PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Rationale and design of the Lowlands Saves Lives trial: A randomised trial to compare CPR quality and long-term attitude towards CPR performance between face-to-face and virtual reality training with the Lifesaver VR-app
AUTHORS	Nas, Joris; Thannhauser, Jos; Vart, Priya; van Geuns, Robert-Jan; van Royen, Niels; Bonnes, Judith; Brouwer, Marc

VERSION 1 – REVIEW

REVIEWER	Prof. Dr. Bernd W. Böttiger Head of the Department of Anaesthesiology and Intensive Care Medicine University Hospital of Cologne Kerpener Straße 62 D-50937 Köln Germany Bernd W. Böttiger is European Resuscitation Council (ERC) Board Director Science and Research; Chairman of the German Resuscitation Council (GRC); Member of the „Advanced Life Support (ALS) Task Force of the International Liaison Committee on Resuscitation (ILCOR); Member of the executive committee of the German Interdisciplinary Association for Intensive and Emergency Medicine (DIVI); Associated Editor of the European Journal of Anaesthesiology (EJA), Co-Editor of “Resuscitation”; Editor of the Journal “Notfall + Rettungsmedizin”. He received professional fees for lectures from the following companies: Medupdate GmbH, “Forum für medizinische Fortbildung (FomF)”, Baxalta Deutschland GmbH, Bayer Vital GmbH, ZOLL Medical Deutschland GmbH, C. R. Bard GmbH, GS Elektromedizinische Geräte G. Stemple GmbH.
REVIEW RETURNED	04-Sep-2019

GENERAL COMMENTS	Summary: Nas et al. present a thoughtfully, well planned study protocol of the bystander- cardiopulmonary resuscitation (CPR) learning performance of festival-visitors using an innovative virtual reality (VR) app. By addressing a unique study-cohort containing young people in particular, the manuscript pursues innovative aspects to sensitize the population for CPR. The manuscript is well-written and structured. Moreover, the impact of alcohol intake on CPR-performance will be examined for the first time, which is innovative. The reviewer is confident that the study – when finished – contributes to scientific knowledge gain and recommends the present study protocol to be published. Introduction:

	• Well-Structured reflecting the current scientific knowledge. A systematic chain of causation becomes apparent for the reader. (strength) Methods and Analysis • The study follows the SPIRIT guidelines thus representing an established tool for interventional guidelines. (strength) • Since a music festival is a unique event addressing a younger population in particular a detailed characterization of the study group could be profitable. Gender, age, CPR-training etc. are aspects frequently addressed in studies evaluating bystander CPR-training. • Hypothesis: o A non-inferior study design requires a large study population to give evidence. This is a favorable design but could be difficult to be realized (aspired study population: 480 participants). Otherwise, the hypothesis has to be reconsidered. (potential weakness) • Overview of the study design: o An interesting aspect to be pursued is the influence of alcohol consumption on the CPR performance. To our knowledge, this approach is not examined to date. To exclude participants after failing the tandem gail test seems to be a logical approach. (strength) o Line 9: To assess the participants immediately after initial training is a logical approach: However, to representatively evaluate bystander CPR-performance, a baseline value is obligate. Thus, evaluation of bystander CPR-performance prior to a teaching approach is useful. (potential weakness) o Although difficult to be realized, a practical follow-up examination instead of a theoretical examination only would increase statements related to the sustainability of VR. (potential weakness) Interventions: o Face-to-face training: Using an official instructor of the Dutch Resuscitation Council and national BLS criteria is a quality characteristic increasing the scientific value of the study. (strength) o Lifesaver VR-training: the concept seems to be mature and applicable. (strength) Outcome measures and other parameters: o The primary outcome parameters are established and standard in bystander CPR-studies. A conclusive statement can be drawn if evaluation is technically precise. (strength) Other study parameters: o The reviewer highly recommends to limit the follow-up period to 6 month. To assess the population after one year, as proposed by the authors, could lead to high drop-out rates. A follow-up period of 6 months is scientifically common and thus can be easily compared to other studies in the field. (potential weakness) Pre-specified additional analyses: o To draw precise conclusions, the reviewer recommends to completely exclude participants that underwent a CPR training in the past. Otherwise, results of this study could be diluted. (potential weakness) Exploratory analyses: o Well-considered sub-groups (strength) Follow-up assessment: o The reviewer highly recommends to limit the follow-up period to 6 months to compare the study to other studies in the field and avoid high drop-out-rates. (potential weakness) Statistical considerations:

	o A non-inferior study design requires a large study population to give evidence. This is a favorable design but could be difficult to be realized (aspired study population: 480 participants). Otherwise, the hypothesis has to be reconsidered. However, the sample size calculation seems to be conclusive. From the experiences of the reviewer, drop-out rates after follow-up period could be very high, which would impede calculations based on the sample-size calculation (potential weakness) Ethics and dissemination: o The ethical requirements are already fulfilled. The study seems to follow the “Good clinical “practice”. (strength) Discussion o The study examines a predefined study population. In fact, young people visiting music festivals are an interesting target group that represents a part of the population being in charge to assume responsibility in the terms of conducting CPR. However, examining this particular study group, a potential bias could arise. Thus, the reviewer recommends to discuss this issue when drawing conclusions from the results and in this manuscript respectively. o Page 15, line 35: “mouth to mouth ventilation”. Layperson CPR: o Addressing barriers and attitudes of bystanders is a present scientific topic. (strength) o Page 15, line 46: reference? Where do you know, that the vast majority of citizens did not participate in a CPR training? o Page 15, line 50: “…last about five hours…”: on the basis of which curriculum? Only in the Netherlands? ERC? Please state. Implications: o Embedded in a festival setting, the study also increases the awareness on CPR in the population. Thus, beside the scientific knowledge gain a social effect is associated with the study. (strength) Conclusions of the reviewer: The current study may contribute to scientific knowledge gain and may increase the awareness on CPR in the young population. To the reviewer, the study seems to be well planned and follows recommendations of “Good clinical practice”. Considering the recommendations related to the follow-up period and the potential statistical problems resulting from higher drop put rates than expected, the current study may gain profitable results in the field of bystander CPR training. Interestingly, the study pursues an educational approach by teaching CPR to unknowing persons and also sensitizes young people for CPR. Thus, both a social and a scientific aspect are fulfilled, which is the foundation for the recommendation of the reviewer to publish this study protocol.

REVIEWER	Helge Myklebust Laerdal Medical, Norway I am the research director at Laerdal Medical with a great interest in community CPR training research and innovations. I do not have any conflicts regarding the application of VR in community CPR training
REVIEW RETURNED	11-Sep-2019

GENERAL COMMENTS	The authors want to study the difference between two CPR learning methods, traditional and VR. Use VR in CPR training may be of high importance.

	I have concerns regarding the study method and the selection of study participants and the selection of CPR performance variables for the test. I have added my comments in the pdf file - The reviewer provided a marked copy with additional comments. Please contact the publisher for full details.

VERSION 1 – AUTHOR RESPONSE

Note to reviewers and editor: the numbers of the pages and lines refer to those of the revised manuscript without tracked changes, which is the file labelled as "Main document"

REVIEWER 1

We would like to thank prof. Böttiger for his thorough review and valuable comments on our manuscript. We will systematically reply to all comments that have been marked as potential weaknesses of our study, and thank the reviewer for also appointing several strengths of this trial.

Comment: Since a music festival is a unique event addressing a younger population in particular a detailed characterization of the study group could be profitable. Gender, age, CPR-training etc. are aspects frequently addressed in studies evaluating bystander CPR-training.

Answer: The reviewer raises an interesting point. Indeed conducting a study on a music festival provides a unique sample of participants. We agree that it is of interest to describe in detail the characteristics of our study population, particularly to put our findings into the context of other CPR education trials. This is why we have designed a questionnaire with relevant baseline characteristics that will be provided to all participants together with the informed consent form. This questionnaire is available as Supplement 2.

In our manuscript with study results we will report on these baselines, and have added a remark in our manuscript addressing this issue (page 11, line 3).

Comment: A non-inferior study design requires a large study population to give evidence. This is a favorable design but could be difficult to be realised (aspired study population: 480 participants). Otherwise, the hypothesis has to be reconsidered. (potential weakness)

Answer: Indeed a non-inferiority design generally requires a larger sample size when compared to a superiority trial. Given the potential benefits of VR-training (low costs, ability to be performed at home at any given time without much additional equipment etc.), we feel that if VR-training results in noninferior performance regarding chest compression quality and CPR-skills, it could be a valuable training method. This particularly applies to settings where resources are scarce, which is an area of study of specific interest as pointed out in current CPR-guidelines. Therefore, we feel that noninferiority is the most appropriate design for our study, as is acknowledged by the reviewer.

We calculated a desired sample size of 190 participants to provide statistically sound answers to our research questions (page 13, line 17). The sample size was calculated for the primary outcome measure chest compression depth, as a continuous measure, with noninferiority margins based on a recently published review.(1)

This sample size might seem challenging to recruit during a three-day festival, yet it is well below our maximum capacity of 480 participants. During the previous years of Lowlands Science, there was an overwhelming interest for the studies performed. Moreover, our study in particular received much

attention on several media-platforms in the week before the festival. Therefore, we feel confident that our calculated sample size of 190 could be feasible.

Comment: To assess the participants immediately after initial training is a logical approach: However, to representatively evaluate bystander CPR-performance, a baseline value is obligate. Thus, evaluation of bystander CPR-performance prior to a teaching approach is useful. (potential weakness).

Answer: We agree with the reviewer on the potential value of a baseline measurement, if one wants to assess how much each training method contributes to *acquired,* (i.e. increase in) CPR-performance. Our main objective is to assess CPR-performance after each training method. Moreover, given the randomised design, a difference in pre-test CPR performance is unlikely to affect our outcomes. In addition, we specified in our protocol that the proportion of participants with previous (recent) CPR-experience will be capped at 20%, to ensure enough participants without experience (page 8, line 15). After consultation with our statistician, we ensured that with our current design we will have sufficient power to address our study questions also on the group without previous experience.

Moreover, a pre-training CPR-test can also be considered an education moment, i.e. performing CPR for the first time with for example dispatcher-like instructions is likely to result in acquired knowledge that would not have been available if the test had not been done. This could also obscure the effect of the training itself. Furthermore, our methodology is in line with many previous large trials on assessment of CPR skills after training.(1)

Nevertheless, we agree with the reviewer on this potential limitation and have addressed this issue in the revised version of the manuscript (page 18, line 17).

Of note, of participants with previous CPR-experience, we will also collect the date and level of the most recent CPR-course. This allows for detailed comparisons between both study groups.

Comment: Although difficult to be realised, a practical follow-up examination instead of a theoretical examination only would increase statements related to the sustainability of VR. (potential weakness)

Answer: This is indeed a limitation of the current study protocol. In current CPR-guidelines, CPR-skill retention is a major topic and assessments of this outcome would indeed be of additional value.

The specific study setting of a music festival will likely result in a sample of participants coming from different cities in the Netherlands, and very likely from abroad as well. Therefore, performing a practical follow-up examination would provide such logistical challenges that we deemed it not feasible.

Commitment to a long-term practical follow-up could also be a barrier for participation, and as we did not know beforehand how many participants would apply, we chose to lower the bar for participation as much as possible.

In studies that will be performed in more regular settings, such as a school or workplace, follow-up measurements might be more easy to perform. We put more emphasis on this limitation in the revised version of our manuscript (page 18, line 18).

Comment: The reviewer highly recommends to limit the follow-up period to 6 month. To assess the population after one year, as proposed by the authors, could lead to high drop-out rates. A follow-up period of 6 months is scientifically common and thus can be easily compared to other studies in the field. (potential weakness).

Answer: We thank the reviewer for this valuable comment. We have adjusted our follow-up period to 6 months in the revised version of the manuscript (page 11, line 4; page 12, line 8).

Comment: To draw precise conclusions, the reviewer recommends to completely exclude participants that underwent a CPR training in the past. Otherwise, results of this study could be diluted. (potential weakness)

Answer: We fully agree with the possibility of dilution, acknowledged this during the design of our study protocol, and prospectively designed the study to tackle this potential weakness. In our protocol we have specified that we will include a maximum of 20% participants with previous (recent) CPR training. Our sample size calculations have been performed together with our statistician, to be able to provide adequate power to perform noninferiority analyses on the subgroup without training (page 13, line 14) for the primary outcome measures. This subgroup of particular interest has therefore been prespecified and described as such in the manuscript (page 11, line 18).

The reason for including a portion of participants with previous experience is twofold.

First, analyses on this subgroup can provide an indication of the effect of these training modalities in people with previous experience: this could provide a first clue with regard to their potential for re-training purposes. Retraining of trained volunteers is a major topic in current guidelines, and the optimal training modality has yet to be identified. Although our primary analyses are not powered for this subgroup, it may provide some indication as to whether it could be helpful to perform additional study aimed specifically at this research question.

The second is for pragmatic reasons, as we did not know beforehand how many participants would volunteer to participate in our trial. Furthermore, our methodology is in line with previous large trials on this subject, as a recent review on this topic revealed that 22 out of the 34 included studies did not exclude participants with previous CPR training.

We added this comment as a limitation in our revised manuscript (page 18, line 19).

Comment: A non-inferior study design requires a large study population to give evidence. This is a favorable design but could be difficult to be realised (aspired study population: 480 participants). Otherwise, the hypothesis has to be reconsidered. However, the sample size calculation seems to be conclusive. From the experiences of the reviewer, drop-out rates after follow-up period could be very high, which would impede calculations based on the sample-size calculation (potential weakness)

Answer: this issue has been addressed in one of our replies above. In our sample size calculation, we accounted for a 10% drop-out for the primary outcome measures (page 13, line 17). Thus, our analyses are still adequately powered if 10% or less of the participants would not take the post-training CPR test.

In addition, we would like to mention that our power calculations have been performed for the primary outcome measure CPR-quality, and not for the follow-up measurements. The follow-up questionnaire can be considered exploratory, as it is also not obligatory to provide informed consent for the follow-up when consenting to participate in the main study. Thus, although drop-out after the follow-up might indeed occur, this does not affect the analyses and power of our primary analyses.

Comment: The study examines a predefined study population. In fact, young people visiting music festivals are an interesting target group that represents a part of the population being in charge to assume responsibility in the terms of conducting CPR. However, examining this particular study group, a potential bias could arise. Thus, the reviewer recommends to discuss this issue when drawing conclusions from the results and in this manuscript respectively.

Answer: We agree with the reviewer that our study sample is unique, which may limit generalizability of our results to for example elderly civilians. We have added this in our limitations section (page 18, line 23), and will address this issue in the manuscript on the study results as well. This also stresses the importance of the earlier mentioned point, i.e. the importance of providing a detailed description of our study population.

Comment: Page 15, line 35: "mouth to mouth ventilation".

Answer: This has been adapted (this line is now on page 15, line 16).

Comment: Page 15, line 46: reference? Where do you know, that the vast majority of citizens did not participate in a CPR training?

Answer: The sentence has been rephrased and a reference has been added (number 35).

Comment": Page 15, line 50: "…last about five hours…": on the basis of which curriculum? Only in the Netherlands? ERC? Please state.

Answer: The Dutch Resuscitation Council endorsed courses indeed last approximately 4-5 hours (source: website of Dutch Resuscitation Council). This has been added in the manuscript (page 15, line 23).

REVIEWER 2

We would like to thank dr. Myklebust for his review of our manuscript. Below we have copied the comments from the attached pdf, and will answer these queries point-by-point.

1. *Abstract must be more clear on the similarities and differences in training method, including the differences and similarities of manikins used by instructor, VR and test, respectively.*

   Thank you for this comment. We have added the description of the used CPR manikins in the abstract, and stated the main difference between both training protocols, i.e. that in the Lifesaver VR group a pillow in stead of a manikin is used to practice chest compressions.

   With regard to the latter, it should be noted that Lifesaver VR is designed to practice chest compressions on a pillow, which is why we used a pillow in stead of a manikin for this training. This also ensures that the results we achieve in this group might be extrapolated to setting as it is at home, without additional equipment and without an instructor.

2. *Leaning should then be included.*

   We agree with the reviewer that leaning is an important outcome measure in studies on CPR education, as the reviewer also cites from current guidelines. For this trial, we chose compression depth and rate, as these are the most commonly used primary chest compression quality indicators. This is confirmed in two large, recently published reviews on this topic.(1) and “Chest compression components (rate, depth, chest wall recoil and leaning): a scoping review”, J Considine et al., Resuscitation 2019, Manuscript in press, Journal pre-proof available at https://doi.org/10.1016/j.resuscitation.2019.08.042

   Nevertheless, the CPR manikin that we use for the exams (Resusci Anne QCPR, Laerdal Medical, Stavanger, Norway) also registers the proportion chest compressions with full release. As stated previously, and correctly pointed out by the reviewer, leaning is an important parameter in studies on CPR-quality.

   As data on the impact of leaning on clinical outcomes is limited, and information is primarily restricted to animal studies and hemodynamic studies, we decided not to incorporate it in our primary outcome measure. However, though not specifically mentioned, it is part of the CPR quality criteria we intend to study as secondary outcome parameters (section Outcome measures and other parameters, page 10, line 11). We have therefore revised our manuscript to specifically mention leaning as one of the secondary outcome measures, which we defined as proportion of chest compressions with complete release (page 10, line 23).

3. *It is unclear to me how much alcohol, or possibility other substances, or lack of sleep etc will influence the study purpose.*

   We agree with the reviewer’s remark that our specific study setting, i.e. a music festival, might lead to a sample of participants with specific baseline characteristics. To provide a clear description of these characteristics, we will incorporate a baseline table in the manuscript with data per group. To acquire these data, we have designed a questionnaire with questions regarding age, gender, previous CPR course, but also substance use in the past 24 hours. This questionnaire is attached as Supplement 2 in our manuscript.

With regard to whether alcohol/other substances/sleep may influence the study purpose, the randomised design is one of the key factors to minimize this possibility. We also implemented an additional aspect in the design of our study: stratification by alcohol level.

We will assess alcohol levels in every participant, and stratify our randomisation accordingly. Using this unique methodology we ensure that alcohol levels are equally distributed among both training groups, which precludes confounding due to alcohol level.

In our statistical analysis plan, we have not only specified binary analyses by alcohol level, but also analyses with alcohol ‰ as a continuous variable.

Furthermore, due to the randomised design it is expected that other factors, such as lack of sleep, are equally distributed between the two intervention groups and therefore the chance of significant confounding is small.

We agree with the reviewer that our study sample is unique, which may limit generalizability of our results to for example elderly civilians. We have added this in our revised manuscript (page 18, line 23). This also stresses the earlier mentioned point, i.e. the importance of describing into detail our study population.

4. *You choose an inferior study question. But if all participants are really not interested in CPR (they are there for a party), using alcohol, maybe other substances.. then the participants become less relevant for the study question - to understand differences between two training methods,. If you really wanted to study the differences in effect of two different CPR trainings, you need normal participants who have signed up for CPR training*

We thank the reviewer for this comment. We chose a noninferiority design as we feel that VR training has certain advantages over face-to-face training that warrant use of VR smartphone training, provided that the corresponding CPR-quality is at least noninferior compared to face-to-face training.

In real-life, cardiac arrests may occur in bars or during festivals, where alcohol intake is allowed and common. Therefore, information on CPR-performance in this particular study group is of interest and may constitute data relevant for real-world cardiac arrest.

Additionally, this study is performed on the Lowlands Science, which is a section of the Lowlands festival dedicated exclusively to scientific research. This area is separated from the rest of the festival, and thus participants that attend this area have specific interest in participating in a scientific study.

Furthermore, the randomised design minimizes chances of significant confounding due to for example substance use (which will be registered in all participants) or alcohol use, which will be measured in all participants and for which we will stratify our randomisation.

We more extensively mentioned the possible limitations with regard to generalizability in our revised manuscript, as described under answer 3.

5. *I am confused by the study objective vs participants use of alcohol.*

One of the key ancillary analyses of the present study is to assess the association between alcohol level and CPR-quality. This is the reason that we measure alcohol levels in every participant and stratify our randomisation accordingly. Although the main aim of the study is to compare two training methods in terms of quality of CPR, the impact of alcohol on these

parameters is important as well. Currently, there are no studies on this topic, whereas in daily practice a cardiac arrest may very well occur in a bar, or on a festival where alcohol consumption is allowed and common. Appreciating the growing number of alert systems for bystander CPR by civilians, information on alcohol use and CRP-performance is important, and, at present, no data and recommendations are available.

The unique study during a music festival setting allows for the first analyses on this topic, and therefore we incorporated special attention for these analyses in our methodology and in the present manuscript (page 11, line 15)

6. *Knowing that there will be alcohol consumption among the participants, perhaps other drugs, and little sleep, do you have the right participants to answer the study question?*

This is an important issue, which we acknowledge, and therefore addressed with a thorough study design, specifically focussed on these potential issues, in close collaboration with our statistician. See also points 3 and 4.

7. *Celenza paper: Number of trainings more important for retention that time since last training. Inclusion must ensure that there is balanced between the groups regarding number of trainings*

Thank you for this valuable reference, which we have incorporated in our revised manuscript (number 28). In a recent review on this subject, 12 out of 34 examined studies excluded participants on the basis of the date of their previous training, whereas there were only 2 studies that investigated the number of times trained.(1) In the design of this study, we complied with the vast majority of previous studies, which focussed on whether and when previous training had been performed by participants.

8. *Will teaching include feedback device as recommended by AHA, ERC?*

During the face-to-face training, Mini Anne manikins will be used (Laerdal Medical, Stavanger, Norway). These manikins will provide feedback on chest compression depth using a “clicker” that provides auditory feedback on compression depth. We incorporated this in the revised version of the manuscript (page 9, line 11). Moreover, the instructors will provide feedback on compression rate and leaning.

In the Lifesaver VR group, chest compressions will be practiced on a pillow, to mimic the situation when the app is used at home. The app will provide real-time feedback on chest compression rate, and give instructions on chest compression depth (page 10, line 1).

During the exam, no feedback is given to objectively measure the achieved CPR-quality. After the training, all participants will receive a short feedback on their performance.

9. *What is a certified manikin?*

With certified manikins we refer to manikins that have been regularly checked and in which regular maintenance has been performed to ensure proper functioning of the manikin. For our study, we will use Laerdal manikins, kindly provided by Laerdal Medical Benelux, that comply with these requirements.

10. *Will each participant have their own manikin?*

During the face-to-face training we will provide enough manikins for each participant to have their own, but practicing CPR-skills will be done in pairs of two participants. We have clarified this in the revised version of the manuscript (page 9, line 11).

11. *Clarify what manikin is used for Lifesaver VR training.*

    As stated, during the Lifesaver VR training, no manikin will be used. Chest compressions will be practised on a pillow, with the app providing feedback on rate, and instructions on depth (page 10, line 1).

    The app is designed to be used with a pillow, and we will not provide CPR manikins to mimic the at home situation as well as possible. Moreover, no additional instructions will be given to the participants in the Lifesaver VR group. This will allow us to measure CPR-quality that can likely be achieved at home, without professional CPR-equipment and without an instructor.

12. *What is the duration of the test and what is the justification of that duration?*

    The duration of the test is approximately five minutes, which is in accordance with a recently published study that is among the largest randomised CPR education trials to date. (2) Participants will continue chest compressions for at least three full cycles of 30 chest compressions and two ventilations. This will allow for a robust estimate of our primary outcome measures, i.e. the achieved depth and rate of chest compressions.

13. *Why is not incomplete release included?*

    As per answer 2, we have specifically mentioned leaning as one of the secondary outcome measures. The reason not to include this in the primary outcome measure is provided earlier (see answer 2). We will compare the proportions of chest compressions with complete release, as measure for leaning, between groups.

14. *Define certified manikin.*

    This issue was addressed as per answer 9.

15. *How will the study comply with GDPR?*

    The study protocol has been reviewed by our medical ethics committee with regard to compliance with the GDPR. When a participant signed for informed consent, a case report form (CRF) number will be generated and all further documents will be coded with this CRF number, which precludes directly relating data to individuals. The transcription key is only available to the project leader and study coordinator. All data will be entered into the eCRF using the Castor database program under their unique identification number. Data will be stored on a secured location for 15 years. The handling of personal data complies with the EU General Data Protection Regulation and the Dutch Act on Implementation of the General Data Protection Regulation.

16. *AHA consensus: Full Chest Recoil: No Residual Leaning Incomplete chest wall release occurs when the chest compressor does not allow the chest to fully recoil on completion of the compression.44,45 This can occur when a rescuer leans over the patient's chest, impeding full chest expansion. Leaning is known to decrease the blood flow throughout the heart and can decrease venous return and cardiac output.46 Although data are sparse regarding outcomes related to leaning, animal studies have shown that leaning increases*

right atrial pressure and decreases cerebral and coronary perfusion pressure, cardiac index, and left ventricular myocardial flow.46–48 Human studies show that a majority of rescuers often lean during CPR and do not allow the chest to recoil fully.49,50 Therefore, the expert panel agrees that leaning should be minimised

As mentioned previously, this point is well taken, and we have revised the manuscript with specific mentioning of leaning as a secondary outcome measure, as described in answer 2.

References:

1. Riggs M, Franklin R, Saylany L. Associations between cardiopulmonary resuscitation (CPR) knowledge, self-efficacy, training history and willingness to perform CPR and CPR psychomotor skills: A systematic review. Resuscitation. 2019;138:259-72.
2. Bylow H, Karlsson T, Claesson A, Lepp M, Lindqvist J, Herlitz J. Self-learning training versus instructor-led training for basic life support: A cluster randomised trial. Resuscitation. 2019;139:122-32.

VERSION 2 – REVIEW

REVIEWER	Bernd W. Böttiger Department of Anaesthesiology and Intensive Care Medicine University Hospital of Cologne Kerpener Straße 62 D-50937 Köln Germany Bernd W. Böttiger is European Resuscitation Council (ERC) Board Director Science and Research; Chairman of the German Resuscitation Council (GRC); Member of the „Advanced Life Support (ALS) Task Force of the International Liaison Committee on Resuscitation (ILCOR); Member of the executive committee of the German Interdisciplinary Association for Intensive and Emergency Medicine (DIVI); Associated Editor of the European Journal of Anaesthesiology (EJA), Co-Editor of “Resuscitation”; Editor of the Journal “Notfall + Rettungsmedizin”. He received professional fees for lectures from the following companies: Medupdate GmbH, “Forum für medizinische Fortbildung (FomF)”, Baxalta Deutschland GmbH, Bayer Vital GmbH, ZOLL Medical Deutschland GmbH, C. R. Bard GmbH, GS Elektromedizinische Geräte G. Stemple GmbH.
REVIEW RETURNED	24-Oct-2019

GENERAL COMMENTS	Ladies and Gentlemen, thank you for submitting a revision of your manuscript. Proposals from my first review – mainly related to follow-up period and the potential statistical analysis - were seriously addressed. Despite weak remaining concerns, I renew my support for the present study protocol and recommend the manuscript to be published. Main reason for my decision is the sensitization of a younger population by this study that mirrors an important part of our society. Since increase of bystander CPR is the only measure to improve long-term outcome of survivors of cardiac arrest, campaigns like the present are important key elements to raise peoples´ awareness for CPR-training. Above that, the study may

	gain new scientific knowledge in this field that may additionally improve target-group-specific CPR training and further studies.