesive with silk sutures for the population registered in all functional units of primary health care in a region of Portugal.

### Methods

A descriptive, exploratory, cross-sectional study was used, with a convenience sample (n=17). The study on the effectiveness of the topical adhesive took place during 2019; the study on direct costs was completed in 2021.

All ethical principles applicable to a research study with the proposed methodology were applied, including the informed consent of the patient or family member for photographing, applying the topical adhesive and participating in the study.

The effectiveness of the treatment with N-butyl-2-cyanoacrylate topical adhesive was assessed by evaluating the wound on the third day after the product was applied and the final evaluation took place in the second week of healing. These clinical results were evaluated under the variables:

- Signs of infection within 3 days.
- Wound closure within  $\pm$  14 days.
- Aesthetic result within  $\pm$  14 days.
- Patient satisfaction expressed in the final evaluation.

Given the short time between injury and evaluation, the Wound Evaluation Scale parameters were used, specifically step-off borders, contour irregularities, scar width, edge inversion, inflammation and overall cosmesis, (Hollander et al, 1995).

Direct costs were assessed by calculating the variables involved in the two types of treatment in the study, using the Portuguese SNS price lists.

These costs for the region studied were calculated by extrapolating the sample obtained data in the effectiveness study, by using the data from the SNS platform.

Direct costs for users were calculated based on the values of the SNS user charges in force.



Figure 2. Before and after the application of N-butyl-2-cyanoacrylate adhesive: child's face (a, b); adult's hand (c, d); and adult's fingers (e, f).

Table 2: Resources needed for treatments.

	Topical adhesive	Suture
Functional unit, number of consultations	1	3
Emergency service, number of consultations	0	1
Materials	N-butyl-2-cyanoacrylate Normal saline unidose 10 ml Iodopovidone unidose 10 ml Compresses 1 packet Sterile gloves 1 pair	Silk suture 2/0 Normal saline unidose 10 ml Iodopovidone unidose 10 ml Simple suture kit Sterile gloves 1 pair Lidocaine 1 amp Syringe 2 ml Needle 0.8 × 40 Simple dressing
Healthcare professionals	Nurse x 1	Nurse x 4 Doctor x 1
Administrative service	1	4

## Results

N-butyl-2-cyanoacrylate topical adhesive was applied in simple laceration type wounds, mostly traumatic, but also surgical, not deep, in areas of low tissue tension, with regular edges

and easily approachable, without signs or high risk of infection [Figure 1].

The temporal distribution was irregular, related to the occurrence of events and the availability of the product. Six patients aged 2–18 years and 11 patients aged 22–65 years were treated.

In children and young people, the wounds were mostly located on the face; and in adults they were mainly on the hands [Table 1].

The effectiveness of the treatment with N-butyl-2-cyanoacrylate topical adhesive was measured by the rate of assessment of the wound at day 3 (53%), the rate of signs of infection at day 3 (0%) and the rate of final assessment of cicatrisation (41% of the sample).

The cicatrisation maturation was as expected for the cicatrisation phase in 100% of the cases evaluated, as well as the aesthetic result of the scar, without step-off borders, contour irregularities, margin separation, scar width, edge inversion or inflammation in all the cases. Some sample photos are presented in Figure 2.

All the patients expressed total satisfaction with the procedure. Some patients did not participate in the face-to-face evaluation, but were contacted by phone. Parents answered for the children.

The direct costs to the SNS and to the user implementing the two types of procedures and subsequent treatments to the patient were estimated.

It was verified that both the contacts with services and the material resources required are lower for topical adhesive treatment than with suture treatment. Topical adhesive treatment requires one contact with health services for the application of the product. This intervention only requires one nurse for most cases of simple wounds. The treatment with suture requires at least three contacts: first, the surgical procedure, performed by a doctor and a nurse; second, the nursing care for assessment, cleaning and dressing change; and third, at least, one more nursing contact to remove the suture material [Table 2].

The cost of the necessary materials and products is €0.59 higher for topical adhesive (€6.94 versus €6.35 for suturing; [Table 3]).

The cost to the SNS of treating a wound with topical adhesive is €82.41 less (adhesive €22.94 versus suturing €105.35 [Table 4]).

The cost for the patient is €16.40 less with topical adhesive, with the treatment with topical adhesive costing €3.50 and suture treatment costing €19.90 [Table 5].

The estimated annual cost for the SNS in

Topical adhesive	Cost	Surgical suture	Cost
Adhesive	€6.0418	Silk suture 2/0	€0.4551
Normal saline unidose 10 ml	€0.1166	Normal saline unidose 10 ml	€0.1166
Iodopovidone unidose 10 ml	€0.2169	Iodopovidone unidose 10 ml	€0.2169
Sterile compresses 1 packet	€0.0212	Simple suture kit	€3.7242
Sterile gloves 1 pair	€0.5412	Sterile gloves 1 pair	€0.5412
		Lidocaine 1 amp	€0.8268
		Syringe 2 ml	€0.0406
		Needle 0.8 x 40	€0.0234
		Simple dressing	€0.4028
<b>Total</b>	<b>€6.9377</b>		<b>€6.3476</b>
<b>Difference</b>	<b>€0.5901</b>		

region under analysis shows that wound treatment with topical adhesive is €11,808 less than treatment with topical adhesive, being €2,520 for topical adhesive and €14,328 for suture [Table 7].

## Discussion

Wound treatment with N-butyl-2-cyanoacrylate topical adhesive was effective. All cases evaluated showed good closure of the wound plan, without dehiscence, despite the short interval between product application and wound evaluation.

In the final assessment, ± 14 days, all the wounds were epithelialised and at the start of the cicatrisation maturation process, with good aesthetic results [Figure 2]. All patients expressed total satisfaction with the procedure.

The direct cost estimates, made for both the SNS and patients, were made by extrapolating data from the product application sample. This sample was small because the topical adhesive was frequently out of stock. For this reason, many other patients with wounds were referred to the emergency service but this variable was not documented. Therefore, in future studies, the frequency of cases that were not treated with topical adhesive because it was not available should be included and accounted for. However, even with this limitation, the resource savings achieved in wound treatment with topical adhesive are significant for both patients and the SNS.

Treatment with topical adhesive thus, represented a greater benefit to patients, both in terms of cost, by reducing contacts with SNS services, and by the results of its effectiveness.

Given the benefits of wound treatment documented in the literature, as well as those obtained in this paper, the quality of care provided, as well as the patient safety, accessibility and equity of access to care for wound patients may be compromised by the unavailability of topical adhesive in treatment rooms.

## Conclusion

Wound care with N-butyl-2-cyanoacrylate topical adhesive in the treatment room of primary healthcare units is a cost-effective procedure that is technically appropriate to the level of care provided by nurses, and could constitute significant resource savings for both the SNS and patients.

As a result of the findings of this study, this procedure can be considered a good practice that can improve the quality of care provided to

	Topical adhesive	Cost	Surgical suture	Cost
Product	Adhesive unidose	€6.0418	Silk suture 2/0	€0.4551
Materials for application of the treatment	Saline Iodopovidone Compresses Gloves	€0.8959	Saline Iodopovidone Gloves Anaesthetic Syringe Needle Simple suture kit Simple dressing	€5.8928
Functional unit nurse consultations/treatment	1	€16	3	€48.00
Emergency service consultations	0	0	1	€51.00
<b>Total</b>		<b>€22.9377</b>		<b>€105.3479</b>
<b>Difference</b>	<b>€82.4102</b>			

	Topical adhesive	Cost	Surgical suture	Cost
Functional unit user charges/nurse consultations	1	€3.50	1	€3.50
Functional unit user charges /nurse treatment	0	0	2 (€1.20 x2)	€2.40
Emergency service user charges	0	0	1	€14
<b>Total</b>		<b>€3.50</b>		<b>€19.90</b>
<b>Difference</b>	<b>€16.40</b>			

the region under analysis, shows that wound treatment with topical adhesive would be €59,335.34 lower, being €16,515.14 for topical adhesive and €75,850.49 for suture [Table 6].

The estimated annual cost for users in the



**Table 6: Annual cost for the Regional Health Administration.**

Population	Topical adhesive treatments n/year	Cost/treatment topical adhesive (€22.9377)	Cost/treatment suture (€105.3479€)	Annual savings with topical adhesive
Population of the functional unit studied (n=11,033)	17	€389.9409	€1,790.9143	€1 400.9734
Population of the functional units served by the Regional Health Administration (n=467,124)	720	€16,515.144	€75,850.488	€59 335.344

**Table 7: Annual cost for users of the Regional Health Administration.**

Population	Topical adhesive treatments n/year	User charges for topical adhesive treatment (€3.50)	User charges for suture treatment (€19.90)	Annual savings in user charges with topical adhesive
Population of the functional units studied (n=11,033)	17	€59.50	€338.30	€278.80
Population of the functional unit served by the Regional Health Administration (n=467,124)	720	€2 520	€14 328	€11 808

people with wounds. Therefore, patient safety, accessibility and equity in the access to health care for people with wounds can improve if the product is available in the treatment rooms of the SNS' primary health care.

**WINT**

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