Advanced Bleeding Control in combat casualty care – Delphi Consensus Survey rounds

Additional email questions

Would you please answer the questions below to verify whether you meet the inclusion criteria for the survey?

1. Are you currently serving in the military?
2. Are you experienced in the treatment of noncompressible torso hemorrhage (NCTH)?
3. If yes, what is your caseload of patients with NCTH?
    a. 0-5 cases
    b. 5-10 cases
    c. 10-15 cases
    d. >15 cases

Would you please indicate your medical specialty?

a. Surgeon: trauma, acute care or vascular surgery
b. Surgeon: other
c. Emergency medicine physician
d. Anesthetist
e. Interventional cardiologist
f. Interventional radiologist
g. Other, namely …

Advanced Bleeding Control in combat casualty care – Delphi Consensus Round 1

1. **What is your nationality?**

2. **For which military nations were you deployed?**

3. **How many times have you been deployed?**

4. **For which military nation were you most recently deployed?**

Please answer further questions based on your experience from your **national** army.

5. **Which means for hemorrhage control does your military system currently have available?**

a.	Junctional tourniquet:	☐ yes	☐ no
b.	Wound clamp or zipper:	☐ yes	☐ no
c.	Intra-abdominal gas insufflation:	☐ yes	☐ no
d.	Intra-abdominal self-expanding foam:	☐ yes	☐ no
e.	Hemostatic agents:	☐ yes	☐ no
f.	Pelvic binders / stabilizers	☐ yes	☐ no
g.	REBOA	☐ yes	☐ no
h.	Other	☐ yes	☐ no

- If other, please specify: …

Please specify for each of the hemorrhage control means which types are available in your military system.

6. **Junctional tourniquet: (select all that apply)**
   - ☐ CroC
   - ☐ JETT
   - ☐ SAM-JT
   - ☐ AAJT
   - ☐ Other, please specify …
   - ☐ Our system does not have a junctional tourniquet available

7. **Wound clamp or zipper: (select all that apply)**
   - ☐ iTClamp
   - ☐ TopClosure
   - ☐ Other, please specify …
   - ☐ Our system does not have a wound clamp available

8. **Intra-abdominal gas insufflation: (please specify)**

   _____

9. **Intra-abdominal self-expanding foam: (select all that apply)**
   - ☐ ResQFoam
   - ☐ ClotFoam
   - ☐ Fibrin sealant foam (FSF)
   - ☐ Hydrophobically modified chitosan foam (HM-CS)
   - ☐ Other, please specify …
   - ☐ Our system does not have self-expanding foam available

10. **Hemostatic agents: (select all that apply)**
    - ☐ XStat
    - ☐ Celox-A
    - ☐ Hemostatic gauzes (please specify which types)
    - ☐ Other, please specify …
    - ☐ Our system does not have hemostatic agents available

11. **Pelvic binders / stabilizers: (select all that apply)**
    - ☐ T-POD
    - ☐ SAM-sling
    - ☐ PelvicBinder
    - ☐ Pelvic sheet
    - ☐ Other, please specify …
    - ☐ Our system does not have pelvic binders / stabilizers available

12. **Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA): (select all that apply)**
    - ☐ ER-REBOA
    - ☐ Tokai rescue balloon
    - ☐ MIT aortic balloon
    - ☐ Reliant Balloon
    - ☐ CODA Balloon
    - ☐ Our system does not have a REBOA capability yet, but implementation is expected
    - ☐ Our system does not have a REBOA capability
    - ☐ Other, please specify …

Indicate for each of the resources whether it is advocated or available for use in a certain environment.

13. **Junctional tourniquet: (select all that apply)**

- ☐ Point of injury / warm zone
- ☐ Casualty collection point near the battlefield
- ☐ En route care
- ☐ Forward surgical hospital/damage control (Role 1)
- ☐ Fixed surgical facility (Role 2/3)
- ☐ Other (please specify) …

14. Wound clamp: (select all that apply)

- ☐ Point of injury / warm zone
- ☐ Casualty collection point near the battlefield
- ☐ En route care
- ☐ Forward surgical hospital/damage control (Role 1)
- ☐ Fixed surgical facility (Role 2/3)
- ☐ Other (please specify) …

15. Intra-abdominal gas insufflation: (select all that apply)

- ☐ Point of injury / warm zone
- ☐ Casualty collection point near the battlefield
- ☐ En route care
- ☐ Forward surgical hospital/damage control (Role 1)
- ☐ Fixed surgical facility (Role 2/3)
- ☐ Other (please specify) …

16. Intra-abdominal self-expanding foam: (select all that apply)

- ☐ Point of injury / warm zone
- ☐ Casualty collection point near the battlefield
- ☐ En route care
- ☐ Forward surgical hospital/damage control (Role 1)
- ☐ Fixed surgical facility (Role 2/3)
- ☐ Other (please specify) …

17. Hemostatic agents: (select all that apply)

- ☐ Point of injury / warm zone
- ☐ Casualty collection point near the battlefield
- ☐ En route care
- ☐ Forward surgical hospital/damage control (Role 1)
- ☐ Fixed surgical facility (Role 2/3)
- ☐ Other (please specify) …

18. Pelvic binders / stabilizers: (select all that apply)

- ☐ Point of injury / warm zone
- ☐ Casualty collection point near the battlefield

☐ En route care
☐ Forward surgical hospital/damage control (Role 1)
☐ Fixed surgical facility (Role 2/3)
☐ Other (please specify) …

Specify for each of the resources which types of providers are currently allowed to apply them. If a certain provider is not allowed, please specify why (e.g. because of health law restrictions, not authorized based on protocol, provider is not trained, etc.).

19. Junctional tourniquet

- Trauma Surgeon: ☐ yes ☐ no
  Please specify reason: …
- Vascular Surgeon: ☐ yes ☐ no
  Please specify reason: …
- General Surgeon: ☐ yes ☐ no
  Please specify reason: …
- Anesthesiologist: ☐ yes ☐ no
  Please specify reason: …
- Physician Emergency Medicine: ☐ yes ☐ no
  Please specify reason: …
- Physician Other: ☐ yes ☐ no
  Please specify reason: …
- Nurse: ☐ yes ☐ no
  Please specify reason: …
- Medic: ☐ yes ☐ no
  Please specify reason: …
- Non physician other: ☐ yes ☐ no
  Please specify reason: …
- Other (please specify): ☐ yes ☐ no
  Please specify reason: …
- This resource is not currently available in my national military: ☐ yes ☐ no
  Please specify reason: …

20. Wound clamp

- Trauma Surgeon: ☐ yes ☐ no
  Please specify reason: …
- Vascular Surgeon: ☐ yes ☐ no
  Please specify reason: …
- General Surgeon: ☐ yes ☐ no
  Please specify reason: …
- Anesthesiologist: ☐ yes ☐ no

Please specify reason: …

- Physician Emergency Medicine: ☐ yes ☐ no
  Please specify reason: …
- Physician Other: ☐ yes ☐ no
  Please specify reason: …
- Nurse: ☐ yes ☐ no
  Please specify reason: …
- Medic: ☐ yes ☐ no
  Please specify reason: …
- Non physician other: ☐ yes ☐ no
  Please specify reason: …
- Other (please specify): ☐ yes ☐ no
  Please specify reason: …
- This resource is not currently available in my national military: ☐ yes ☐ no
  Please specify reason: …

21. Intra-abdominal gas insufflation

- Trauma Surgeon: ☐ yes ☐ no
  Please specify reason: …
- Vascular Surgeon: ☐ yes ☐ no
  Please specify reason: …
- General Surgeon: ☐ yes ☐ no
  Please specify reason: …
- Anesthesiologist: ☐ yes ☐ no
  Please specify reason: …
- Physician Emergency Medicine: ☐ yes ☐ no
  Please specify reason: …
- Physician Other: ☐ yes ☐ no
  Please specify reason: …
- Nurse: ☐ yes ☐ no
  Please specify reason: …
- Medic: ☐ yes ☐ no
  Please specify reason: …
- Non physician other: ☐ yes ☐ no
  Please specify reason: …
- Other (please specify): ☐ yes ☐ no
  Please specify reason: …
- This resource is not currently available in my national military: ☐ yes ☐ no
  Please specify reason: …

22. Intra-abdominal self-expanding foam

- Trauma Surgeon: ☐ yes ☐ no

Please specify reason: …

- Vascular Surgeon: ☐ yes ☐ no
  Please specify reason: …
- General Surgeon: ☐ yes ☐ no
  Please specify reason: …
- Anesthesiologist: ☐ yes ☐ no
  Please specify reason: …
- Physician Emergency Medicine: ☐ yes ☐ no
  Please specify reason: …
- Physician Other: ☐ yes ☐ no
  Please specify reason: …
- Nurse: ☐ yes ☐ no
  Please specify reason: …
- Medic: ☐ yes ☐ no
  Please specify reason: …
- Non physician other: ☐ yes ☐ no
  Please specify reason: …
- Other (please specify): ☐ yes ☐ no
  Please specify reason: …
- This resource is not currently available in my national military: ☐ yes ☐ no
  Please specify reason: …

23. Hemostatic agents

- Trauma Surgeon: ☐ yes ☐ no
  Please specify reason: …
- Vascular Surgeon: ☐ yes ☐ no
  Please specify reason: …
- General Surgeon: ☐ yes ☐ no
  Please specify reason: …
- Anesthesiologist: ☐ yes ☐ no
  Please specify reason: …
- Physician Emergency Medicine: ☐ yes ☐ no
  Please specify reason: …
- Physician Other: ☐ yes ☐ no
  Please specify reason: …
- Nurse: ☐ yes ☐ no
  Please specify reason: …
- Medic: ☐ yes ☐ no
  Please specify reason: …
- Non physician other: ☐ yes ☐ no
  Please specify reason: …
- Other (please specify): ☐ yes ☐ no

Please specify reason: …

- This resource is not currently available in my national military: ☐ yes ☐ no
  Please specify reason: …

24. Pelvic stabilizers

- Trauma Surgeon: ☐ yes ☐ no
  Please specify reason: …
- Vascular Surgeon: ☐ yes ☐ no
  Please specify reason: …
- General Surgeon: ☐ yes ☐ no
  Please specify reason: …
- Anesthesiologist: ☐ yes ☐ no
  Please specify reason: …
- Physician Emergency Medicine: ☐ yes ☐ no
  Please specify reason: …
- Physician Other: ☐ yes ☐ no
  Please specify reason: …
- Nurse: ☐ yes ☐ no
  Please specify reason: …
- Medic: ☐ yes ☐ no
  Please specify reason: …
- Non physician other: ☐ yes ☐ no
  Please specify reason: …
- Other (please specify): ☐ yes ☐ no
  Please specify reason: …
- This resource is not currently available in my national military: ☐ yes ☐ no
  Please specify reason: …

25. Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA)

- Trauma Surgeon: ☐ yes ☐ no
  Please specify reason: …
- Vascular Surgeon: ☐ yes ☐ no
  Please specify reason: …
- General Surgeon: ☐ yes ☐ no
  Please specify reason: …
- Anesthesiologist: ☐ yes ☐ no
  Please specify reason: …
- Physician Emergency Medicine: ☐ yes ☐ no
  Please specify reason: …
- Physician Other: ☐ yes ☐ no
  Please specify reason: …
- Nurse: ☐ yes ☐ no

Please specify reason: …

- Medic: ☐ yes ☐ no
  Please specify reason: …
- Non physician other: ☐ yes ☐ no
  Please specify reason: …
- Other (please specify): ☐ yes ☐ no
  Please specify reason: …
- This resource is not currently available in my national military: ☐ yes ☐ no
  Please specify reason: …

The following questions focus on the abovementioned hemorrhage control resources, with **exclusion** of REBOA.

26. What type of training has your system utilized to prepare providers for hemorrhage control resources (REBOA excluded)? (select all that apply)

- ☐ Training course specifically designed by your military unit or service
- ☐ BEST
- ☐ EVTM
- ☐ TCCC
- ☐ TECC
- ☐ None
- ☐ Other (please specify) …

27. If a course is used for training the use of hemorrhage control resources, what components are included? (select all that apply)

- ☐ Didactic component
- ☐ Skills component - simulator
- ☐ Skills component - animal lab
- ☐ Skills component - cadaver
- ☐ Other (please specify)
- ☐ Our system does not have a training course for hemorrhage control resources

28. To limit or prevent degradation of skills after initial training, in what frequency does your system repeat training for advanced bleeding control options?

_____

29. Does your system have a registry in which patients are registered in whom advanced bleeding devices are deployed?

- ☐ Yes, namely … (please specify)
- ☐ No, but we are interested in such registry

☐ No, because … (please specify)

30. **Does your system have a formal clinical practice guideline dictating hemorrhage control care?**
    ☐ Yes, namely … (please specify which guideline)
    ☐ No, because … (please specify)

31. **Does your system have a formal process by which to collect data on hemorrhage control (for instance a registry to capture "lessons learned" or for process improvement?)**
    ☐ Yes
    ☐ No, because … (please specify)

The following questions focus **exclusively** on REBOA.

32. **How long have you had REBOA in your military system?**
    ☐ <1 year
    ☐ 1-3 years
    ☐ 3-5 years
    ☐ >5 years
    ☐ Our system does not have a REBOA capability

33. **How many times has your military (military providers) utilized REBOA**
    - In combat zone? (please estimate if the exact number is unknown)
      ☐ <5 times
      ☐ 6-10 times
      ☐ 11-20 times
      ☐ >20 times
      ☐ We have not yet utilized this adjunct
      ☐ Our system does not have a REBOA capability
      ☐ I don't have this information

    - In civilian (international) use? (please estimate if the exact number is unknown)
      ☐ <5 times
      ☐ 6-10 times
      ☐ 11-20 times
      ☐ >20 times
      ☐ We have not yet utilized this adjunct
      ☐ Our system does not have a REBOA capability
      ☐ I don't have this information

34. **Which types of providers have used REBOA in your organization? (select all that apply)**
    ☐ Trauma Surgeon

- ☐ Vascular Surgeon
- ☐ General Surgeon
- ☐ Anesthesiologist
- ☐ Physician Emergency Medicine
- ☐ Physician Other
- ☐ Nurse
- ☐ Medic
- ☐ Non physician other
- ☐ Our system does not have a REBOA capability
- ☐ Other (please specify) …

35. For REBOA utilization in your organization, what is the preferred vascular access site?

- ☐ Common femoral artery
- ☐ Brachial artery
- ☐ Choice depends on clinical situation

36. For REBOA utilization in your organization, what is the preferred means of arterial access?

- ☐ Ultrasound guided access
- ☐ Percutaneous access using landmarks
- ☐ Open cut down
- ☐ Choice depends on clinical situation

37. What is the preferred means of access site arteriotomy closure after REBOA?

- ☐ Open surgical repair
- ☐ Manual pressure over time
- ☐ Manufactured pressure device
- ☐ Manufactured closure device
- ☐ Other (please specify) …

38. For which indications is REBOA applied in your military system? (select all that apply)

- ☐ junctional injury
- ☐ penetrating abdominal injury
- ☐ blunt abdominal injury
- ☐ penetrating thoracic injury
- ☐ blunt thoracic injury
- ☐ neck injury
- ☐ multiple bleeding sites
- ☐ traumatic cardiac arrest
- ☐ other (please specify) …

39. Does your military system have a training course to prepare providers specifically for REBOA use?

☐ Yes, we have a course specifically designed for REBOA, namely … (please specify)
☐ Yes, training for REBOA is integrated in the general training course for hemorrhage control resources.
☐ No, our system does not have a training course for REBOA.
☐ No, our system does not have a REBOA capability.
☐ Other, … (please specify)

40. If a course is used for the training of REBOA use, what components are included? (select all that apply)

☐ Didactic component
☐ Skills component - simulator
☐ Skills component - animal lab
☐ Skills component – cadaver
☐ Our system does not have a training course for REBOA
☐ Other (please specify) …

41. To limit or prevent degradation of skills after initial training, in what frequency does your system repeat training for REBOA?

_____

42. In which environment is REBOA currently available in your organization?

☐ Point of injury / warm zone
☐ Casualty collection point near the battlefield
☐ En route care
☐ Forward surgical hospital/damage control (Role 1)
☐ Fixed surgical facility (Role 2/3)
☐ Other (please specify) …

43. In your opinion, considering that adequate training conditions are met for a certain type of physician or non-physician, in which environment should REBOA be available? (select all that apply)

☐ Point of injury / warm zone
☐ Casualty collection point near the battlefield
☐ En route care
☐ Forward surgical hospital/damage control (Role 1)
☐ Fixed surgical facility (Role 2/3)
☐ Other (please specify) …

44. In my organization current legal conditions allows us to use REBOA: (select all that apply)

☐ at the point of injury / warm zone
☐ at the casualty collection point near the battlefield

- ☐ en route
- ☐ in a forward surgical hospital/damage control (Role 1)
- ☐ in a fixed surgical facility (Role 2/3)
- ☐ the use of REBOA is not allowed

45. Does your system have a formal clinical practice guideline dictating REBOA care?

- ☐ Yes
- ☐ No, because … (please specify)
- ☐ Our system does not have a REBOA capability

46. Does your system have a registry to manage the patient case history of the patients in whom REBOA is deployed?

- ☐ Yes, we use the ABO registry
- ☐ Yes, we use another registry, namely … (please specify)
- ☐ No, but we are interested in such registry
- ☐ No, because … (please specify)
- ☐ Our system does not have a REBOA capability

47. Does your system have a formal process by which to collect data on REBOA use, other than the patient case history (e.g. data on the employment of the REBOA procedure (where it was used, by whom, complications, etc.), to capture "lessons learned" or for process improvement?)

- ☐ Yes
- ☐ No, because … (please specify)
- ☐ Our system does not have a REBOA capability

48. If your military system currently not has a REBOA capability, is your system interested in further developing this capability?

- ☐ Yes
- ☐ No, because … (please specify)

The following questions are related to your level of expertise.

49. Do you consider yourself an expert in advanced bleeding control?

- ☐ Yes
- ☐ No

Please specify: _____

50. Are you have experienced in the treatment of noncompressible torso hemorrhage?

- ☐ Yes
- ☐ No

51. Have you been trained in REBOA?

- ☐ Yes (please specify what kind of training you received) …
- ☐ No

52. At what intervals do you retrain your REBOA skills outside of clinical use?

_____

53. Have you used REBOA in military setting?

- ☐ Yes (please indicate how many times) …
- ☐ No

54. Have you used REBOA in civilian setting?

- ☐ Yes (please indicate how many times) …
- ☐ No

55. Would you be willing to join a collaboration of international military providers using REBOA to study of the use of this device in austere environments?

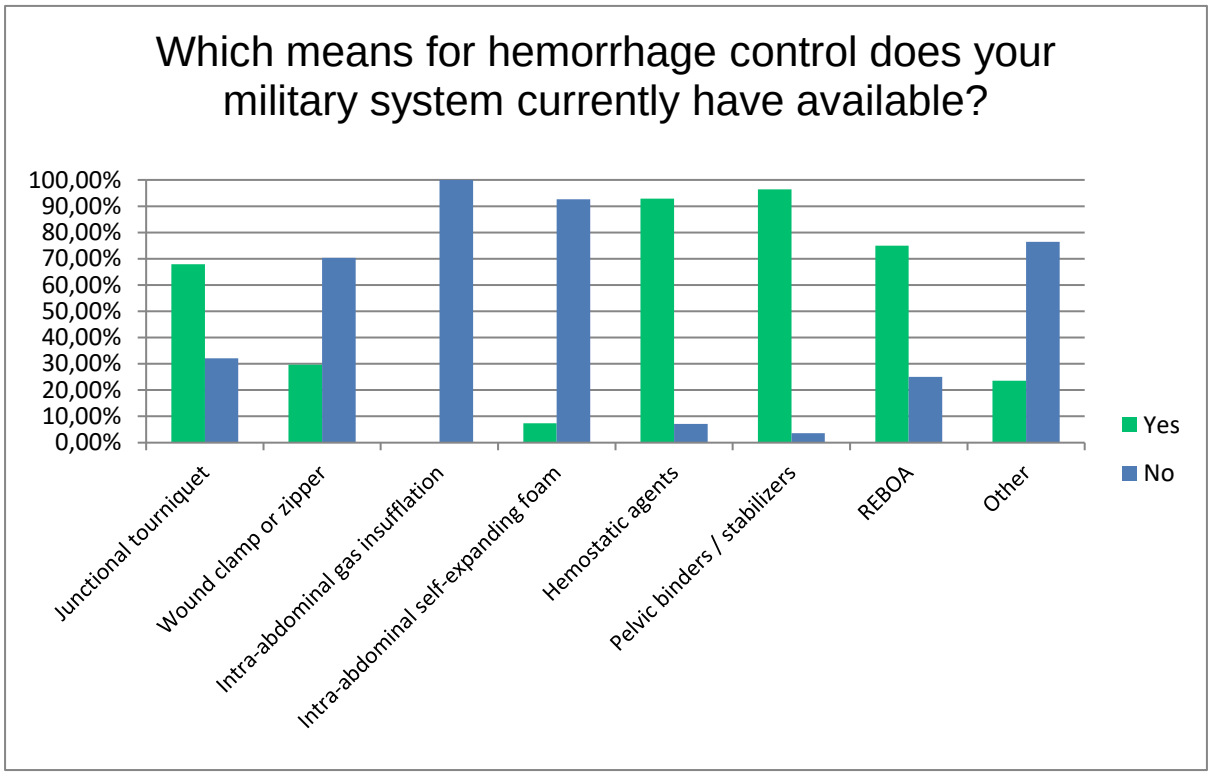
- ☐ Yes
- ☐ No

56. To conclude, please identify any colleague who is experienced in the treatment of noncompressible torso hemorrhage. We intend to include them in the panel.

_____

Advanced bleeding control in combat casualty care - Delphi Consensus Round 2

Response round 1:



1. **Do you agree or disagree with the following statement?**
   The standard toolbox for hemorrhage control in (austere) military environments should include bandages, junctional and limb tourniquets, pelvic binders/stabilizers and hemostatic agents.

   ☐ Agree
   ☐ Disagree

2. **In your opinion, should REBOA be part of the standard toolbox for hemorrhage control in (austere) military environments?**

   ☐ Yes
   ☐ No

3. **In your opinion, should a wound clamp be part of the standard toolbox for hemorrhage control in (austere) military environments?**

   ☐ Yes
   ☐ No

4. **In your opinion, should abdominal gas insufflation be part of the standard toolbox for hemorrhage control in (austere) military environments?**

   ☐ Yes
   ☐ No

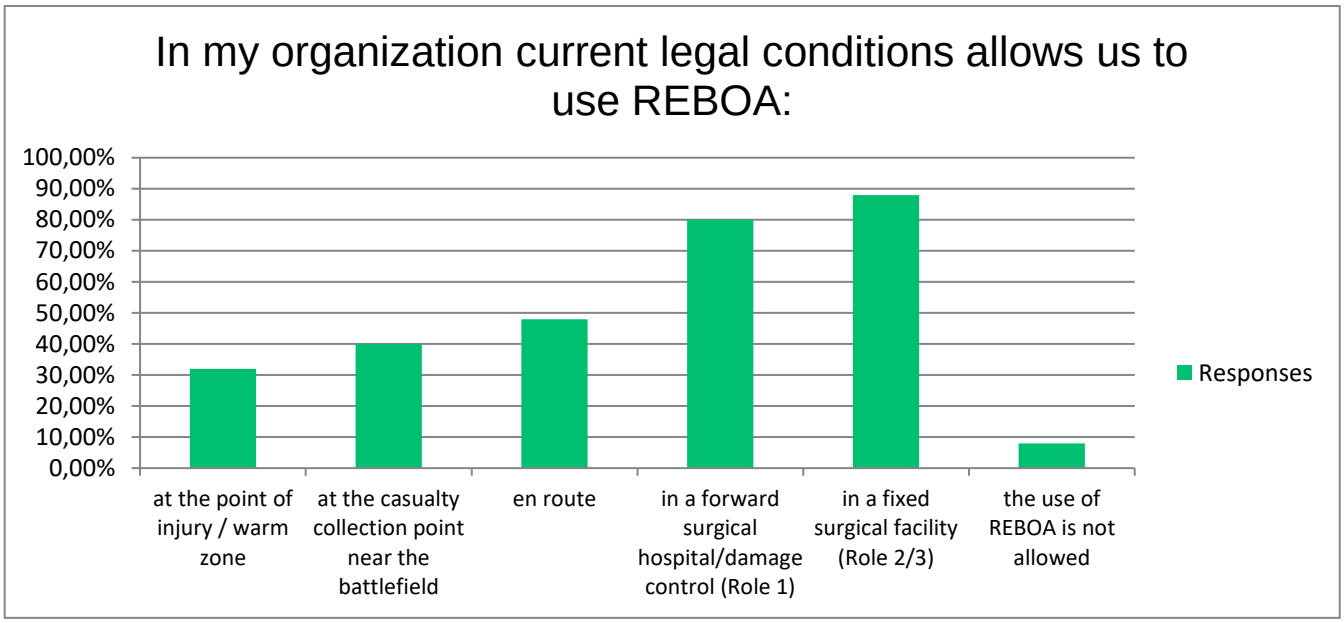
5. **In your opinion, should intra-abdominal self-expanding foam be part of the standard toolbox for hemorrhage control in (austere) military environments?**

   ☐ Yes
   ☐ No

6. **Do you agree or disagree with the following statement?**
   Provided that there are protocols when and by whom to use the various resources, the standard toolbox for hemorrhage control (containing available advanced bleeding control resources, including bandages, junctional and limb tourniquets, pelvic binders/stabilizers, hemostatic agents, REBOA, wound clamps and intra-abdominal foam/gas) should be available at all levels of care (from point of injury to role 3 facilities).

   ☐ Agree
   ☐ Disagree

7. **Response round 1:**



Do you agree or disagree with the following statement?
Considering that adequate training conditions are met for a certain type of physician or non-physician and the casualty can be transported into an OR within 45 minutes with a dedicated medevac, REBOA should be available at the point of injury/warm zone.

☐ Agree
☐ Disagree

8. **Do you agree or disagree with the following statement?**
Considering that adequate training conditions are met for a certain type of physician or non-physician and the casualty can be transported into an OR within 45 minutes with a dedicated medevac, REBOA should be available at the casualty collection point near the battlefield.

☐ Agree
☐ Disagree

9. **Do you agree or disagree with the following statement?**
Considering that adequate training conditions are met for a certain type of physician or non-physician and the casualty can be transported into an OR within 45 minutes with a dedicated medevac, REBOA should be available for en route care**.**

☐ Agree
☐ Disagree

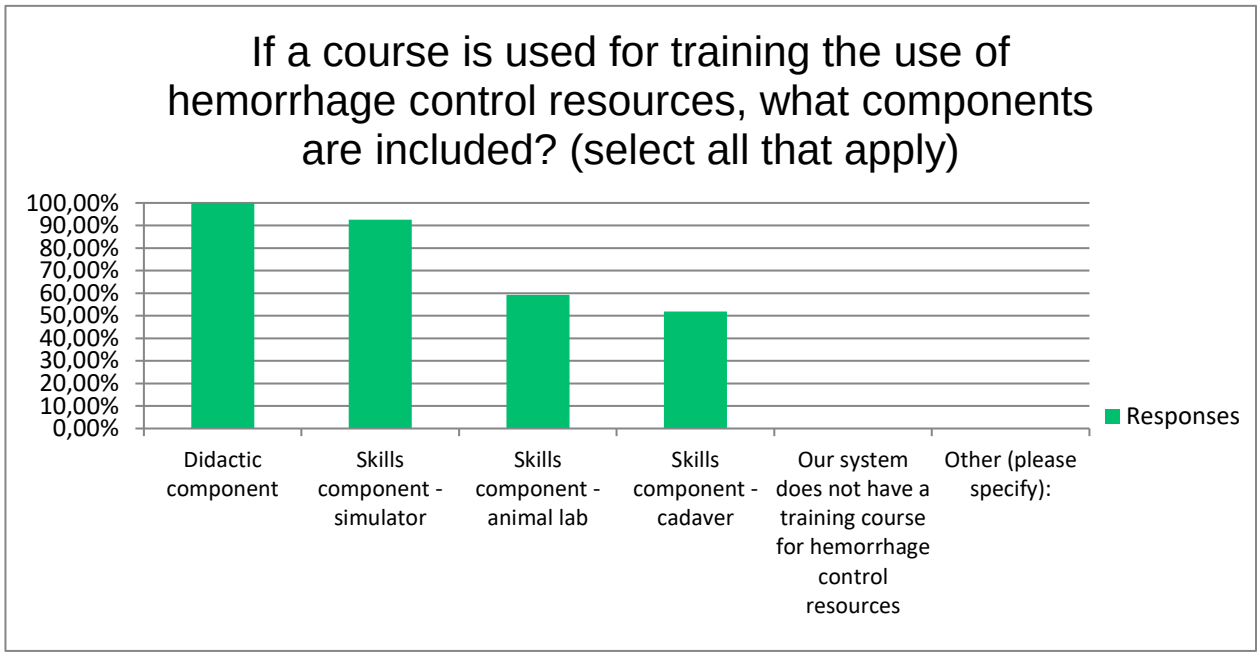
10. **In your opinion, when we divide the hemorrhage control resources in non-invasive (bandages, junctional and limb tourniquets, pelvic binders/stabilizers, hemostatic agents) and invasive (REBOA, intra-abdominal foam/gas) resources, which care providers should be allowed to apply them?**

☐ *All* care providers should be allowed to apply all resources, provided adequate training.
☐ Invasive resources should only be applied by trained trauma or vascular surgeons. Non-invasive resources may be applied by other medical personnel (e.g. general surgeons, anesthesiologists, other physicians, medics, nurses, PA).
☐ Invasive resources should only be applied by trained trauma, vascular or general surgeons or anesthesiologists. Non-invasive resources may be applied by other medical personnel (e.g. other physicians, medics, nurses, PA).
☐ Invasive resources should only be applied by trained physicians (*both* surgical and non-surgical, e.g. cardiologists, intensivists, interventional radiologists). Non-invasive resources may be applied by other medical personnel (e.g. medics, nurses, PA).
☐ Invasive resources should only be applied by trained physicians (*both* surgical and non-surgical, e.g. cardiologists, intensivists, interventional radiologists). Non-invasive resources may be applied by other personnel, including non-medical personnel (e.g. soldiers or other first responders, medics, nurses, PA).
☐ Invasive resources should only be applied by trained physicians (*both* surgical and non-surgical, e.g. cardiologists, intensivists, interventional radiologists) or medics. Non-invasive resources may be applied by other personnel, *including* non-medical personnel (e.g. soldiers or other first responders, nurses, PA).

11. **To train providers in the use of hemorrhage control resources, most nations use a training course specifically designed by their military service, combined with general battlefield and/or civilian trauma care courses. Most systems have an additional course specifically designed for REBOA.**
Do you agree or disagree with the following statement?
Endovascular skills for hemorrhage control should be a regular (standard) part of the training curriculum for military care providers.

☐ Agree
☐ Disagree

12. **Response round 1:**



Do you agree or disagree with the following statement?
For adequate preparation of our military care providers, a training curriculum for the various advanced bleeding control resources should include *all* of the following: a didactic component, simulator skills, animal lab skills and cadaver skills.

☐ Agree
☐ Disagree

13. **Repetition of training of advanced bleeding control skills varied considerably between the military systems and formal policies often do not exist.**
In your opinion, should there be an official guideline dictating the frequency of training such skills, to limit or prevent degradation of skills after initial training?

☐ Yes
☐ No

14. **In your opinion, what is the appropriate frequency of refresher training for advanced bleeding control skills (in general) for providing physicians?**

☐ Every 4 years
☐ Every 3 years
☐ Every 2 years
☐ Annually

- ☐ Every 6 months
- ☐ Quarterly
- ☐ Before any deployment
- ☐ Provider should be instructor for trauma management training courses

15. **Do you agree or disagree with the following statement?**
    Training of endovascular bleeding control skills, such as REBOA, should be refreshed more frequently than other hemorrhage control skills training.

    ☐ Agree
    ☐ Disagree

16. **In your opinion, what is the appropriate frequency of refresher training for endovascular bleeding control skills, such as REBOA?**

    ☐ Every 4 years
    ☐ Every 3 years
    ☐ Every 2 years
    ☐ Annually
    ☐ Every 6 months
    ☐ Quarterly
    ☐ Before any deployment

17. **In your opinion, what is the appropriate frequency of refresher training for advanced bleeding control skills for providing non-physicians (e.g. PA, nurses, medics, service members)?**

    ☐ Every 4 years
    ☐ Every 3 years
    ☐ Every 2 years
    ☐ Annually
    ☐ Every 6 months
    ☐ Quarterly
    ☐ Before any deployment

18. **Most nations have a registry in which patients are registered in whom advanced bleeding devices, including REBOA, are deployed, or are interested in such registry.**
    Which statement do you agree with?

    ☐ Every nation should have its own patient registry.
    ☐ There should be an international collaboration to capture these patients in an international registry.
    ☐ There is no need for such registry.

19. **Most nations have or are developing a formal process to collect data on hemorrhage control, for instance a registry to capture "lessons learned" or for process improvement.**
Which statement do you agree with?

☐ Every nation should have its own formal process to evaluate and improve combat casualty care.
☐ There should be an international collaboration to capture these data to evaluate and improve combat casualty care.
☐ There is no need for such process.

20. **Almost every nation has a formal clinical practice guideline dictating hemorrhage control care.**
Which statement do you agree with?

☐ Every nation should have its own guidelines.
☐ There should be an international collaboration to formulate best clinical practice guidelines and recommendations.
☐ There should be an international collaboration to formulate best clinical practice guidelines and recommendations and in addition, every nation should have its own guidelines.

REBOA

21. **Do you agree or disagree with the following statement?**
In a formal clinical practice guideline dictating hemorrhage control care, REBOA should be explicitly discussed.

☐ Agree
☐ Disagree

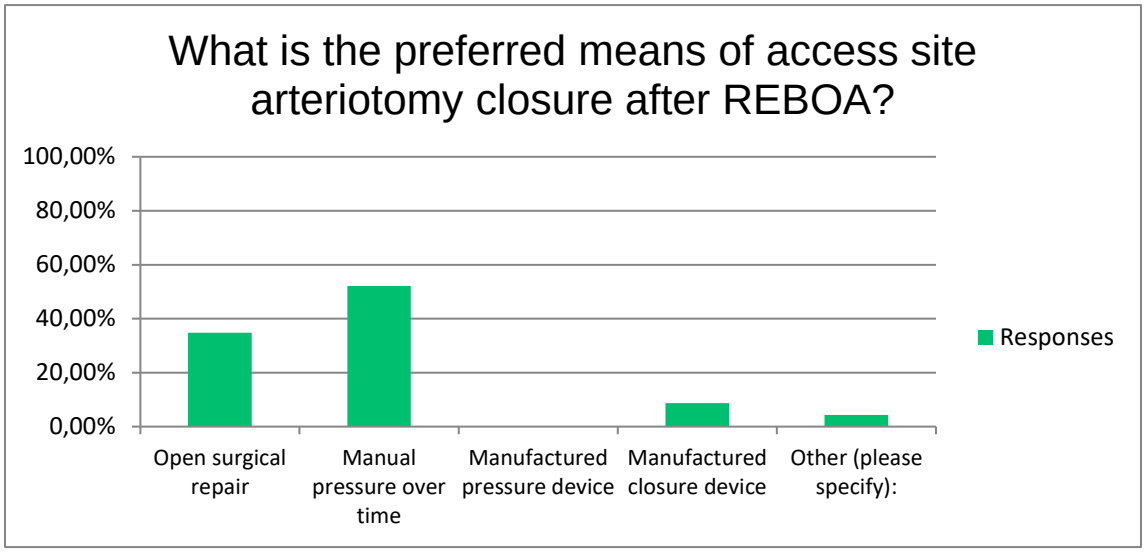
22. **In round 1, consensus has been reached on the preferred vascular access site for REBOA (common femoral artery) and the preferred means of arterial access (ultrasound guided).**
Do you agree or disagree with the following statement?
A guidewire-free device should be used for REBOA when it is used outside a surgical facility and if there is no fluoroscopic guidance available.

☐ Agree
☐ Disagree

23. **Do you agree or disagree with the following statement?**
Considering an indication for REBOA has been set, REBOA should be placed in zone 1 when it is used outside the OR and if there is no fluoroscopic guidance available.

☐ Agree
☐ Disagree

24. Response round 1



In round 1, no consensus has been reached on the preferred means of access site arteriotomy closure after REBOA. Please revise your judgment or specify the reasons for remaining outside the consensus.
The preferred means of access site arteriotomy closure after REBOA is:

☐ Open surgical repair
☐ Manual pressure over time
☐ Manufactured pressure device
☐ Manufactured closure device
☐ Depends on the situation
Specify reasons for remaining outside the consensus …….

25. Among hemodynamic unstable patients: The use of REBOA for junctional axillary injuries is indicated in military environments, assuming that surgical care will be available within an acceptable timeframe.

☐ Agree
☐ Disagree

26. **Among hemodynamic unstable patients: The use of REBOA for junctional groin injuries is indicated in military environments, assuming that surgical care will be available within an acceptable timeframe.**

☐ Agree
☐ Disagree

27. **Among hemodynamic unstable patients: The use of REBOA for pelvic injuries is indicated in military environments, assuming that surgical care will be available within an acceptable timeframe.**

☐ Agree
☐ Disagree

28. **Among hemodynamic unstable patients: The use of REBOA for traumatic cardiac arrest is indicated in military environments, assuming that surgical care will be available within an acceptable timeframe.**

☐ Agree
☐ Disagree

29. **Among hemodynamic unstable patients: The use of REBOA for penetrating injuries in the chest is contra-indicated in military environments, regardless of the timeframe in which surgical care will be available.**

☐ Agree
☐ Disagree

30. **Among hemodynamic unstable patients: The use of REBOA for blunt thoracic injuries is contra-indicated in military environments, regardless of the timeframe in which surgical care will be available.**

☐ Agree
☐ Disagree

31. **Among hemodynamic unstable patients: The use of REBOA for solitary major neck injuries is contra-indicated in military environments, regardless of the timeframe in which surgical care will be available.**

☐ Agree
☐ Disagree

32. **Among hemodynamic unstable patients: The use of REBOA for patients with one or more major thoracoabdominal bleeding sites *and* with a major neck injury is contra-indicated in military environments, regardless of the timeframe in which surgical care will be available.**

☐ Agree
☐ Disagree

33. **Among hemodynamic unstable patients: The use of REBOA for multiple major bleeding sites is NOT contra-indicated in military environments, assuming that surgical care will be available within an acceptable timeframe.**

☐ Agree
☐ Disagree

34. **Only a minority of nations has a formal process to collect data on REBOA use, other than the patient case history (e.g. data on the employment of the REBOA procedure (where it was used, by whom, complications, etc.), to capture "lessons learned" or for process improvement?)**
Which statement do you agree with?

☐ Every nation should have its own formal process to evaluate and improve REBOA combat care.
☐ There should be an international collaboration to capture these data to evaluate and improve REBOA combat care.
☐ There is no need for such process.

35. **Have you used REBOA in military setting?**

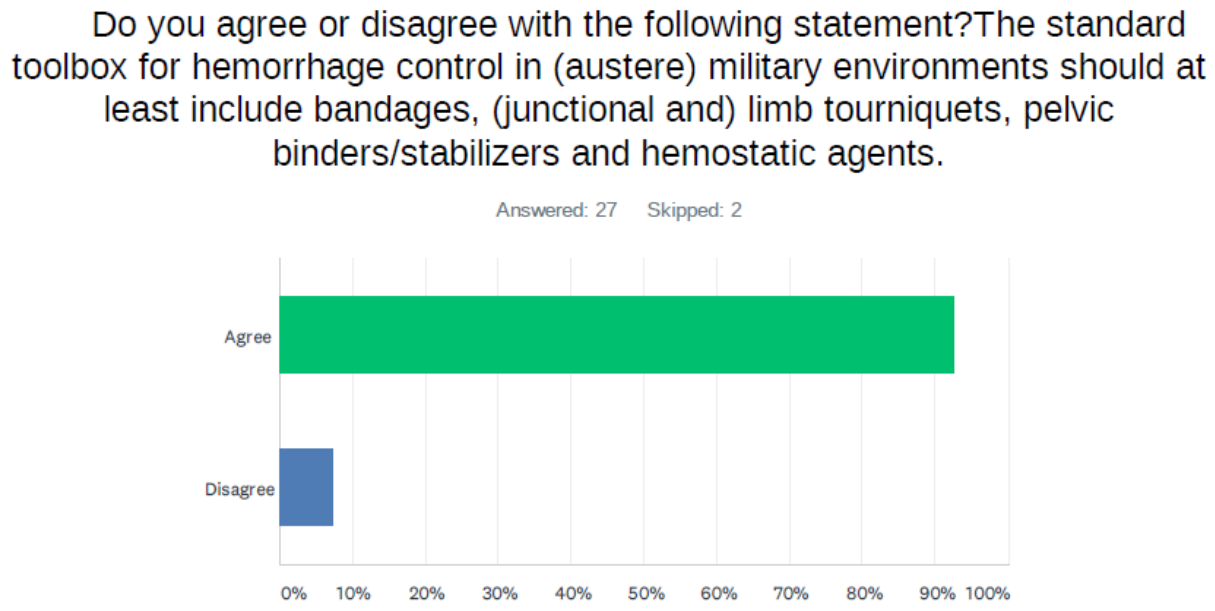
☐ Yes (please indicate how many times)
☐ No
If yes, please indicate how many times: ……..

36. **Have you used REBOA in civilian setting?**

☐ Yes (please indicate how many times)
☐ No
If yes, please indicate how many times: ……..

Advanced bleeding control in combat casualty care - Delphi Consensus Round 3

1. Response round 2:



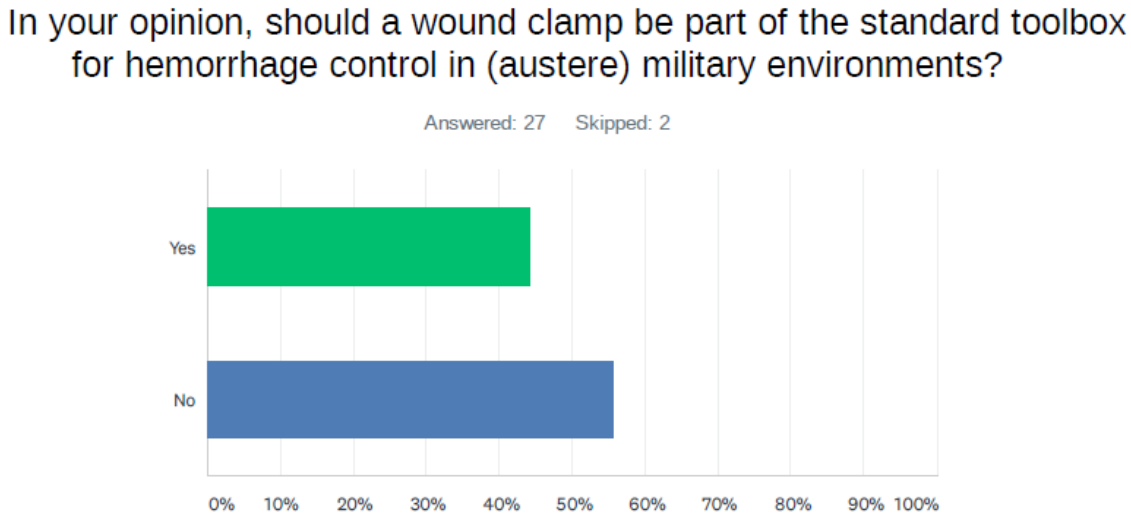
ANSWER CHOICES	RESPONSES
Agree	92.59%
Disagree	7.41%

1. We have reached consensus that a standard toolbox for hemorrhage control in (austere) military environments should at least include bandages, (junctional and) limb tourniquets, pelvic binders/stabilizers and hemostatic agents. We have also reached consensus that abdominal gas or foam should NOT be part of the standard toolbox.

Do you agree or disagree with the following statement?
For trained personnel, REBOA should be part of the standard toolbox for hemorrhage control in (austere) military environments.
Please elaborate the reasoning behind your answer.

☐ Agree
☐ Disagree
Specify the reason behind your answer: ...

2. Response round 2:



ANSWER CHOICES	RESPONSES
Yes	44.44%
No	55.56%

2. McKee et al. (2019) and Tan et al. (2015) described favorable results of the iTClamp for hemorrhage control. In round 2, only 44% of respondents agreed that a wound clamp should be part of the standard toolbox for hemorrhage control.

In your opinion: Is there any indication for the use of a wound clamp in (austere) military environments?
Please specify the reason.

☐ Yes
☐ No
Please specify the reason: …

3.

We have reached consensus that a standard toolbox for hemorrhage control in (austere) military environments should *at least* include:
- bandages
- (junctional and) limb tourniquets
- pelvic binders/stabilizers
- hemostatic agents

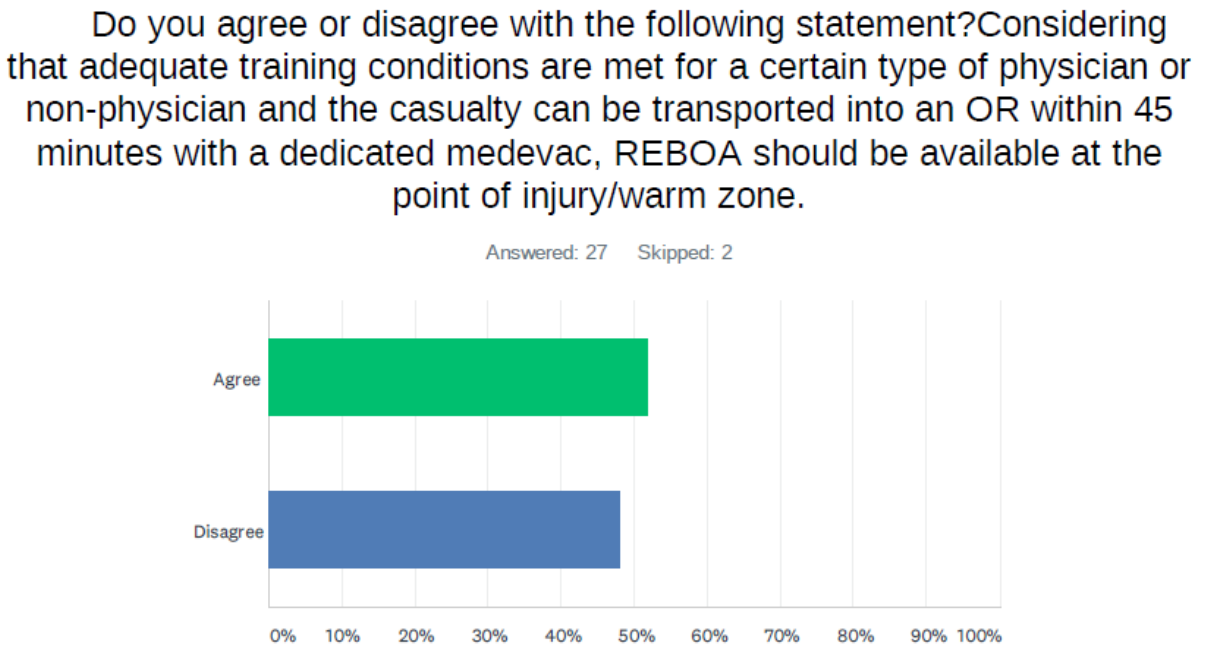
There is no consensus (yet) on whether it should include REBOA.

3. Do you agree or disagree with the following statement?

Provided that there are protocols when and by whom to use the various resources, the standard toolbox for hemorrhage control should be available at all levels of care (from point of injury to role 3 facilities).

☐ Agree
☐ Disagree

4. Response round 2:



ANSWER CHOICES	RESPONSES
Agree	51.85%
Disagree	48.15%

4. In round 2, we have reached consensus that REBOA should be available at the casualty collection point near the combat zone and during en route care, considering specific conditions.

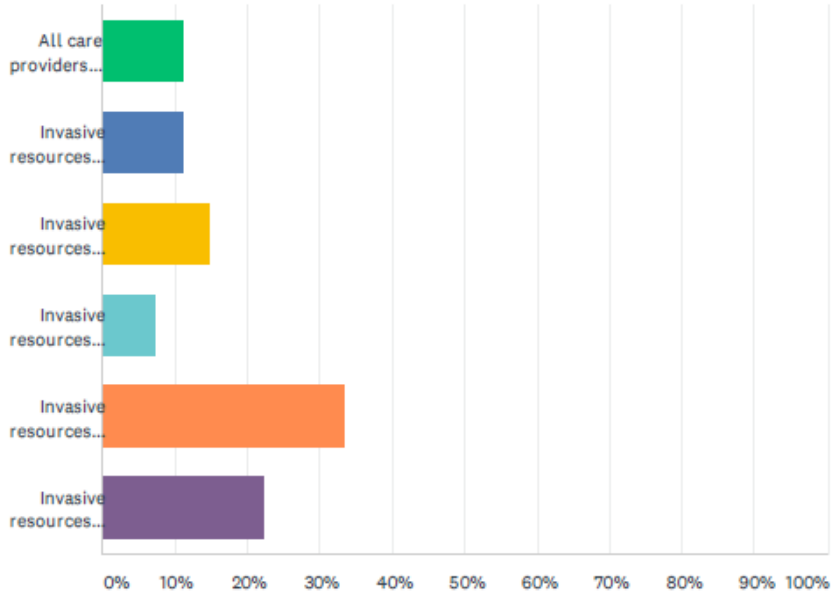
Do you agree or disagree with the following statement?
Considering that adequate training conditions are met and the casualty can be transported into an OR within 45 minutes with a dedicated medevac, REBOA should be available at *the point of injury/warm zone*.
Please revise your judgment or specify the reasons for remaining outside the consensus.

☐ Agree
☐ Disagree
Specify the reasons for remaining outside the consensus: …

5-8 Response round 2:

In your opinion, when we divide the hemorrhage control resources in non-invasive (bandages, junctional and limb tourniquets, pelvic binders/stabilizers, hemostatic agents) and invasive (REBOA, intra-abdominal foam/gas) resources, which care providers should be allowed to apply them?

Answered: 27 Skipped: 2



ANSWER CHOICES	RESPONSES
All care providers should be allowed to apply all resources, provided adequate training.	11.11%
Invasive resources should only be applied by trained trauma or vascular surgeons. Non-invasive resources may be applied by other medical personnel (e.g. general surgeons, anesthesiologists, other physicians, medics, nurses, PA).	11.11%
Invasive resources should only be applied by trained trauma, vascular or general surgeons or anesthesiologists. Non-invasive resources may be applied by other medical personnel (e.g. other physicians, medics, nurses, PA).	14.81%
Invasive resources should only be applied by trained physicians (both surgical and non-surgical, e.g. cardiologists, intensivists, interventional radiologists). Non-invasive resources may be applied by other medical personnel (e.g. medics, nurses, PA).	7.41%
Invasive resources should only be applied by trained physicians (both surgical and non-surgical, e.g. cardiologists, intensivists, interventional radiologists). Non-invasive resources may be applied by other personnel, including non-medical personnel (e.g. soldiers or other first responders, medics, nurses, PA).	33.33%
Invasive resources should only be applied by trained physicians (both surgical and non-surgical, e.g. cardiologists, intensivists, interventional radiologists) or medics. Non-invasive resources may be applied by other personnel, including non-medical personnel (e.g. soldiers or other first responders, nurses, PA).	22.22%

5. In Round 2, 63% agreed that *invasive* hemorrhage control resources (i.e. REBOA, abdominal foam/gas) should be applied by trained physicians, and 33% agreed that invasive resources *could* be applied by medics.
Do you agree that only trained physicians should apply *invasive* hemorrhage control resources?

☐ Yes
☐ No

6. Do you agree or disagree with the following statement?
Provided adequate training, medics should be allowed to apply *invasive* hemorrhage control resources (i.e. REBOA, abdominal foam/gas).

☐ Agree
☐ Disagree

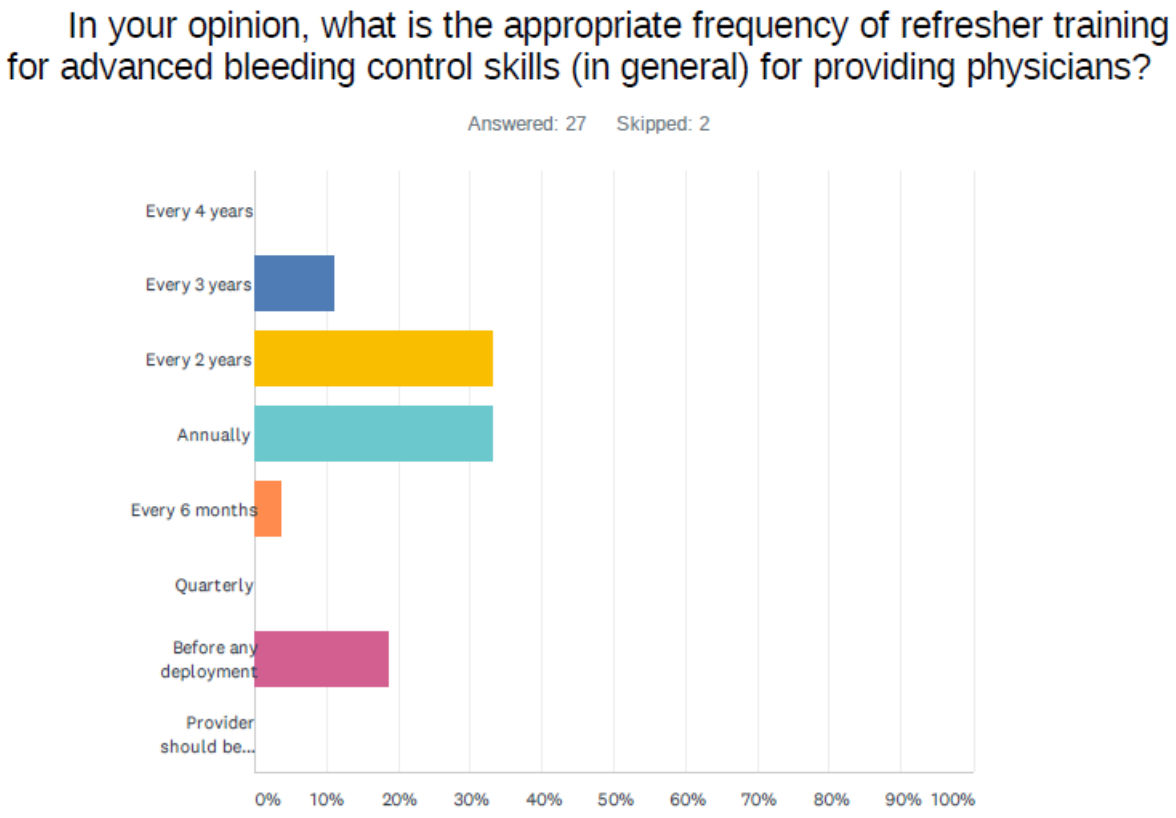
7. Do you agree or disagree with the following statement?
All medical personnel should be allowed to apply *non-invasive* hemorrhage control resources (i.e. bandages, junctional and limb tourniquets, pelvic binders/stabilizers, hemostatic agents).

☐ Agree
☐ Disagree

8. Do you agree or disagree with the following statement?
Both medical and non-medical personnel (e.g. soldiers or other first responders) should be allowed to apply *non-invasive* hemorrhage control resources (i.e. bandages, junctional and limb tourniquets, pelvic binders/stabilizers, hemostatic agents).

☐ Agree
☐ Disagree

9. Response round 2:



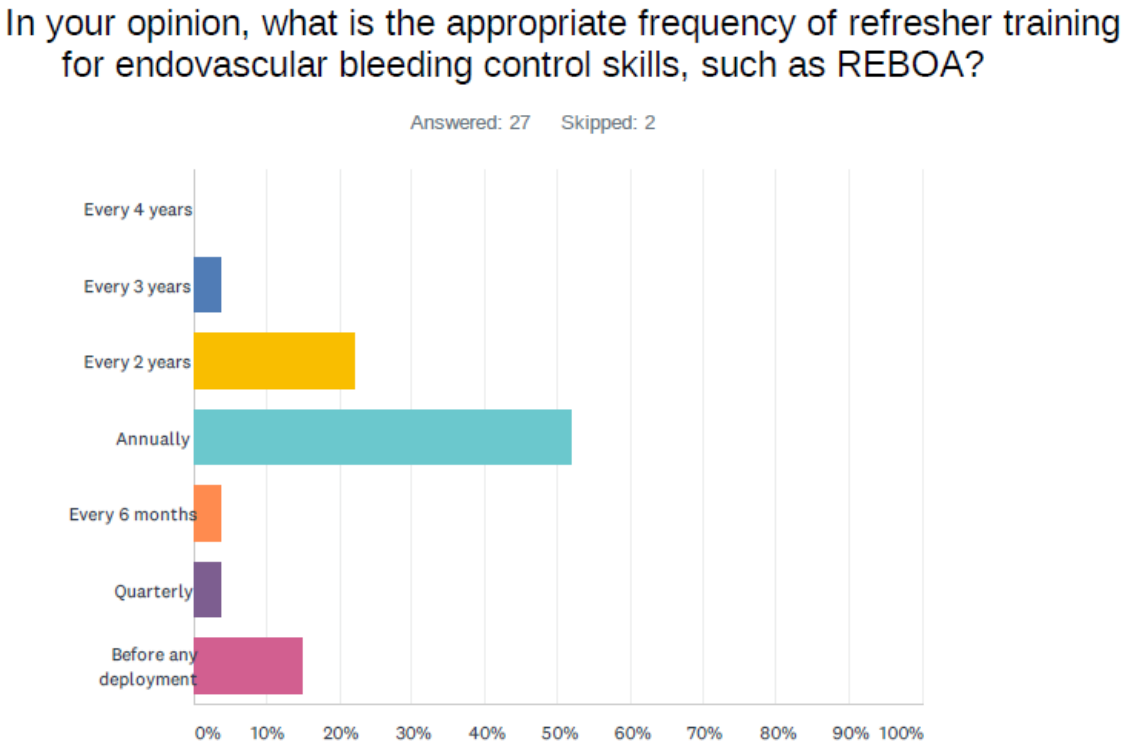
ANSWER CHOICES	RESPONSES
Every 4 years	0.00%
Every 3 years	11.11%
Every 2 years	33.33%
Annually	33.33%
Every 6 months	3.70%
Quarterly	0.00%
Before any deployment	18.52%
Provider should be instructor for trauma management training courses	0.00%

9. No consensus has been reached on the appropriate frequency of refresher training for advanced bleeding control skills (in general) for providing physicians.

Do you agree or disagree with the following statement?
Providing physicians should follow refresher training for advanced bleeding control skills (in general) at least every 2 years and before deployment.

☐ Agree
☐ Disagree

10 Response round 2:



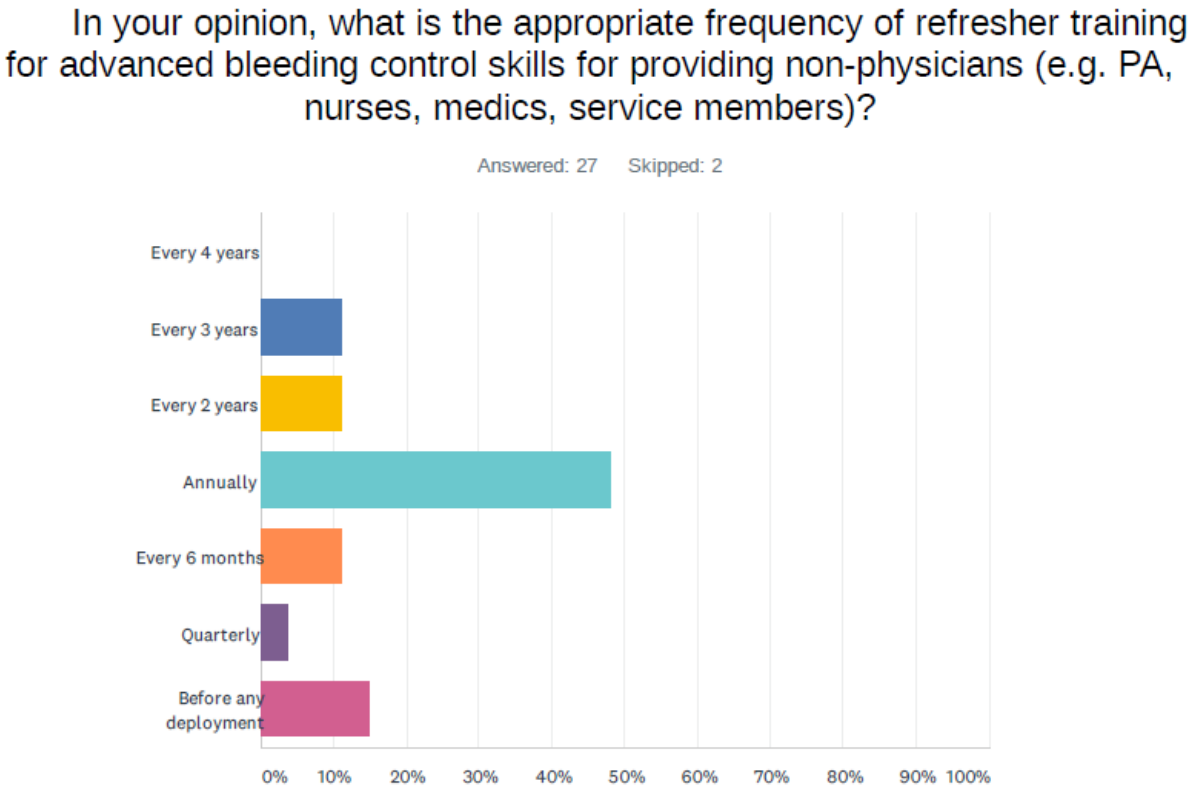
ANSWER CHOICES	RESPONSES
Every 4 years	0.00%
Every 3 years	3.70%
Every 2 years	22.22%
Annually	51.85%
Every 6 months	3.70%
Quarterly	3.70%
Before any deployment	14.81%

10. We have reached consensus that training of endovascular bleeding control skills, such as REBOA, should be refreshed more frequently than other hemorrhage control skills training (as discussed in the previous question).

Do you agree or disagree with the following statement?
Providing physicians should follow refresher training for endovascular bleeding control skills, such as REBOA at least annually and before any deployment.

☐ Agree
☐ Disagree

11. Response round 2:



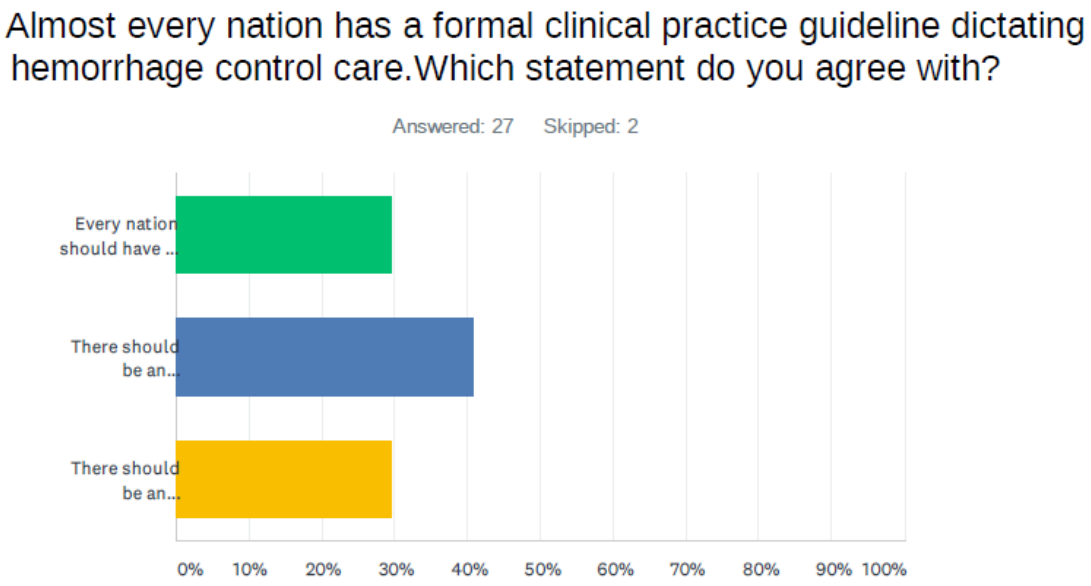
ANSWER CHOICES	RESPONSES
Every 4 years	0.00%
Every 3 years	11.11%
Every 2 years	11.11%
Annually	48.15%
Every 6 months	11.11%
Quarterly	3.70%
Before any deployment	14.81%

11. Do you agree or disagree with the following statement?

Providing *non-physicians* (e.g. PA, nurses, medics, service members) should follow refresher training for advanced bleeding control skills at least annually and before any deployment.

☐ Agree
☐ Disagree

12. Response round 2:



ANSWER CHOICES	RESPONSES
Every nation should have its own guidelines.	29.63%
There should be an international collaboration to formulate best clinical practice guidelines and recommendations.	40.74%
There should be an international collaboration to formulate best clinical practice guidelines and recommendations and in addition, every nation should have its own guidelines.	29.63%

12. 70.4% of the expert panel thinks there should be an international collaboration to formulate best clinical practice guidelines and recommendations for hemorrhage control care.

Do you agree or disagree with the following statement?

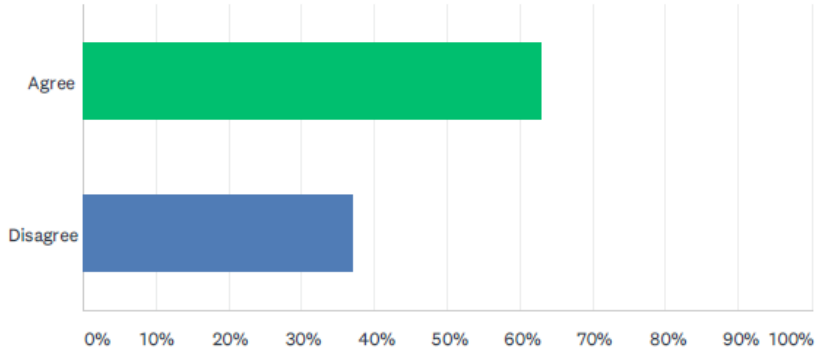
In addition to an international clinical practice guideline dictating hemorrhage control care, each nation should be able to make its own nation-specific adjustments.

☐ Agree
☐ Disagree

13. Response round 2:

Do you agree or disagree with the following statement?Considering an indication for REBOA has been set, REBOA should be placed in zone 1 when it is used outside the OR and if there is no fluoroscopic guidance available.

Answered: 27 Skipped: 2



ANSWER CHOICES	RESPONSES
Agree	62.96%
Disagree	37.04%

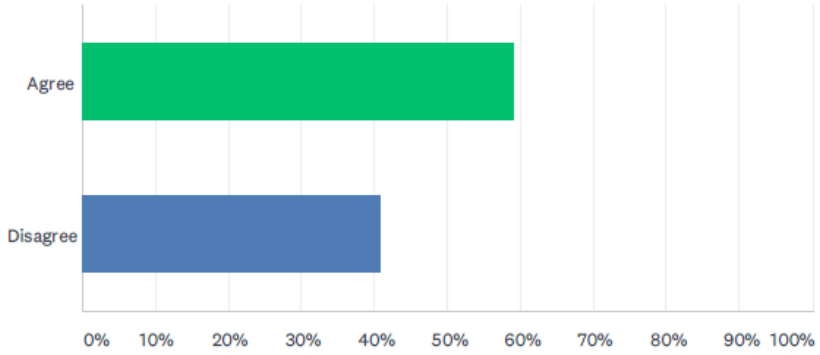
13. Eliason et al. (2019) described a significant variance in aorta zone 3 depths, making the use of anatomical landmarks (level of umbilicus) of increased risk of malpositioning. Linnebur et al. (2016) described a 100% correlation between mid-sternum and zone 1.
When used in a fluoroscopy-free environment, do you agree to REBOA zone 1 placement?

☐ Yes
☐ No

14. Response round 2-1:

Among hemodynamic unstable patients: The use of REBOA for penetrating injuries in the chest is contra-indicated in military environments, regardless of the timeframe in which surgical care will be available.

Answered: 27 Skipped: 2

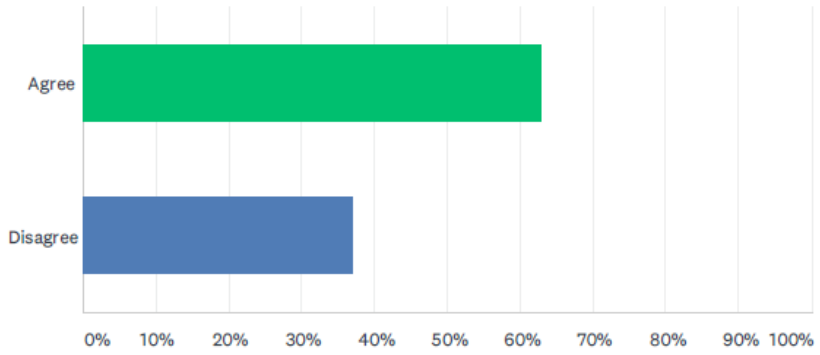


ANSWER CHOICES	RESPONSES
Agree	59.26%
Disagree	40.74%

14. Response round 2-2:

Among hemodynamic unstable patients: The use of REBOA for blunt thoracic injuries is contra-indicated in military environments, regardless of the timeframe in which surgical care will be available.

Answered: 27 Skipped: 2



ANSWER CHOICES	RESPONSES
Agree	62.96%
Disagree	37.04%

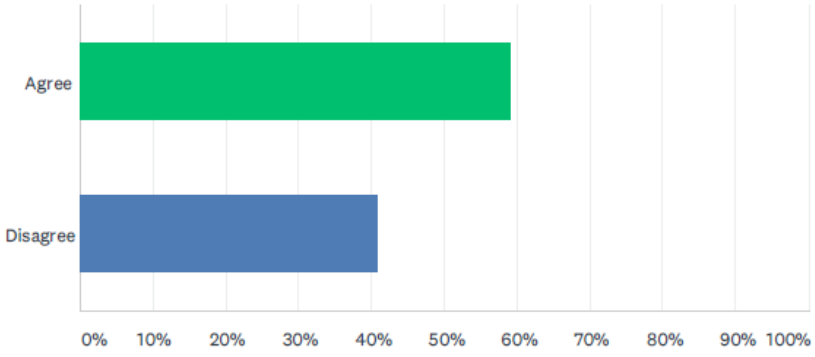
14. Do you agree or disagree with the following statement?
Although certain contra-indications for REBOA in blunt and penetrating chest injuries exist, there are specific indications for REBOA in hemodynamically unstable patients with chest injuries in military environments.
Please specify the indications.

☐ Agree
☐ Disagree
Please specify the indications: …

15. Response round 2:

Among hemodynamic unstable patients: The use of REBOA for patients with one or more major thoracoabdominal bleeding sites and with a major neck injury is contra-indicated in military environments, regardless of the timeframe in which surgical care will be available.

Answered: 27 Skipped: 2



ANSWER CHOICES	RESPONSES
Agree	59.26%
Disagree	40.74%

15. We have reached consensus that REBOA is contra-indicated in military environments for solitary major neck injuries.

Do you agree or disagree with the following statement?
Among hemodynamic unstable patients: The use of REBOA as an adjunct for patients with one or more major bleeding source below the diaphragm AND with a major neck injury is contra-indicated in military environments, regardless of the timeframe in which surgical care will be available.
Please revise your judgment or specify the reasons for remaining outside the consensus.

☐ Agree

☐ Disagree

Specify the reasons for remaining outside the consensus: …