MACOVA 2020

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THE A-DIVA SCALE

Prediction of a difficult intravenous access in hospitalized adults

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een santeon ziekenhuis

INTRODUCTION

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Catharina Hospital

- Clinical epidemiologist
- Nurse anesthetist

Fontys University of Applied Sciences

- Lecturer
- Research coordinator

Conflicts of interest

- Member of the EuropeanBoard for Vascular Access Management, as initiated by BD

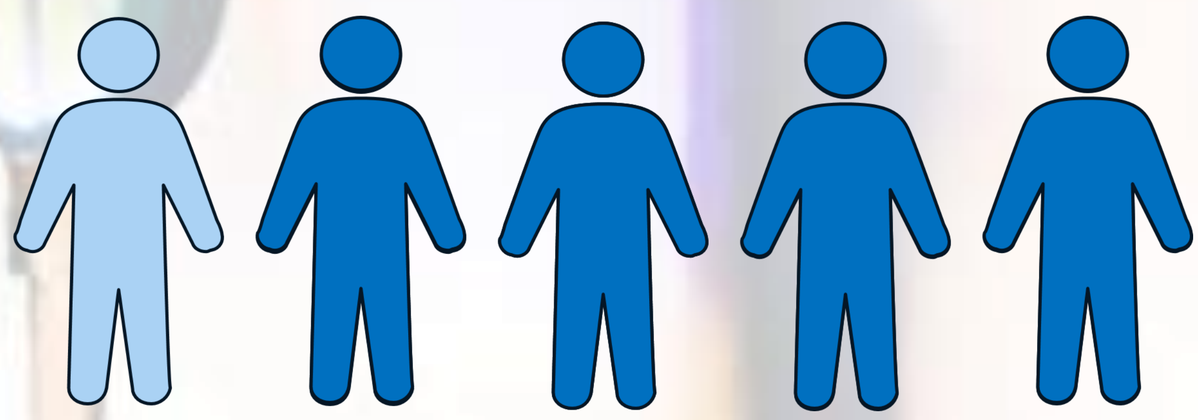
PERIPHERAL INTRAVENOUS CANNULATION

PREVALENCE

Peripheral intravenous cannulation is the most common invasive hospital procedure performed worldwide to administer drugs, fluids, and blood products during their admission. [1,2]

In clinical practice, four out of five patients needs an intravenous access, making an estimated prevalence of peripheral intravenous cannulation up to 85%. [3,4]

Every surgical patient needs an intravenous access before we can start with the administration of anesthesia.



FAILED CANNULATION

DEFINITION

Intravenous cannulation is considered successful if the practitioner is able to inject a saline flush without signs of infiltration or subcutaneous infusion. [5-7]

One attempt is determined as a percutaneous needle puncture, regardless the amount of subcutaneous exploration from the single puncture site. [5-7]

FAILED CANNULATION

CONSEQUENCES

Peripheral intravenous cannulation is associated with an unacceptable high overall failure rate, posing a burden to: [2,5]

- Patients
- Caregivers
- Healthcare system

Moreover, failed cannulation results in an increased: [2,5]

- Number of painful and stressful punctures
- Nursing and medical workload
- Catheter-related infections and phlebitis

FAILED CANNULATION

CONSEQUENCES – PAIN

A previous observational study reported a mean pain score of 3.3±2.2 for peripheral intravenous cannulation. [8]

Inserting a smaller sized catheter did not result in a lower pain sensation; the lowest pain score was registered when the catheter was inserted successfully at the first attempt on the dorsum of the hand in males with an ASA classification 1 and a low-risk for a difficult intravenous access. [8]

FAILED CANNULATION

CONSEQUENCES – PAIN

A successful first attempt resulted in both statistically and clinically significant lower pain scores when compared to multiple unsuccessful attempts. [8]

	B coefficient	95% CI	p value	Standard error
Size of the PIVC	0.35	−0.74 to +1.01	0.13	0.01
Sex	0.34	0.11–0.57	0.01	0.12
ASA classification	0.28	0.13–0.43	<0.001	0.10
Site of cannulation	0.17	0.03–0.32	0.02	0.07
A-DIVA risk profile	0.56	0.31–0.82	<0.001	0.13
Successful attempt	2.52	2.13–2.90	<0.001	0.13

FAILED CANNULATION

CONSEQUENCES – PAIN

Conclusion: to prevent pain must an unsuccessful attempt be avoided. [8]

Original research article

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Pain upon inserting a peripheral intravenous catheter: Size does not matter

Fredericus HJ van Loon[1,2,3], Lisette APM Puijn[3], Wesly H van Aarle[3], Angelique TM Dierick-van Daele[1,2] and Arthur RA Bouwman[3,4]

FAILED CANNULATION

CONSEQUENCES – COSTS

In another study, a mean of 1.37 (±0.77) attempts were needed for a successful cannulation with a mean time of 3.5 (±2.7) minutes across the sample of patients. [9]

Costs for peripheral intravenous cannulation were estimated to be €11,67 for each patient. [9]

FAILED CANNULATION

CONSEQUENCES – COSTS

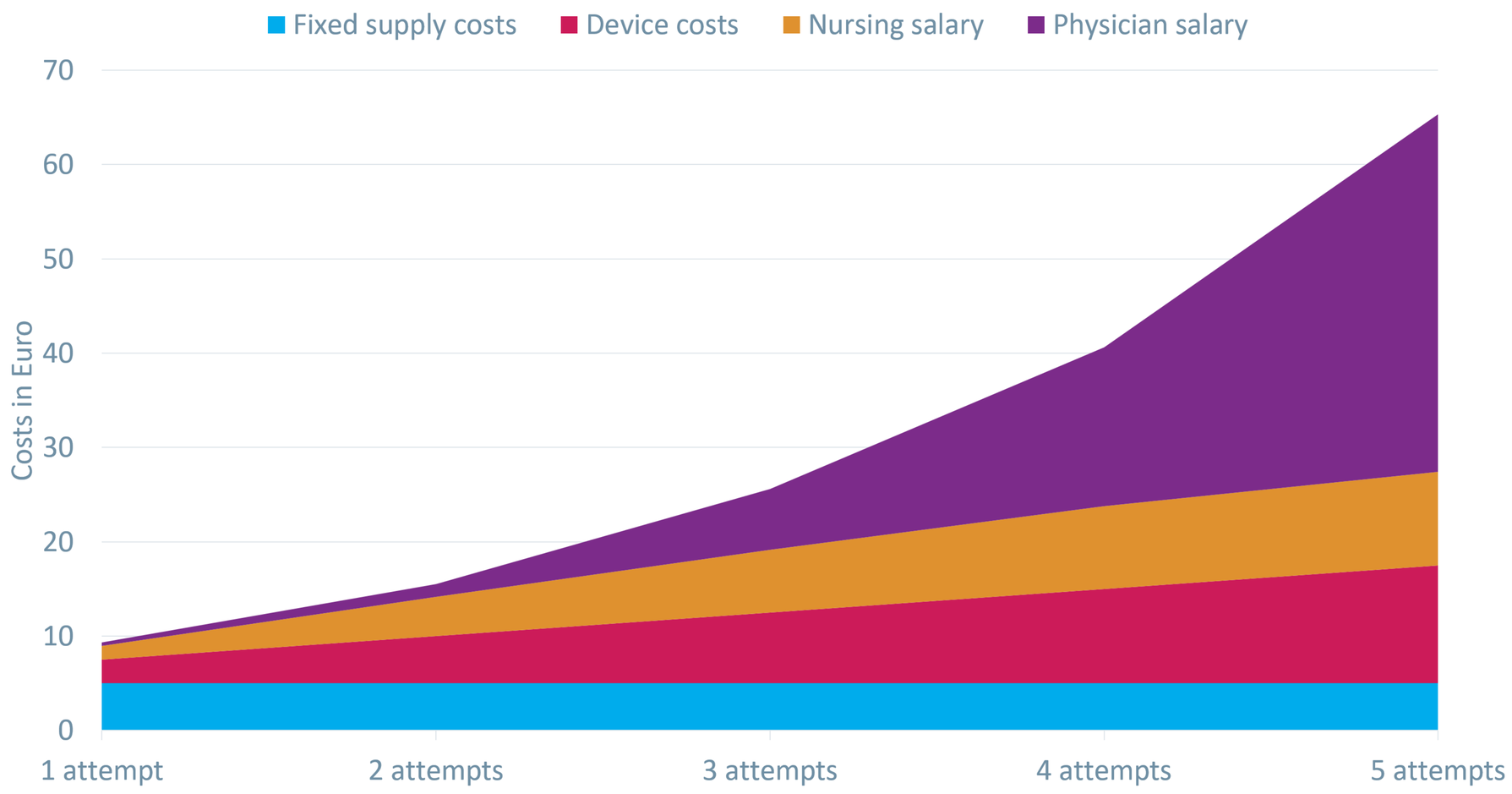
Overall, intravenous cannulation is most frequently performed by nurses, although physician participation increased if the number of failed attempts increased. [9]

While successful cannulation on the first attempt was performed by nurses in 93% of patients, when five or more attempts were needed it was physicians who performed the procedure in 85% of patients. [9]

FAILED CANNULATION

CONSEQUENCES – COSTS

Total costs for PIVC increased as the number of attempts needed for successful cannulation increased. The costs for PIVC were estimated to be €9,32 with a successful first attempt, but increased to €65,34 when five attempts were needed, based on clinician deployment. [9]



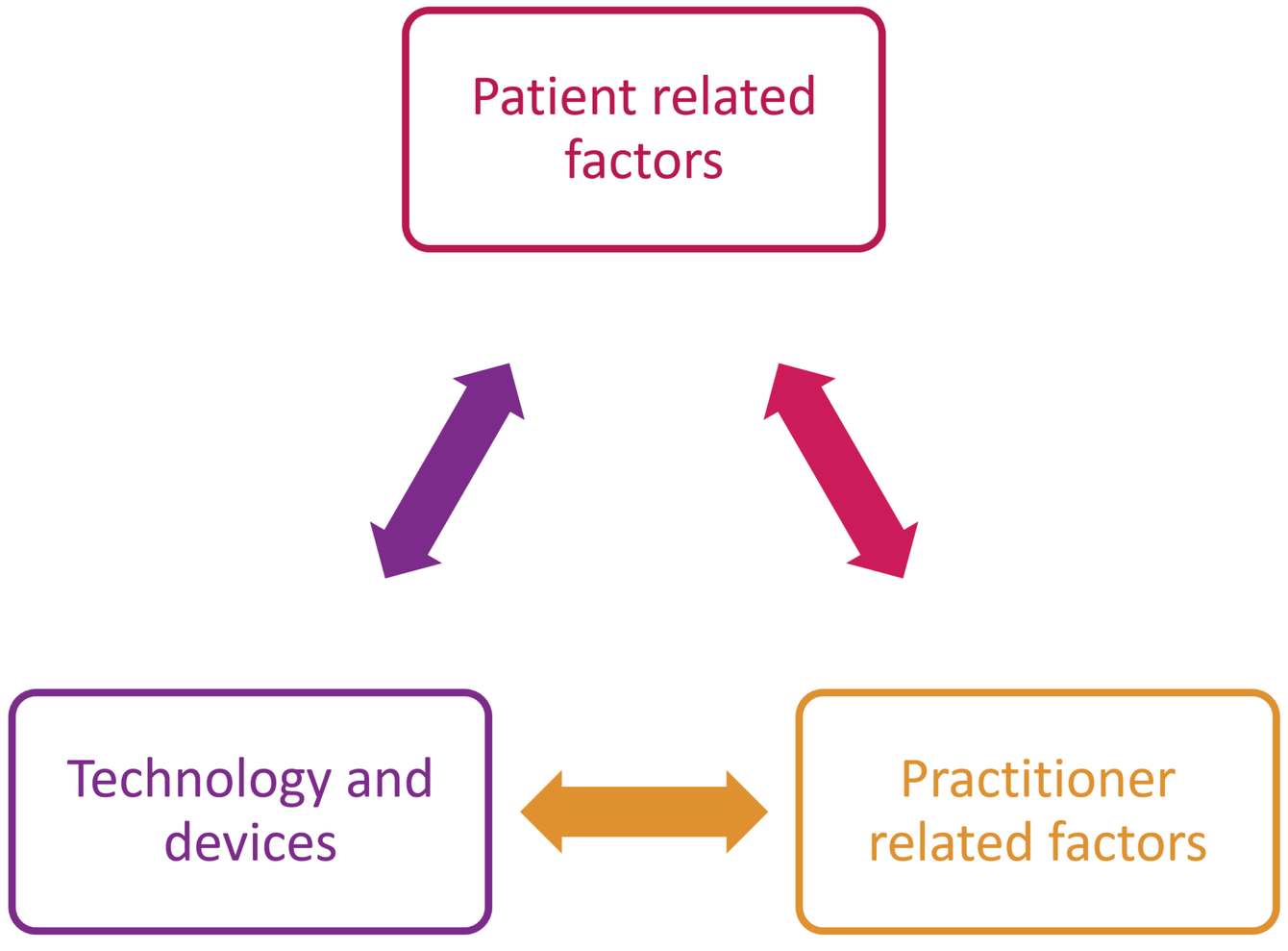
FAILED CANNULATION

CONSEQUENCES – COSTS

Conclusion: multiple attempts are a burden for patients and expensive to the healthcare system, and preventable when state of the art techniques are used as applied by nurses to individual patients based on predicted difficult intravenous access, will make the application of these additional technologies, in turn, more efficient. [9]

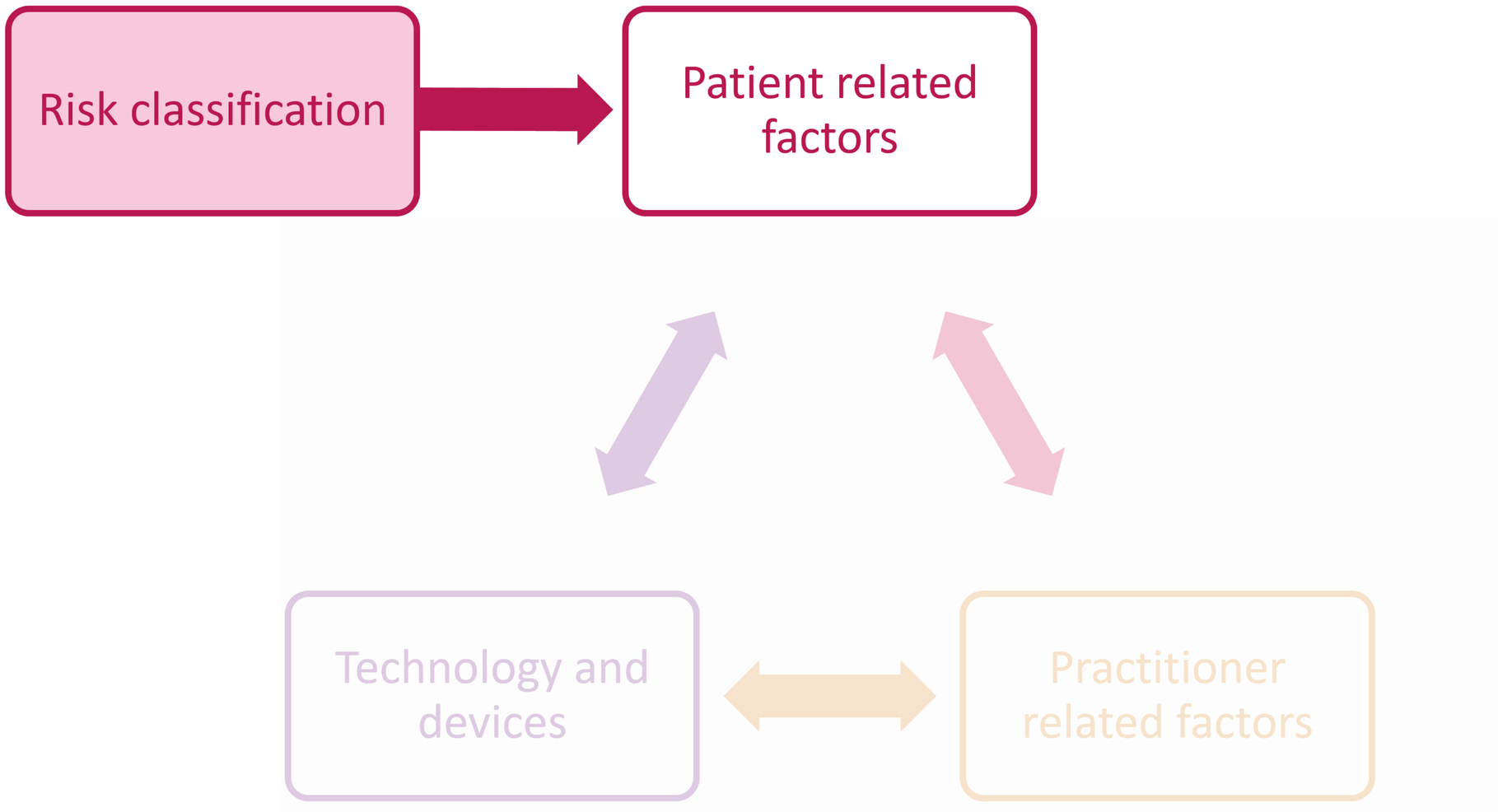
THE KEY TO SUCCESS

TRIANGLE TO SUCCESS



THE KEY TO SUCCESS

TRIANGLE TO SUCCESS



THE KEY TO SUCCESS

TRIANGLE TO SUCCESS

Risk classification → Patient related factors

Journal of *Clinical Medicine*

MDPI

Article

The Modified A-DIVA Scale as a Predictive Tool for Prospective Identification of Adult Patients at Risk of a Difficult Intravenous Access: A Multicenter Validation Study

Fredericus H. J. van Loon [1,2,*], Loes W. E. van Hooff [3], Hans D. de Boer [4], Seppe S. H. A. Koopman [5], Marc P. Buise [2], Hendrikus H. M. Korsten [2,6], Angelique T. M. Dierick-van Daele [7,8] and Arthur R. A. Bouwman [2,6]

THE A-DIVA SCALE

A-DIVA STUDY

The aim of our study was to: [6]

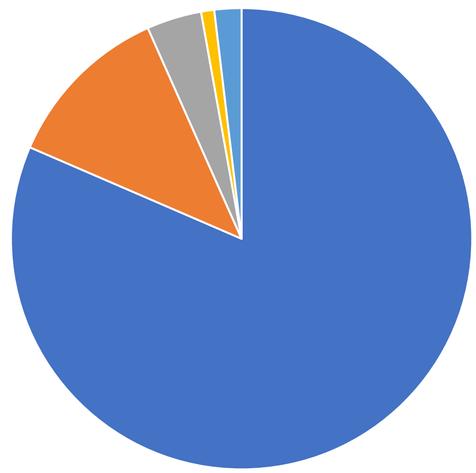
1. Identify risk factors for failure of peripheral intravenous cannulation in adult patients;
2. Create a simplified additive scale to calculate the risk of failed intravenous cannulation on the first attempt;
3. Classify patients with a difficult access prospectively.

THE A-DIVA SCALE

A-DIVA STUDY

Of the 3587 patients included in our study: [6]

- The first attempt of intravenous cannulation was successful in 2923 patients, resulting in a first attempt success rate of 81%;
- 425 patients needed 2 attempts (12%);
- 138 patients needed 3 attempts (4%);
- 33 patients needed 4 attempts (1%);
- 68 patients needed ≥5 attempts (2%).



THE A-DIVA SCALE

THE SCALE

The A-DIVA scale was created as the Adult Difficult IntraVenous Access scale and included five variables from a multivariate logistic regression analyses. [6]

Factor	β	SE	p Value	Odds Ratio	95% CI
History of a difficult intravenous cannulation	0.976	0.180	<0.001	2.7	1.6 to 4.4
Practitioner's expectation of a difficult intravenous access	0.936	0.191	<0.001	2.6	1.6 to 4.0
No palpable vein after tourniquet placement	1.670	0.187	<0.001	4.8	2.5 to 8.1
No visible vein after tourniquet placement	1.879	0.192	<0.001	5.9	2.5 to 10.1
Diameter of the vein less than 3 millimeters after tourniquet placement	1.247	0.094	<0.001	3.5	2.7 to 4.4

Constant β 8.950, SE 0.543, $p < 0.001$. SE = Standard Error. CI = Confidence Interval.

What's New?

THE A-DIVA SCALE

THE SCALE

Based on the additive scale were patients classified into either a low, moderate, or high-risk group, depending on the existence of risk factors in the individual patient. [6]

Question	Score
Is there a known history of a difficult intravenous access?	1
Do you expect a failed first attempt or a difficult intravenous access?	1
Is there an inability to identify a dilated vein by palpating the extremity?	1
Is there an inability to identify a dilated vein by visualizing the extremity?	1
Has the largest dilated vein a diameter less than 3 millimeters?	1

THE A-DIVA SCALE

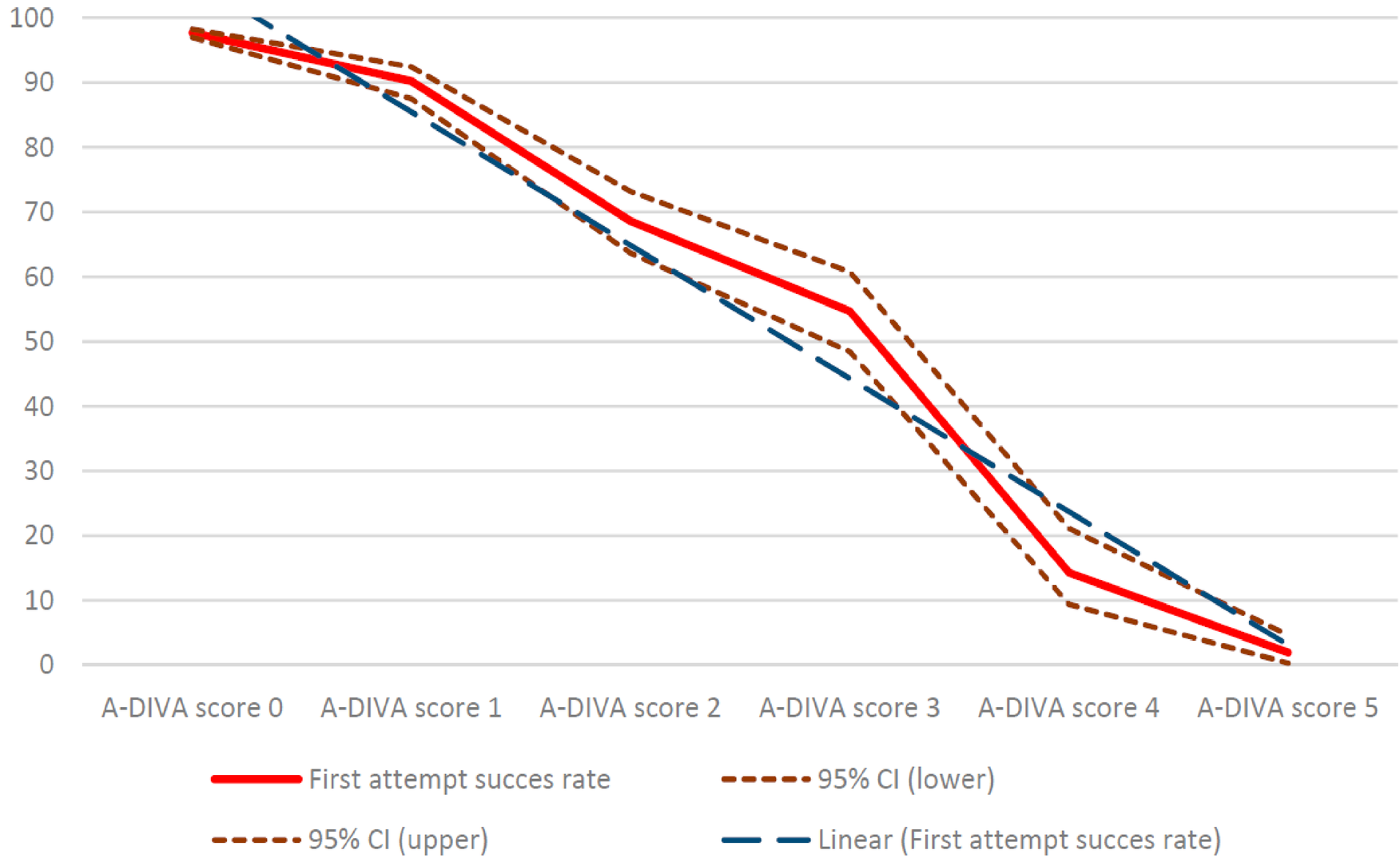
RISK CLASSIFICATION

- Patients in the low risk group had a relative risk for a failed first attempt of 0.07 (95% CI 0.06 to 0.08). [6]
- Patients in the moderate risk group had a relative risk for a failed first attempt of 2.52 (95% CI 2.20 to 2.88). [6]
- Patients in the high risk group had a relative risk for a failed first attempt of 8.97 (95% CI 8.08 to 9.96). [6]

Risk group	Number of patients	Success rate
Low risk *(A-DIVA 0 – 1)*	2619	96%
Moderate risk *(A-DIVA 2 – 3)*	610	63%
High risk *(A-DIVA 4 – 5)*	358	6%

THE A-DIVA SCALE

RISK CLASSIFICATION



THE A-DIVA SCALE

LEVEL OF ACTION

IMPLICATIONS

Low risk: no advanced action needed, peripheral intravenous cannulation can be performed by every practitioner.

THE A-DIVA SCALE

LEVEL OF ACTION

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Low risk: no advanced action needed, peripheral intravenous cannulation can be performed by every practitioner.

Moderate risk: no advanced action needed, peripheral intravenous cannulation must be performed by the most experienced practitioner.

THE A-DIVA SCALE

LEVEL OF ACTION

IMPLICATIONS

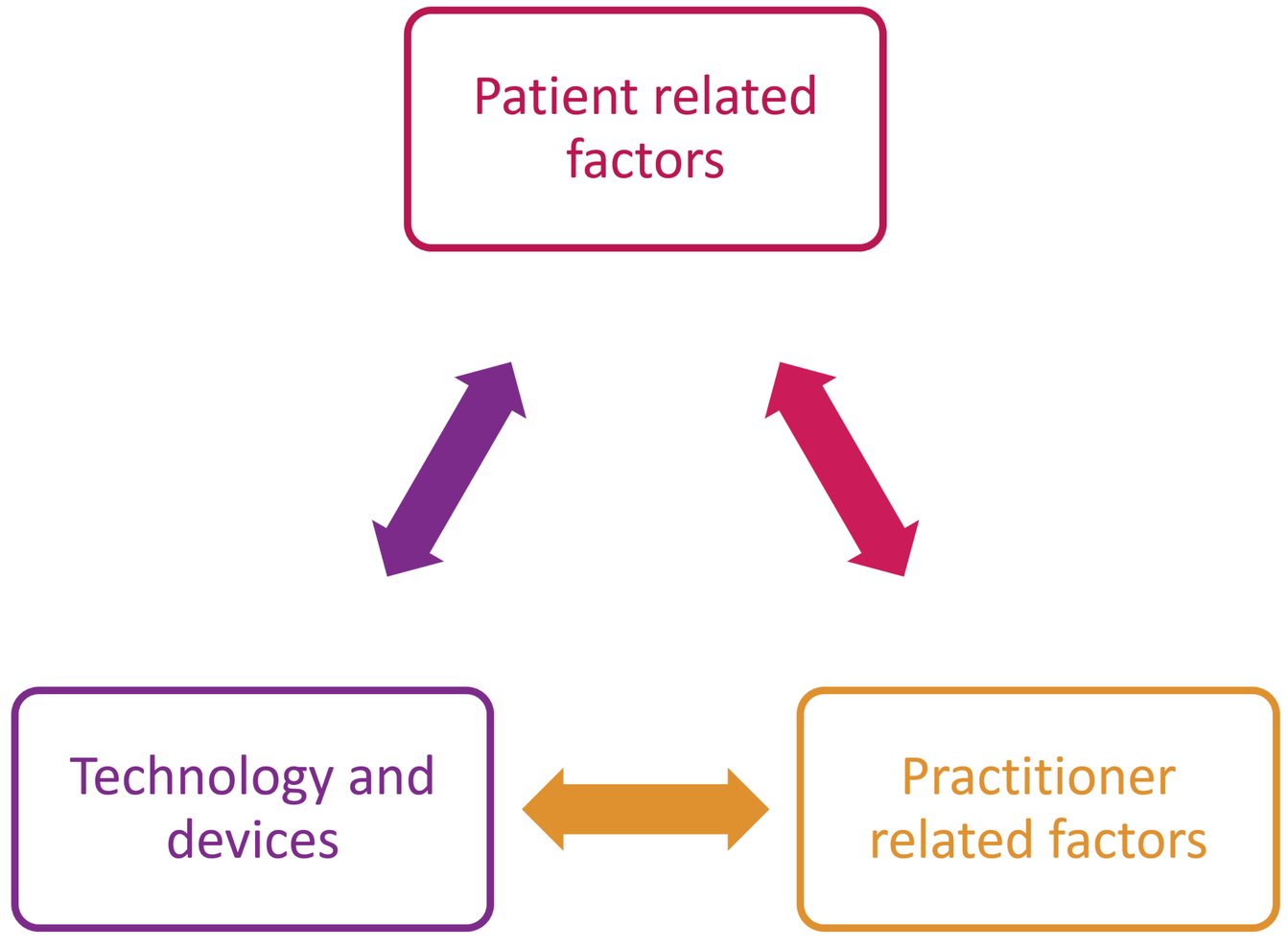
Low risk: no advanced action needed, peripheral intravenous cannulation can be performed by every practitioner.

Moderate risk: no advanced action needed, peripheral intravenous cannulation must be performed by the most experienced practitioner.

High risk: use of ultrasound upon peripheral intravenous cannulation, as performed by trained and highly experienced practitioner.

THE KEY TO SUCCESS

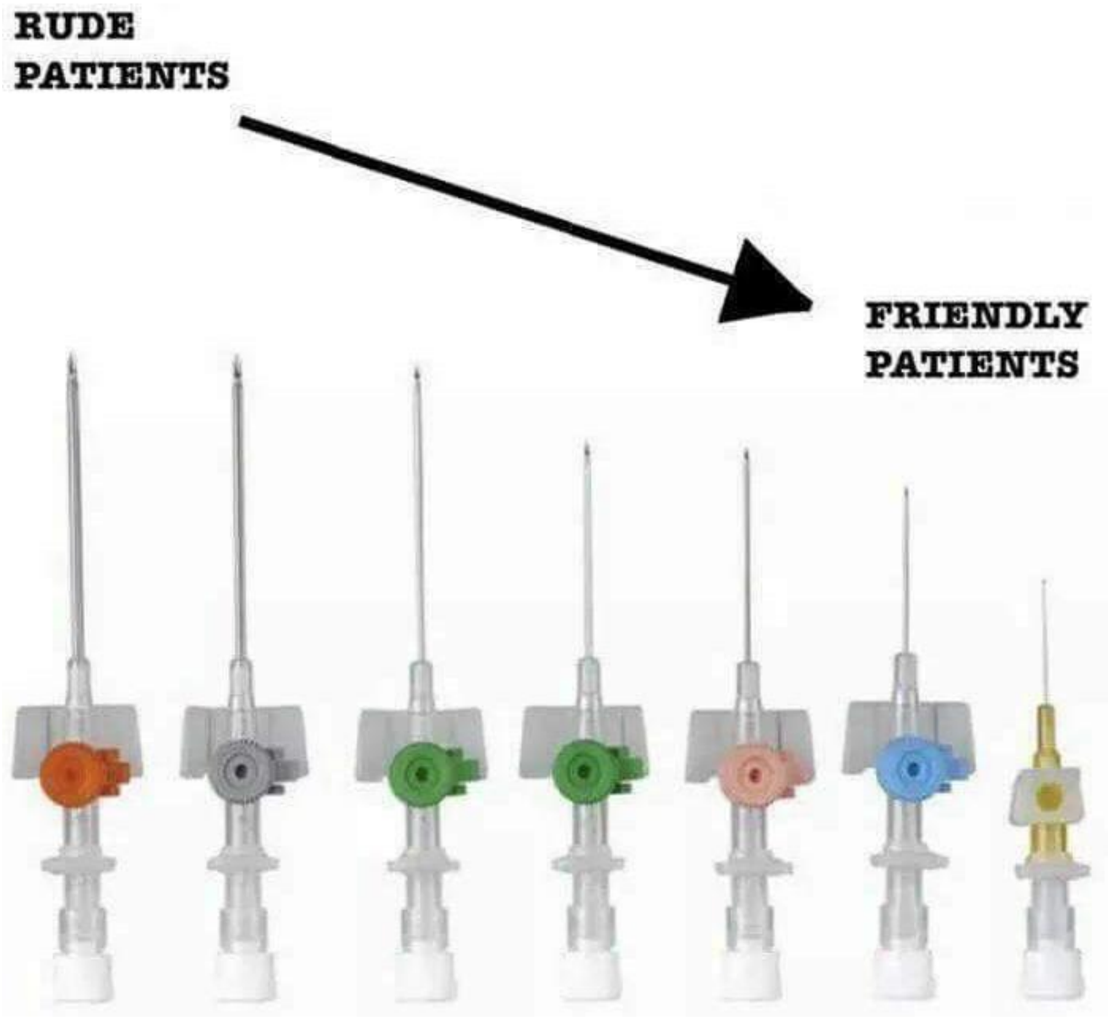
IMPLICATIONS



THE KEY TO SUCCESS

IN GENERAL

Peripheral intravenous cannulation requires a multifactorial approach, taking risk factors and opportunities into account.



THE KEY TO SUCCESS

IN GENERAL

First attempt cannulation success can be increased by:

- Selection of those patients at risk;
- Following a strategy to an individual risk profile.

This strategy included:

- Selection of the right intravenous access device;
- The use of the right (advanced) technology;
- Managed by an experienced clinician.

CONCLUSION

TAKE HOME MESSAGE

The five-variable additive A-DIVA scale is a reliable and generalizable predictive scale to identify patients at risk of a difficult intravenous access. A patient's individual score on the A-DIVA scale will predict the likelihood of failed peripheral intravenous catheter placement; a higher score on the A-DIVA scale indicates a higher risk of the presence of a difficult intravenous access.

Applying the A-DIVA scale to hospitalized patients may increase the success rate of inserting a peripheral intravenous catheter on the first attempt, because it creates awareness of those patients at risk.

Most importantly, selection of those patients at risk creates a possibility to use other techniques, such as ultrasound, in an earlier time frame by experienced clinicians.

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