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## Study Information

### Title

*Provide the working title of your study. It is helpful if this is the same title that you submit for publication of your final manuscript, but it is not a requirement.*

The effect of safety climate, situation awareness and leadership on unsafe actions on chemical tanker vessels

### Authors

*The author who submits the preregistration is the recipient of the award money and must also be an author of the published manuscript. Additional authors may be added or removed at any time.*

Bjørn Sætrevik, Randi Elisabeth Hope Aga, Line Raknes Hjellvik

### Research Questions

*Please list each research question included in this study.*

We will test whether the company and the vessel's 'safety climate', the captain's leadership style and the crew's self-report of 'situation awareness' are associated with commission of 'unsafe actions' onboard chemical tanker vessels.

### Hypotheses

*For each of the research questions listed in the previous section, provide one or multiple specific and testable hypotheses. Please state if the hypotheses are directional or non-directional. If directional, state the direction. A predicted effect is also appropriate here.*

We will test the following hypotheses:

H1: 'Safety climate' will be negatively associated with 'unsafe actions'.

H2: 'Situation awareness' will be negatively associated with 'unsafe actions'.

H3: 'Authentic leadership' will be negatively associated with 'unsafe actions'.

## Sampling Plan

### Existing Data

*Preregistration is designed to make clear the distinction between confirmatory tests, specified prior to seeing the data, and exploratory analyses conducted after observing the data. Therefore, creating a research plan in which existing data will be used presents unique challenges. Please select the description that best describes your situation. Please do not hesitate to contact us if you have questions about how to answer this question (prereg@cos.io).*

Missing data

Registration prior to creation of data

Exploratory analysis

Scripts

Explanation of existing data

Script

*If you indicate that you will be using some data that already exist in this study, please describe the steps you have taken to assure that you are unaware of any patterns or summary statistics in the data. This may include an explanation of how access to the data has been limited, who has observed the data, or how you have avoided observing any analysis of the specific data you will use in your study. The purpose of this question is to assure that the line between confirmatory and exploratory analysis is clear.*

Other

Other

The surveys are currently in the process of being collected, and completed surveys are being returned to the researchers by mail. None of the received envelopes have yet been opened or examined.

Data collection procedures

*Please describe the process by which you will collect your data. If you are using human subjects, this should include the population from which you obtain subjects, recruitment efforts, payment for participation, how subjects will be selected for eligibility from the initial pool (e.g. inclusion and exclusion rules), and your study timeline. For studies that don't include human subjects, include information about how you will collect samples, duration of data gathering efforts, source or location of samples, or batch numbers you will use.*

A survey measuring variables related to safety as well as demographic information was sent to approximately 570 crew members working on 18 different vessels in a Norwegian ship-owning company. There are 30-35 employees working on each vessel in the company, and the number of surveys were adapted accordingly. The surveys were distributed by the captain on each vessel. The participants were not paid for participation, but could complete the survey during working hours. Participation was encouraged, but the crew members were informed that it was voluntary to participate in the study. The participants received informed consent in which they were informed that the aim of the study is not to learn about individual vessels or specific crew members, and that it is not possible to identify individual crew members or vessels. The completed surveys were sent directly to the researchers, while only averages for the whole data set are shared with the ship-owning company.

See the survey used in the attached file.

Safety survey on chemical tanker vessels.pdf

Sample size

*Describe the sample size of your study. How many units will be analyzed in the study? This could be the number of people, birds, classrooms, plots, interactions, or countries included. If the units are not individuals, then describe the size requirements for each unit. If you are using a clustered or multilevel design, how many units are you collecting at each level of the analysis?*

We expect a high response rate due to our collaboration with the ship-owning company. Our target sample size is 570 participants.

Sample size rationale

*This could include a power analysis or an arbitrary constraint such as time, money, or personnel.*

All crew members in the company will be invited to participate in the study.

Stopping rule

*If your data collection procedures do not give you full control over your exact sample size, specify how you will decide when to terminate your data collection.*

All surveys returned before March 2018 will be included in the analysis, with no additional sampling.

## Variables

### Manipulated variables

*Describe all variables you plan to manipulate and the levels or treatment arms of each variable. For observational studies and meta-analyses, simply state that this is not applicable.*

This is not applicable for the current study.

no file selected

### Measured variables

*Describe each variable that you will measure. This will include outcome measures, as well as any predictors or covariates that you will measure. You do not need to include any variables that you plan on collecting if they are not going to be included in the confirmatory analyses of this study.*

The study's measuring instrument is a pen-and-paper survey with 122 items. Apart from the first seven items collecting demography, all items are statements to which the participants mark (on a scale from '1: completely disagree' to '5 completely agree') how much they agree with them. We use both positive and negatively phrased statements to avoid response bias. The following variables are collected: 'situation awareness', 'safety climate', 'authentic leadership', 'safety leadership', 'unsafe actions', 'risk management', 'negative attitudes to reporting', and 'safety attitudes'. 'Safety climate', 'authentic leadership' and 'situation awareness' will be the predictors (independent variable) in our analysis, while 'unsafe actions' will be the outcome measure (dependent variable).

The variable 'Safety climate' will be measured at both organizational and group level, where the organization corresponds to the ship-owning company, and the group corresponds to the vessel. The survey measures this variable under the heading "The captain's focus on safety" and "The ship-owners focus on safety", and the scale has 32 items (numbered 21-52) adopted from a scale developed by Zohar, Luria, and Zedeck (2005, Journal of Applied Psychology). Items 21-26 relate to the captain's focus on safety, while items 37-52 relate to the ship-owning company's focus on safety. The respondents are presented with statements about the captain's focus on safety, and the company's focus on safety, resulting in separate measures of 'safety climate' at the organizational level and at the group level. An example-item from the organizational scale is: 'The management reacts quickly to solve the problem when told about safety hazards,' and an example from group level is: 'The captain discusses with us how we can improve safety.'

The variable 'Situation awareness' will be measured with a 13-item scale that describes perception of elements in the environment, comprehension of the situation, and assessment of what the situation might lead to in the near future. The scale is based on Endsley's (1995) three level-model of situation awareness. Four items (9, 11, 17 and 19) measure perception (level 1 situation awareness), five items (10, 13, 15, 16 and 20) measure comprehension (level 2 situation awareness), and four items (8, 12, 14, and 18) measure prediction (level 3 situation awareness) (Sætrevik, 2013, International Journal of Maritime Health). An example of an item with negative phrasing in this scale is: 'I sometimes lose track of information relevant to maintaining safety in my work.'

Under the heading 'The captain's leadership style', the variable 'Authentic leadership' will be measured with the 16 item 'Authentic Leadership Questionnaire' (Walumbwa, et al., 2008, Journal of Management). This measures four subscales: 'self-awareness' (item 65-68), 'moral perspective' (item 58-61), 'relational transparency' (item 53-57) and 'balanced processing' (item 62-64). An example item is: 'The captain says exactly what he means'.

The variable 'Unsafe actions' will be measured with 7 items (74-80) under the heading 'Safety in your work', which assess actions that the employees perform (or do not perform), which can lead to accidents or near-accidents. The scale is developed by the researchers based on literature review and have been adapted to this setting through discussions with subject matter experts. An example of a negatively phrased item from this scale is: 'To get the job done, I have taken shortcuts with regards to safety'.

no file selected

indices

If any measurements are going to be combined into an index (or even a mean), what measures will you use and how will they be combined? Include either a formula or a precise description of your method. If you are using a more complicated statistical method to combine measures (e.g. a factor analysis), you can note that here but describe the exact method in the analysis plan section.

The items in the 'situation awareness' variable will be combined to an average score from items numbered 8-20.  
The items in the 'unsafe actions' variable will be combined to an average score from items numbered 74-80.  
The items in the 'authentic leadership' variable will be combined to an average score from items numbered 53-68.  
The 'safety climate' variable will be combined to an average score from items numbered 21-52.

no file selected

## Design Plan

### Study type

Please check one of the following statements

Observational Study - Data is collected from study subjects that are not randomly assigned to a treatment. This includes surveys, "natural experiments," and regression discontinuity designs.

### Blinding

Blinding describes who is aware of the experimental manipulations within a study. Mark all that apply.

No blinding is involved in this study.

### Study design

Describe your study design. Examples include two-group, factorial, randomized block, and repeated measures. Is it a between (unpaired), within-subject (paired), or mixed design? Describe any counterbalancing required. Typical study designs for observation studies include cohort, cross sectional, and case-control studies.

The current analysis is based on a single time-point self-report survey measure.

no file selected

### Randomization

If you are doing a randomized study, how will you randomize, and at what level?

No randomization is done in this study.

## Analysis Plan

### Statistical models

What statistical model will you use to test each hypothesis? Please include the type of model (e.g. ANOVA, multiple regression, SEM, etc) and the specification of the model (this includes each variable that will be included as predictors, outcomes, or covariates). Please specify any interactions that will be tested and remember that any test not included here must be noted as an exploratory test in your final article.

To confirm H1, H2 and H3 respectively, a multiple regression will test the main effects of 'safety climate', 'authentic leadership' and 'situation awareness' (independent variables) on 'unsafe actions' (dependent variable). Correlations will be calculated between the dependent variables to test for multicollinearity.

In order to investigate the strength and direction effect of 'safety climate', 'authentic leadership' and 'situation awareness' on 'unsafe actions' we will calculate squared Pearson's r.

no file selected

## Transformations

If you plan on transforming, centering, recoding the data, or will require a coding scheme for categorical variables, please describe that process.

Responses (scored from 1-5) will be reversed (producing scores 5-1) for the following items that are negatively phrased with regards to the direction of our variables: 9, 10, 11, 14, 17, 75 and 80.

## Follow-up analyses

If not specified previously, will you be conducting any confirmatory analyses to follow up on effects in your statistical model, such as subgroup analyses, pairwise or complex contrasts, or follow-up tests from interactions? Remember that any analyses not specified in this research plan must be noted as exploratory.

If the planned analysis finds that 'Safety climate' has an effect on 'Unsafe actions', it will be followed up by a similar analysis where the variable is split into 'Captain's safety climate' (items 21-36), and 'Ship-owner's safety climate' (items 37-52).

If the planned analysis finds that 'Authentic leadership' has an effect on 'Unsafe actions', it will be followed up by a subgroup analysis testing the effect of the four factors in 'Authentic leadership', namely: 'self-awareness' (items 65-68), 'moral perspective' (items 58-61), 'relational transparency' (items 53-57) and 'balanced processing' (items 62-64).

If the planned analysis finds that 'Situation awareness' has an effect on 'Unsafe actions', it will be followed up by a subgroup analysis testing the effect of the three levels of 'Situation awareness', namely: 'level 1: perception' (items 9, 11, 17 and 19), 'level 2: comprehension' (items 10, 13, 15, 16 and 20) and 'level 3: prediction' (items 8, 12, 14, and 18).

While responses from the captains are excluded from the planned analyses (see 'Data exclusion'), follow-up analyses may include the captains' responses in variations of the analyses to see if the relationships also hold for this sample.

The multiple regression analysis to test H1, H2 and H3 will be followed up with a similar analysis that also includes the interactions between 'safety climate', 'authentic leadership' and 'situation awareness', to test mediator effects between the independent variables.

## Inference criteria

What criteria will you use to make inferences? Please describe the information you'll use (e.g. specify the p-values, Bayes factors, specific model fit indices), as well as cut-off criterion, where appropriate. Will you be using one or two tailed tests for each of your analyses? If you are comparing multiple conditions or testing multiple hypotheses, will you account for this?

We will use one-tailed tests for our directed hypotheses. We will use the standard p smaller than .05 criteria for determining if the correlations and regression analysis suggest that the results are significantly different from those expected if the null-hypotheses were correct.

## Data exclusion

How will you determine which data points or samples (if any) to exclude from your analyses? How will outliers be handled?

As the 'Authentic leadership' variable and half of the items on the 'Safety climate' variable concerns the captain, there is reason to believe that the responses from the captain on the vessels will be qualitatively different from the rest of the responses. Therefore, the responses from the captain will be excluded from the current analysis (but may be included in follow-up analyses).

No outliers removal or other data exclusion based on response pattern are planned.

## Missing data

How will you deal with incomplete or missing data?

If more than 33% of a participants responses are missing on any of the variables used in the analysis, the participants responses will be excluded from the analysis.

## Exploratory analysis

If you plan to explore your data set to look for unexpected differences or relationships, you may describe those tests here. An exploratory test is any test where a prediction is not made up front, or there are multiple possible tests that you are going to use. A statistically significant finding in an exploratory test is a great way to form a new confirmatory hypothesis, which could be registered at a later time.

No exploratory analyses are planned.

## Scripts

### Upload an analysis script with clear comments

This optional step is helpful in order to create a process that is completely transparent and increase the likelihood that your analysis can be replicated. We recommend that you run the code on a simulated dataset in order to check that it will run without errors.

no file selected

## Other

### Other

If there is any additional information that you feel needs to be included in your preregistration, please enter it here.

OSF

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