# A Pilot Randomised Controlled Trial Evaluating Nurses' Professional Judgement of Emergency Cases

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# A Pilot Randomised Controlled Trial Evaluating Nurses' Professional Judgement of Emergency Cases

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by

LUCA BUGELLI

A dissertation submitted in part fulfilment of the requirements for the

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## Abstract

**Purpose –** The purpose of this study was to explore an area where recurrent critical decisions in healthcare are taken, capture decision outcomes and analyse the variance which is produced as a result of judgemental error. **Design/method –** The study took a non-practitioner's (outsider) standpoint and utilised an experimental, blinded, randomized controlled trial using Simulation-Based Research (SBR) methods, with a control group and two experimental groups, to address the hypotheses and purpose of the study. A tailor-made web-application was developed specifically for participants to self-report and rate their mood, score triage judgements on fictitious emergency cases, provide a justification, and share details about their personality traits. Sessions were conducted at the hospital administration building and University campus, and participants were not allowed to interact with the academic personnel on the setup and configuration. **Findings –** Despite being inconclusive, results unveiled variances in judgements from the selected sample in a simulated environment. Under time pressure and distractions, participants performed better (a possible explanation being the inverted U theory). Participants shared the common personality traits of conscientiousness, agreeableness and extraversion. Neuroticism was one of the reported lower scores among all groups which could possibly indicate that the participants are well-trained to perform the task or that their personality traits fit the bill. **Research limitations –** The sample of participants was not representative of the whole population. Navigating a pandemic and post-pandemic environment led to underestimating the amount of time required to complete the project, hence the setting up of research sessions appointments was challenging, causing participant attrition. Future studies should consider re-testing the research software to improve temporal stability and response bias, and find alternative sources to share cross-border information related to hospital admissions or triage-related statistics. **Practical implications –** The risks of cognitive biases in emergency medicine and diagnostic error are significant; measures to mitigate these risks need to be put in place and may include improved staff training and education, implementation of cognitive aids and decision support tools, simulation-based research and the creation of a culture of safety and openness that promotes learning from errors. **Originality/value –** The term 'noise' in behavioural studies and academia (the unwanted variability in judgements) is being considered as much of a concern in professional decision-making as bias. The study itself is a demonstration of a real-life application of a noise audit and presents an opportunity to industry to further expand on such an approach at dealing with the analysis of variance.



**Keywords** – Bounded Rationality, Judgemental Error, Variance Analysis, System Noise, Healthcare management, Triage, Simulation-based Research

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## *Dedication*

To all the educators for inspiring me to never stop learning, never stop questioning, never stop trying. To all the frontline workers working within emergency and crises contexts for their tireless, heroic work. To the victims who succumbed to the COVID-19 pandemic, the war crimes in the Russio-Ukraine conflict and the Kahramanmaras earthquake in Türkiye. To the scientific community, humanists and all those who go out of their comfort zone to challenge the status quo and are not afraid to speak their minds. To the youth, students and change makers quietly working to make this world a more tolerable place.

This project would not have been possible without the constant support, patience and encouragement from close relatives and friends, collaborators and mentors.

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## Abbreviations

ACQ – Acquiescence Bias
ATS – Australasian Triage Scale
BMIS – Brief Mood Introspection Scale
BR – Bounded Rationality
CN – Charge Nurse
CPT – Cold-Pressor Task
CSS – Cascading Style Sheets
CTAS – Canadian Triage Scale
ED – Emergency Department
EM – Emergency Medicine
ESI – Emergency Severity Index
FREC – Faculty Research Ethics Committee
HTML – Hypertext Mark-up Language
MAP – Mediating Assessments Protocol
MBTI – Myers-Briggs Type Indicator
MENA – Malta Emergency Nurses Association
MTS – Manchester Triage Scale
NPA – Newcastle Personality Assessor
NPT – Newcastle Personality Test
PANAS – Positive and Negative Affect Schedule
RCA – Root Cause Analysis
SBR – Simulation Based Research
SCWT – Stroop Colour and Word Test
SDR – Social Desirability Bias
SJT – Social Judgement Theory
SN – Staff Nurse
SSN – Senior Staff Nurse
TAE – Total Analytic Error
TSST – Trier Social Stress Test

# 1. Introduction

Smoke detectors are a critical component of fire safety systems, designed to detect smoke particles in the air and alert occupants of a building to the potential danger of a fire. They can increase the likelihood of surviving a fire by up to 50%[1]. Effective implementation of smoke detectors requires an understanding of the principles behind their design and operation, including the types of detectors available, their placement, and maintenance. In this study, the smoke detector concept is explored in the context of managerial decision making, since errors and judgments are an inevitable part of decision-making processes and given that organisational leaders, management, employees and decision-makers deal with false-positive and negatives repeatedly and under various circumstances.

The error component which refers to the portion that is influenced by random factors or uncontrollable variables, can lead to incorrect decisions. It is claimed that bias and noise – which is referred to in the literature as 'the unwanted variability in human judgement' – are the main contributors to such errors (Baron & Hershey, 1988; Simonsohn, 2013; Arkes & Blumer, 1985; Frederick & Mochon,2012). Bias refers to the systematic distortion leading to a deviation from the true value; whilst on the other hand, noise refers to the variability or randomness in the information used in the decision-making process. This can arise due to measurement errors, individual differences, or other uncontrollable factors.

Early empirical studies by Kahneman and Tversky (1972) have demonstrated the impact of these factors; others highlighted the role of unwanted variability in medical decision-making, particularly in emergency situations (Croskerry & Singhal, 2013). Strategies such as training professionals to recognise and correct for bias, or to reduce the impact of noise through the use of multiple sources can be implemented to mitigate the impact of human error. The purpose of this study, therefore, is to serve as a pilot project enabling the deployment of simulation-based research tools in an attempt to better understand the decision-making processes and judgements where recurrent critical, clinical decisions are taken.

[1] National Fire Protection Association (NFPA; https://www.nfpa.org)

## *1.2 Goals*

Two main goals are devised. The first is to deploy a team of experts to simulate a ‘noise audit’ to capture decision outcomes and analyse any unwanted variances resulting from judgemental errors, thus gaining a better understanding of the extent of variability in judgements and zone of tolerance from a 'non-practitioner’ standpoint (outsiders). A secondary goal is to have the study serve as a referential exploratory exercise for further research in the field.

## *1.3 Rationale*

A 2012 study carried out by the Department of Neurology at the Johns Hopkins Hospital concluded that *“diagnostic errors appear to be the most common, most costly and most dangerous of medical mistakes”* (Smith et al., 2012) supporting the claim in medical research that misdiagnosis accounts for the most severe cases of patient harm); this was also echoed by the World Health Organisation (2016). Given that emergency practitioners working within Emergency Departments are among the first professionals to determine diagnosis, decisions at this initial stage are critical to the patient’s chances of survival. Therefore, from a managerial point of view, the impact of these routine decisions on overall emergency room management need to be understood so that key stakeholders, such as consulting doctors and hospital management will be in a better position to lower the chances of having false-positive or false-negative judgements distorting system flow and therefore impacting hospital operations.

## *1.4 Description*

The study hypothesised that emergency department staff would be more prone to make errors and vary from the actual Emergency Severity Index (ESI) Triage score (set by consulting doctors) under time pressure and whilst being distracted – the experimental groups – than a group judging the same 12 fictive emergency cases free from stressors – the control group. The stressors were inflicted via a software simulator on two groups; at baseline, participants completed a brief questionnaire assessing their mood. The groups then judged 12 fictitious emergency cases based

on the latest version[2] of the ESI Triage Algorithm and providing open-ended justifications for their judgements. Post-intervention, participants were assessed on their Personality Traits via the Newcastle Personality Assessor (NPA).

## *1.5 Summary*

This exploratory study unearthed literature, theories and empirical studies emanating from the behavioural sciences, management, health and scientific journals to better understand the phenomena contributing to error generation and solutions to mitigate the possibility of erroneous professional judgements. The exercise was an attempt at examining the judgemental variability of fifteen professionally active emergency nurse practitioners, and eventually determine the zone of tolerance within an Emergency Department with which hospital management can cope. This evolved into a deeper examination and dissection of the concept of bounded rationality and 'noise' in decision-making, and how the scientific community measured and dissected error through modern history (the true value, and the error component). The study itself is a demonstration of a practical application of a 'noise audit', presenting an opportunity to industry, practitioners and non-practitioners to further expand on such an approach at dealing with the analysis of variance in various domains. The inconclusive observations imply that a need for future simulation-based research could be an essential foundation in "decision-making" under particular conditions.

[2] Emergency Severity Index Version 4

## 2. Review of the Literature

Following a systematic process[3], which entailed reviewing empirical studies from reputable journals and databases, the existing body of knowledge on bounded rationality and managerial decision-making was unearthed, compiled and presented to ‘set the scene’ for deeper insights into how cognitive limitations affect human-decision-making in different contexts, with a focus on emergency medicine, the treatment of statistical error, measurement uncertainty with the true value and error component, being a source of conceptual controversies notably the recent discussions on system noise and unwanted variability and judgements.

Human decision-making is a complex and multi-faceted process, shaped by a range of cognitive, social, and environmental factors. The first sections provide an overview of key contributions to the development of bounded rationality - the notion that individuals make rational decisions, but their decision-making process is limited by their cognitive abilities. The specific views of notable scholars such as Herbert Simon, George Shackle, James G. March, Kahneman, Fisher Black, William Deming are discussed.

The interplay between bias and noise is also brought into focus – two key components of total error – and the potential strategies for reducing the occurrence of errors. Additionally, it highlights the importance of considering individual personality differences and mood states when studying judgemental variability. This review advances the understanding of the complex nature of decision-making and its implications for real-world situations linking with recent literature on system noise, factors that generate noise, and the critical responses to the concept of noise as presented by Kahneman et al. (2021) in their recent non-fiction publication, with a particular focus on decisions made under critical conditions in emergency medicine. Recommendations for reducing the occurrence of errors in acute hospital care have also been explored, following which the resulting research questions and hypotheses were formulated to explore the extent of professional nurses' judgemental variability and the role personality plays in occupational settings.

[3] Refer to Annex I, *“Review of the Literature (Process)”*

## *2.1 The Concept of Bounded Rationality*

Humans typically choose an alternative that satisfies their sufficiency criteria rather than conducting a comprehensive cost-benefit analysis to identify the best course of action, as evidenced by various studies, such as Jordão et al. (2018), who highlighted the significance of cognitive biases in decision-making. They posited that people tend to rely on heuristics and mental shortcuts rather than rational analysis, which can lead to decision-making errors. Pulford's (2017) research on overconfidence in human judgement focuses on the tendency of individuals to have more confidence in their judgements than is justified by the evidence. The author, argues, that overconfidence can result in poor decision-making outcomes, whilst Illankoon and Tretten (2020) explored the impact of judgemental errors in aviation maintenance, pointing towards the fact that judgemental errors can be influenced by several factors, such as time pressure, fatigue, and inadequate training. Furthermore, they also emphasised the significance of effective decision analysis and error management in preventing judgemental errors.

People and professionals are therefore constrained, or rather, ‘bound’ by their cognitive abilities. Bounded rationality is a concept that recognises the limitations of human decision-making, specifically, the fact that individuals have finite cognitive resources and may not always have access to all the information needed to make optimal decisions (Jones, 1990). The idea was first introduced by Herbert Simon in his work on decision-making processes in economic and organizational contexts (Simon, 1955). Simon suggested that individuals often rely on heuristics, or "rules of thumb," to simplify complex decision problems and reduce cognitive effort. His work on bounded rationality has had a significant impact on the field of decision-making, and his contributions have been widely recognised in academia.

George Shackle further built on Simon’s work, emphasizing the role of imagination and uncertainty in decision-making (Shackle, 1972). Shackle argued that individuals must use their imagination to generate alternative scenarios and explore different possibilities, as well as recognize the inherent uncertainty and ambiguity of decision situations. Creativity and imagination can be relevant in entrepreneurial contexts, where individuals must make decisions in highly uncertain and dynamic environments. Augier and Kreiner (2008) too suggested that intelligence can play a significant role in decision-making. They noted that individuals with higher levels of intelligence may be better able to process and analyse complex information, leading

to more accurate predictions and better decision-making. In their 2008 study, they observed that successful entrepreneurs often possess high levels of creativity and imagination, enabling them to generate novel ideas and solutions to complex problems. In addition to intelligence, social factors can additionally play a significant role in group decision-making processes such as group size, diversity, and communication patterns which can all impact the quality of group decision-making (Stasser & Titus, 1985). Other factors, such as power dynamics and group cohesion, can also influence outcomes (Janis, 1972). Jones (1990) suggests that bounded rationality can explain why groups may have difficulty reaching a consensus, as members may have different perspectives.

March (1994) extended the concept of bounded rationality further, highlighting the importance of intuition and the limitations of the Savage paradigm which assumes that individuals make decisions based on a rational evaluation of all available information. March too, argued that intuition and emotion could be important factors in the decision-making process.

**Costs associated with Bounded Rationality**

Radner (1993) introduced the concern that there could be costs linked with information gathering and processing efforts, which poses a financial burden to decision-making within organisations, arguing that individuals and groups must balance the benefits of additional information with the costs of acquiring that information. He suggested that individuals and groups should focus on the expected value of different outcomes when making decisions. The costs associated with information gathering and processing can be particularly relevant in organizational contexts, where decisions may have significant financial and strategic implications (Simon, 1979). Jones (1990) also noted that the fact that humans are rationally bound can lead to a number of decision-making biases, such as overconfidence and confirmation bias[4].

Organisational leaders may therefore need to consider factors such as information overload, information bias, and the opportunity costs of information gathering and processing when making decisions (Acciarini et al., 2020). These biases could potentially have an influence on, and lead to, suboptimal decision outcomes and can be particularly problematic in complex and uncertain decision situations. Effective decision-making, decision analysis, and error management are therefore essential components in professional contexts. Decision-makers must be aware of their cognitive biases, and limitations, and engage in rational analysis to improve decision outcomes. By recognizing the limitations of human decision-making, individuals and organisations can make more informed and effective decisions in a range of contexts.

[4] Confirmation bias is the tendency to favour information that confirms pre-existing beliefs or expectations (Oxford Dictionary)

## *2.2 Total Error and Unwanted Variability in Judgement*

In the context of decision-making, bounded rationality can contribute to the possibility of human errors by limiting the accuracy and precision of the decisions made. Total error refers to the overall error or uncertainty associated with a measurement or analysis and can arise from various sources, including measurement error, sampling error, data processing error, and modeling error (ISO, 1994).

Accuracy is a critical factor in measuring total error, as it reflects the degree to which a measurement or analysis accurately reflects the true value or quantity being measured (ISO, 1994). Measurement error, in particular, is a primary source of total error; the accuracy of a measurement can be assessed by comparing it to a reference or target value using statistical methods such as mean bias, mean absolute error, and root mean square error (ISO, 1994). For instance, in laboratory testing, the accuracy of a measurement can be evaluated by analysing quality control samples with known reference values or participating in proficiency testing programs (Westgard, 2020). By minimizing measurement error through accuracy, individuals can reduce total error and improve the quality and reliability of the measurement or analysis. This is especially critical in fields where accurate measurements are essential for decision-making, such as clinical medicine, environmental monitoring, and quality control in manufacturing (ISO, 1994).

The concept of total error and measurement of uncertainty in managerial decision-making can be traced back to Deming’s (1986) contributions in his work on quality control and management, where the importance of recognizing the concept was popularised and emphasised. Deming's ideas on quality control and management, including his focus on reducing total error and measuring uncertainty, have had a significant impact on manufacturing, engineering, and other fields that require high levels of precision and accuracy. The American statistician is often considered the father of the modern quality control movement, and his work has influenced the development of international standards and best practices for quality control and management.

Since then scholars have researched the topic and identified a number of cognitive biases and heuristics that can contribute to total error. Baron (2015), for example, argued that errors in judgement can arise from biases in information processing, mistakes in assessing the likelihood of events, and errors in determining the value of outcomes; whereas (Fischhoff, 1975; Fischhoff et al., 1978) conducted empirical studies that demonstrate how individuals often overestimate the likelihood of rare events and underestimate the likelihood of common events, the role of feedback in reducing errors in judgement, and the failure to use base rate information when making judgements. Arkes (1991) explored the idea of hindsight bias in total error, finding that individuals tend to overestimate their ability to predict the outcome of events after the fact occurs, leading to overconfidence in their decision-making abilities.

One real-world example of total error can be observed in Ai Weiwei’s 2017 documentary film "Human Flow", where the decisions made by governments and individuals affect the response to the global refugee crisis. The production is a clear demonstration of how cognitive biases and heuristics can lead to significant errors in judgement, such as when governments underestimate the scale of the crisis or fail to provide adequate support for refugees. Inconsistency in many real-world judgements, therefore, can have major negative consequences, in the form of random unfairness, injustice, and misallocation of resources.

**An overview of the statistical treatment of Error in Science**

In statistical science, when verifying a test that gives quantitative results, imprecision and bias are taken into account, with the latter often measured repeatedly over a small number of samples (Joint Committee for Guides in Metrology, 2008). In contrast, bias is typically measured using a large set of samples to cover the whole measuring range, and then calculating either average bias or bias as a function of concentration. When measuring error and dissecting error, therefore, rather than its components, researchers often look at the accuracy element, meaning the closeness of agreement between a test result and the accepted value. Westgard et al. (1974; 2008) for example, provide an overview of the concept of total analytic error (TAE). Its importance in laboratory testing is emphasised and sources of error that can contribute to TAE, including systematic error (such as calibration), random error (such as imprecision or variability), and biological variation are tackled and discussed. TAE represents the overall error that we find in a test result (Westgard, 2008). It gives an upper limit on the total error of a measurement with a selected level of confidence. The idea behind TAE is illustrated in Figure A.1. A mathematical formula, presented in absolute terms is proposed for calculating TAE; where SD denotes Standard Deviation (the width of the normal distribution), and Z is a factor based on confidence level.

$$Bias = Mean - True\ value$$

$$\%Bias = \frac{Mean - True\ value}{True\ value}$$

$$\therefore$$

$$TAE_{abs} = |Bias| + Z \times SD$$

Bias is a result of systematic errors in measurements, and it tells us how far the mean of the distribution is from the true value and which of the two is higher - a positive bias means that the measured results tend to be somewhat higher than the true concentration in the sample whereas a negative bias means that the measured results tend to be lower than the true value. Bias gives us the distance between the true value and the mean value, and *Z* * *SD* describes how much further from the true value the measured result can be with our selected confidence level (as depicted in Figure A.1).

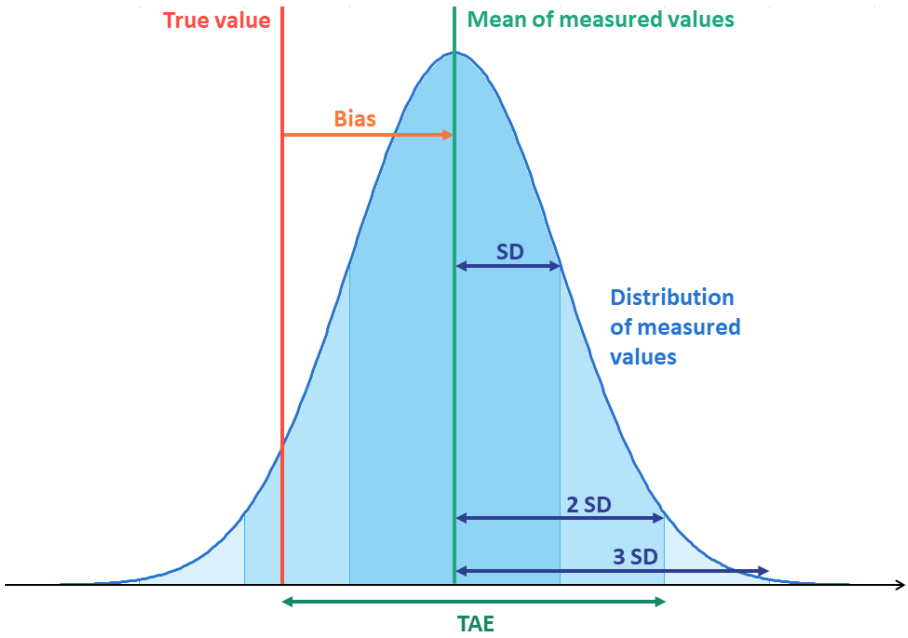


**Figure A.1 – Normal distribution and the true value; equation for TAE (Source: finbiosoft.com)**

Furthermore, Westgard provides guidance on how to minimise TAE, given measurement uncertainty [5,6] in laboratory testing, including the importance of appropriate quality control procedures, measurement traceability, and data analysis; emphasizing the need for ongoing education and training for laboratory professionals to ensure that they have the necessary knowledge and skills to perform high-quality testing.

[5] Evaluation of measurement data — Guide to the expression of uncertainty in measurement : Guide to the expression of uncertainty in measurement - JCGM 100:2008 (GUM 1995 with minor corrections - Evaluation of measurement data (bipm.org), accessed 27 APR 2023

[6] The first international recommendation for measurement uncertainty was approved by International Committee for Weights and Measures in 1981, https://www.bipm.org/en/committees/ci/cipm

## *2.3 Kahneman's view of Total Error: identifying 'Noise' in the real world*

In their recent publication, "Noise", Kahneman et al. (2021) shift their focus to the real world, as opposed to a lab environment, and note that:

> *"Most of the time professionals have confidence in their own judgement. They expect that colleagues would agree with them, and they never find out whether they actually do. In most fields in the real world, a judgement may never be evaluated against a true value and at most will be subjected to vetting by another professional who is considered a respect-expert. Only occasionally will professionals be faced with a surprising disagreement, and when it happens, they will generally find reasons to view it as an isolated case. The authors acknowledge that true experts exist in domains where their skills can be verified and compared with the results; such as Chess Masters" (*p. 369).

Popularised in 2016, the publication amply illustrates the scale of the problem of inconsistent judgements, backing their case on the presence of system noise, a phenomenon often overlooked (Harvard Business Review, 2016). The authors view bias as "*systematic errors of judgement*" and that "*bias is error we can often see and even explain" (*Kahneman et al., 2021, p. 229*)*, they point out that *'judgement'* should be understood as "*a form or measurement in which the instrument is a human mind".* Like physical measurements, it is the process of assigning a score to an object, but unlike physical measurements, the score does not have to be a number - it is the process of assigning a score that results in noise. To help readers conceptualise this distinction better, a visual and an equation (the mean squared error is equal to bias squared plus noise squared) are portrayed, and their argument is sustained by a number of real-world scenarios and studies, where the variability in judgements of all kinds is explored - from court sentencing to insurance underwriting, to medical diagnosis. The authors distinguish between the two using a shooting-range metaphor (Figure A.2). If all the shots land systematically off-target in the same direction, that's bias (Target B); less accuracy is due to statistical bias; some of the shots might even be on target (Target A); an indication that the collective judgement is accurate. The issue here is not missing the target but a lack of consistency - given the same facts, one criminal gets life and another who is equally guilty is liberated. By contrast, noise is all over the place (Target C) because

the shots differ much from each other. Lastly, target D portrays the largest error since it has both bias and noise.

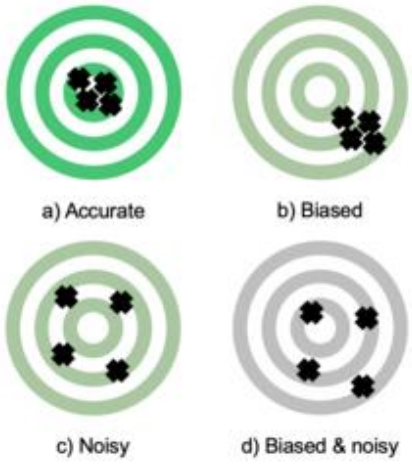


**Figure A.2 – An adaptation of a model on how statistical noise and statistical bias affect error in judgement. (Source: Wikipedia.com)**

The authors, put forward evidence in the form of key studies signalling the presence of the issue of unwanted variability in a number of domains, building their argument that there is more to bias when affecting decisions. Kahneman et al., (2021) cite a study of 208 criminal judges (Clancy, Kevin, et al., 1981), which uncovered significant variations on 16 fictive cases; another concern was a study which revealed French court judges were more forgiving if the defendant's birthday occurred to be that day (Chen & Arnaud, 2020).

Similarly in the business world, specifically in recruitment and insurance, a meta-analysis by Allen et al. (2013), demonstrated that a quarter of the time, two separate recruitment interviewers disagreed on which potential candidate was the best fit for the job, despite the interviewers forming part of the same panel, whereas, concerning underwriters, they mention their own experiment, where they claim that, within an insurance company, the median premiums set independently for the same five fictive customers varied by 55% (five times as much as expected by most underwriters and their executives). Radiologists and psychiatrists are not immune to this phenomenon as well, as evidenced by one study (Craig et. al, 1996) which showed that whereas some radiologists never produced false negatives (missed real breast cancer) when examining mammograms, others did so half the time. Psychiatrists tend to be exposed to such risks as well, as demonstrated in one study

(Ahmed, et al., 2006) where professionals who independently diagnosed 426 state hospital patients agreed on which mental illness the patient suffered from only in half of the cases.

Kahneman et al. (2021) propose that unwanted inconsistency between individuals ("judges") – what they refer to as 'system noise' – can be usefully divided into level noise where judges differ consistently over cases in a particular "direction" from each other, and pattern noise, where there is no consistent "direction of difference" over cases but sometimes one judge responds higher than the other and sometimes lower. An example of level noise is where one examination marker is strict and gives consistently lower scores than a second over a number of scripts. Pattern noise is the deviation that occurs when a judge is unusually affected by a specific situation for one reason or another. An example of pattern noise would be where one judge in sentencing monetary theft cases solely takes account of the amount stolen, while a second judge takes account only of the impact on the victim. These differences will lead to a quite variable picture where sometimes one judge is more severe and sometimes the other is more severe, even if the overall arithmetic difference between the judges is zero. Stable pattern noise arises due to permanent or semi-permanent differences between judges, and what the authors call 'the first lottery' in how one's case will be judged; whereas 'the second lottery' deals with occasion noise and thus whether or not the judge makes the judgement on an occasion beneficial or not, to those affected by the judgement. Occasion noise can be attributed to factors such as the weather, mood, time of day, the order in a series of judgements or the order that information is presented. Kahneman and colleagues stress that, *"there is typically more noise than statistical bias"*[7] (Kahneman et al. 2021, p. 61) and they suggest that, within the noise, there is typically more pattern noise than level noise; within pattern noise, there is typically more stable pattern noise than occasion noise; stable pattern noise is typically larger than level noise on its own (refer to Figure A.3).

[7] Statistical bias is a purely mathematical result of the judgements being systematically wrong in one direction, whereas psychological bias can arise from a multitude of cognitive effects in thinking, as well as from prejudices, and can lead both to statistical bias and to noise ( https://en.wikipedia.org/wiki/Bias_(statistics) )

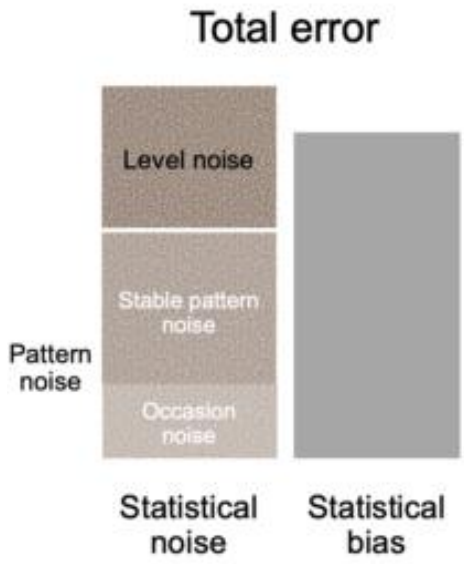


**Figure A.3 - An adaptation of the components of Total Error, their typical proportions and how they add up to total error in judgements, as Proposed by Kahneman (Source: Wikipedia.com)**

**Factors Causing 'Noise'**

Humans in general tend to be pattern seekers (Shermer & Linse, 2002); people constantly search for causal explanations and are often satisfied with shallow ones that they often do not attempt to disprove. The authors call this the causal mode of thinking - what Kahneman (2011) had dubbed as the brain's "System 1", in contrast to "System 2", the statistical mode. As emphasised in "Noise", humans find it easy to maintain the illusion of agreement due to a variety of factors including a common professional language, common rules, and a common understanding of what factors should influence our decisions. In other words, people assume that everyone sees the world the same way that they do. In terms of system noise, where different judges disagree with each other, these differences may well reflect differences in training and experience. There are various other reasons which are put forth for why noise is more difficult to detect than bias, aside from the difficulty the human mind has with comprehending and detecting randomness. Kahneman et al. (2021) make a distinction between action-based and plan-based errors, where, with regards to the former they explain that the plan itself could have been adequate, but was not executed as intended (Hollnagel, 1993; Reason, 1990). These errors can be further divided into those due to "Slips of action" or "Lapses" of memory (e.g., misremembering a phone number; or forgetting to replace a mask after taking it off).

Different action-based errors may also affect different judges' assessments of the same cases and lead to errors, even when judges are attempting to apply correct judgement procedures. However, some noise could also be attributed to plan-based errors (Reason, 1990), in that different judges may follow procedures or plans for judging that will lead to different conclusions. In plan-based errors, the plan itself is flawed and would never work even if executed perfectly.

Kahneman et al. (2021) also point to factors such as perceptions which could lead people to believing that there could be so much unwanted variability between judges that bad decisions are often considered to be rare exceptions or outliers made by "bad apples", rather than important data points to look out for. Apart from situational variables such as, time of day fluctuations in arousal, mood, time-pressures, fatigue, hunger, distractions, which may well have systematic effects on level noise, and be different on different occasions, the authors single out moment-to-moment fluctuations in brain efficacy.

At a very fine grain level the brain's c. 86 billion neurons are subject to constant changes (neural loss and growth) and variations in energy supplies, and so the individual's brain is never in exactly the same state on two different occasions (FA Azevedo, et al., 2009) In other words, brain instability may cause random noise between occasions. The point they make here is that relative stability of performance over time is more concerning than instability or noise over occasions (personality over mood) and that given the existence of noise in repeated judgements by the same individuals, disagreement between individuals is inevitable. Kahneman, Sibony and Sunstein (2021) argue that measuring noise therefore requires deliberate efforts, since: "*Noise is inherently statistical: it becomes visible only when we think statistically about an ensemble of similar judgements.*" (p. 206).

As an advantage over measuring bias, they also state that noise can be measured even when the true value of the judgement task is unknown. To detect bias, one has to know what the right answer is, or “stand at the front of the target” so one can see the bullseye. Noise, however, requires no such particulars since is detectable no matter which side of the target you are standing on; all one needs to know is whether or not there is variability.

**Measuring and reducing unwanted variability**

Kahneman, Sibony and Sunstein (2021) use the metaphor of *decision hygiene* to describe the use of various techniques that can reduce noise in human judgement. They assimilate the idea to the situation in an operating theatre, where, if something goes wrong during surgery it is not necessarily because of scalpel misuse but because the highly skilled surgeon forgot to perform proper hand hygiene before entering. Noise reduction is seen as accompanying bias reduction and therefore can help address long-known but still persistent problems of bias as well. This is both because bias can be decreased as a direct result of noise reduction and because reducing noise will make bias easier to spot, since less variability in the data means less masking of the bias error. This however, could pressure decision-makers into having to decide whether to adopt rules and standards, which is often a decision as to which type of costs in terms of errors one is keenest to avoid: those costs caused by variance in judgement or the costs of errors introduced by rigid rules. The type of technique most suitable for the given situation depends on the type of judgement.

The proposed techniques can be categorised into two. One path is to aid judges in various ways, such as which factors they look at, how they weigh the different factors and how they use the scale in question. Drawing from Van de Ven and Delbecq's (1974) findings, when the first person to voice a view in a group disproportionately influences others, the proposed remedy to this issue is to have group members formulate their views individually before any discussion begins and then submit them. After submission and discussion, the recommendation is to have each individuals' (revised) views submitted for averaging. Conducting 'Noise Audits' is another key technique supported by the authors (Kahneman et al., 2021); noise audits can be performed in organizations where different judges routinely make judgements on many similar cases, anonymous and independent decisions are collected by professionals on carefully prepared fictive cases. The amount of 'noise' is then calculated. Judges and executives asked beforehand to reveal their confidence in their judgements and how much noise there will be, which the authors write can further increase the likelihood of "eye-opening" moments when the results are eventually presented to management.

An alternate path to decision hygiene is to replace human judgement with algorithms in full. In 1954, the prominent psychologist Paul Meehl (1954) showed that statistical models could predict human behaviour better than clinical psychologists do. Similarly, in medicine, or aviation, statistical models have long been shown to be superior to doctors in prognostic prediction and even clinical diagnosis (Jung J. et al., 2020), because those models can unbiasedly weigh multiple factors that humans cannot. Kahneman et al. (2021) therefore propose replacing human judges, with simple rules or algorithms, thus reducing occasion noise completely and therefore displaying less average error than human judges (Grove & Meehl, 1996).

**All the strategies weaved into one**

The Mediating Assessment Protocol (MAP) was developed by Kahneman et. al (2021) for particular judgement tasks and is based on the idea that by designing a structured assessment process and mediating the assessments of multiple assessors, it is possible to reduce the impact of noise on decision-making. With MAP, all their strategies are weaved into one and the technique is put forth to help ensure that all judges address all relevant aspects of the items to be judged and apply similar weightings to all the aspects. They argue that organizations of many different kinds should use MAP for group decisions that require considering and weighing multiple dimensions. An organization that is, for example, contemplating an acquisition would need to conduct individual assessments on the cultural, financial, and legal implications if they were to use this approach. They argue that this separation of evaluations offered through MAP is crucial because it requires thorough assessments of each aspect, which can then be used to form the basis of a final decision. This would not make the decision easier, they concede, but the emphasis on a good process will make the decision better.

The process consists of three main steps. First, one should identify the problem or decision that needs to be made. This involves defining the objective of the decision, determining the relevant criteria for making the decision, and identifying the stakeholders involved. Secondly, MAP requires one to design an assessment process that is tailored to the specific decision at hand. This involves identifying the sources of noise that are likely to affect the decision, designing a set of questions or tasks that will elicit the relevant information, and selecting the appropriate assessors. Finally, comparing the assessments of different assessors, identifying, and resolving any discrepancies or biases, and arriving at a final decision that takes into account the assessments of all the assessors.

Overall, the authors of these strategies raise the point that while professionals might be willing to acknowledge and correct bias in their judgements, they are far less willing to admit to the variance among judges or between judgements. They argue that MAP, noise audits, and other noise-reducing strategies raised in the work, can be applied to a wide range of decision-making contexts, including hiring, performance evaluations, and medical diagnoses, and could go far in helping to arrive at better solutions to operational problems.

**Critical Response to Kahneman's Approach**

Notwithstanding the positive feedback in the press, the numerous examples and the seemingly easy-to-follow methodology presented by Kahneman et. al in 'Noise' (2021), the book received a substantial amount of critique, notably, the work sparked significant discussions among experts and opinion leaders worldwide. Finance Minister Paschal Donohoe, for example, is quoted as stating that noise reduction may come "*at the expense of the diversity of thought and outlook that is central to human agency" and that "guiding decisions towards a central average can create vulnerabilities*" (The Irish Times, 2021).

Szreder (2021) notes that the authors have not been well-exposed to statistical science as evidenced by their questionable claim at a point in the book where they state that "*causation does imply correlation*" (Kahneman 2021, p. 143). Blastland (2021), Nguyen (2022) (hailing from medical field), Gelman (2013) (from political science), and Ortmann (2021) (psychology), challenged the point that the concept of noise in human judgement is presented as something new when the ideas of noise and bias have been explored by notable theorists such as Fisher (1920), Black (1986), and Deming (1940), way before Kahneman et al., and who dedicated their works to this matter. Fisher (1920) invented the analysis of variance that partitions the variation of measurement into two sources: between-group and within-group variation, where the between-group variation represents a signal and within-group variation represent noise. Similarly, Francis Galton had already demonstrated the power of the "wisdom of crowds" (Galton, F., 889), by proposing the noise reduction strategy of replacing individual judgements with the average from multiple judges.

Szreder (2021) further questions the necessity of coining new terms, such as "level noise" and "pattern noise," when existing terms such as "between-people variation" and "within-people variation" have already been accepted. Gilhooly and Sleeman (2022) share similar concerns, noting that the authors' use of the term "noise" may give the impression that randomness underlies inconsistency, which is not always the case.

Doherty et al. (2021) and Gilhooly (2022) consider that while Kahneman et al.'s focus on practical issues is appealing to a lay audience, they overlook classic approaches in Social Judgement Theory (Hammond, 1955) and Human Factors research, where complex human judgements play a large role. In Social Judgement

Theory, for instance, "level noise" between judges would be reflected in different constants in their best-fitting linear equations, while "pattern noise" would be explained by different weights for various attributes. "Occasion noise" could be effectively represented by the overall fit of the model to an individual. Gilhooly and Sleeman (2022) note that Kahneman et al.'s argument, that reducing noise reduces error, is perhaps not easy to follow, and is not intuitively obvious; nonetheless, they praise the fact that their argument is made clear by the use of diagrams. They also point to the fact that while the focus on the negative impact of inconsistency is understandable, not all inconsistency is unwelcome, particularly in group judgements where a degree of inconsistency can provide valuable diversity. Bland and Altman (1986) have addressed this issue in the medical domain, where judgements of the severity of a condition can have significant consequences depending on levels.

Overall, while “Noise” is a valuable contribution to the study of human judgement, the general feedback overlooks classic approaches to analysing judgement and raises some questionable claims.

## *2.4 The Role of Mood, Personality and Emotions in Decision-making*

The intricacies of decision-making have intrigued researchers for decades, with much of the focus traditionally placed on rationality and logic. However, a growing body of evidence suggests that our emotions, personality traits, and mood play substantial roles in shaping the choices we make. The notion that people's judgements are often biased in the same direction as their current mood state, has been supported by a wealth of research on personality and judgement, with the phenomenon often referred to as affective or mood congruence bias (Bower, 1981; Schwarz, 1983; Isen; 1984; Forgas; 1995; Forgas, et al.; 1984).

Theories, such as Gray's (1981; 1994) seminal approach to extraversion[8] and neuroticism[9], illustrated the central role of motivation and emotion in personality; these traits predispose people to experience more frequent and intense positive and negative affect, respectively.

Emotion-related individual differences seem to include processing biases that influence judgements, and these processes often involve the way people use affective information or mood states in making judgements (Clark & Teasdale, 1985; Rusting, 1998; Schwarz & Clore, 1983). Therefore, taking a closer look at personality characteristics can help explain why different people reach different conclusions even when experiencing the same emotions. Johnson and Tversky (1983) demonstrated this in a study which involved participants reading newspaper stories about tragic events, thereby inducing negative moods, which in turn seemed to bias people's judgements in a negative (pessimistic) direction. Personality traits tended also to impact aspects of individuals' knowledge management behaviours and academic performance (Esmaeelinezhad & Afrazeh, 2018; Mammadov, 2021). Tamir and colleagues (Tamir, Robinson & Clore, 2002) examined how quickly people can categorise words along evaluative dimensions and demonstrated that extraverts tend to classify objects as both desirable and undesirable more quickly when in positive moods, whereas people high in neuroticism classify both positive and negative words quicker when in negative moods. Similarly, Rusting's (1999)

[8] Extraversion is *"the quality of being outgoing and socially confident; the fact of enjoying one's company and being energized by social interaction."* – The Oxford Dictionary

[9] Neuroticism is defined as "a personality trait characterized by anxiety, fear, moodiness, worry, envy, frustration, jealousy, and loneliness." – The Oxford Dictionary

study found that participants were more likely to recall positive words from a list if they reported more state-positive affect and if they were extraverted. Moods seem to facilitate these judgements when they are consistent with a person's traits. Peters and Slovic (2000), Rusting and Larsen (1998), and Uziel (2006) sustain the idea that personality variables are important in mood-congruent [10] cognition, especially under natural mood conditions. Individuals' self-esteem levels also play a role in the extent to which they rely on their emotions when making judgements (Harber, 2004).

Individual behaviour is the result of an interaction between a person and a situation, a mixture of several unique personality traits that reflect a lifestyle, level of thinking, feeling, emotions, attitude, and acting. Individual personality differences are crucial when considering emotion and judgement generally, and whether or not emotions help decision-making more specifically. The influence of personality is sometimes mediated by how emotional states interact with personality, which can make emotions' influence helpful for some people and harmful for others (Ristvedt & Trinkaus, 2004) and the notion that Judgements and decisions may be easier to predict, even indirectly, through emotional states is supported by Nettle (2007) and Zelenski, (2007). Any professional responsibility an individual holds, therefore, not only significantly influences behaviour but can potentially have an impact on the organization as a whole. It is therefore essential to comprehend the different types of personalities and their potential effect on decision-making (Madhura, 2020).

[10] Mood congruence is *"The consistency between a person's emotional state with the broader situations and circumstances being experienced by the person at that time. By contrast, mood incongruence occurs when the individual's reactions or emotional state appear to conflict with the situation"* Source: https://en.wikipedia.org/wiki/Mood_congruence

## *2.5 Decisions under critical Conditions: The Case for Emergency Medicine*

The practice of Emergency Medicine in acute hospital care is a unique field of medicine characterised by inconstancy, uncertainty, variety, and complexity. The nature of emergency medicine and emergency departments is such that physicians experience many different forms of uncertainty. The unpredictable nature of emergency cases means that clinical staff are often required to make decisions under pressured ambient conditions. Medical professionals must make quick decisions under pressure while dealing with a variety of injuries and illnesses within narrow time windows (Zavala et al., 2018).

Cognitive sciences research has identified common biases that impact the thinking process, several of which also have implications for the practice of Emergency Medicine (EM) (Croskerry, 2000). Clinical outcomes in emergencies are the result of a complex interplay of organizational, systems, workload, time pressure, teamwork, individual, human factors, and case complexity, as noted by Zavala et al. (2018). The challenges of EM are further compounded by the emotional labour required to manage the precariousness of the role (Kirk & Edgley, 2021).

Indeed, the problem of human error in healthcare is well-documented. Wrong medical diagnoses, missed, or delayed make up a large fraction of all medical errors and cause substantial suffering and injury (Graber, 2005), with most errors being attributed to cognitive biases (Norman & Eva, 2010) and errors of omission or commission, as evidenced by Braddock et al. (1997). Despite using techniques and methods such as Root Cause Analysis to identify and mitigate the root causes of error, human error contributing to sentinel events persists (Deeter & Rantanen, 2012). Acute medical decisions are a clear example of decisions typically taken under time pressure, utilizing limited information, in an environment rich with interruptions and other unpredictable factors (Stone, 2019; Soola, 2022). Because the volume of patient admissions to an emergency department (ED) cannot be precisely planned, the available resources may become overwhelmed at times (“crowding”), with resulting risks to patient safety.

Therefore, to manage emergency departments effectively, triage systems are implemented in Hospitals around the world to assess the severity of incoming patients' conditions and assign treatment priorities effectively. The concept of triage emerged from the French Service de Sante` (Robertson-Steel, I., 2006) and the organisational structure necessary to manage the growing number of casualties in modern warfare. Eventually, in the 19th century, it served as hospital administration to overcome the unjust and medically unreasonable consequences of an unsystematic ad-hoc selection of casualties (Ellebrecht, N., 2019). The triage nurse is typically the first person a patient encounters when presenting for emergency care in the ED (AlMarzooq, 2020), therefore, knowledge of triage among nurses is one of the key elements of supervision and decision-making, if it is not carried out at stander level, the outcomes of care of patients and efficiency of ED get compromised. The triage nurse's decision about the acuity, or risk level, for each patient could therefore potentially result in multiple consequences, including the patient's initial prioritization of care and his or her room placement within the emergency department; it also affects on the amount of time that elapses before the patient is assessed by a provider.

Research efforts and adaptation of the triage system along the years saw the sector develop the Australasian Triage Scale (ATS), the Canadian Triage and Acuity Scale (CTAS), the Manchester Triage System (MTS), and the Emergency Severity Index (ESI) which are the four major kinds, with five-level triage systems being valid and reliable methods for assessment of the severity of incoming patients' conditions by nursing staff in the emergency department (Christ M, et al., 2010). Until today, however, triage systems are often applied incorrectly, (Moon., et al., 2019), with mis-triage over and under-triage rates being a well-known phenomenon, which in turn, increases mortality rates. Over-triage is believed to occur in unclear situations and to comply with normative demands "within" the strict margins of an administrative concept[11] (Tarnutzer, et al., 2017; Grossmann, et al., 2014; Rashid, et al., 2021; Rashid, et al., 2021). "*Better to over- than to under-triage*" is often used colloquially among health professionals as evidenced by Ellebrecht's (2019) research on the overestimation of treatment urgency.

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### *Recommendations to Reduce the Occurrence of Error in Acute Hospital Care*

As hospitals and trauma centres face increasing globalization, the resulting work ambiguity, and task complexity, introduce a need for greater managerial adaptability and speed (Dinur, A., 2011). Adhering to evidence-based recommendations by reputable experts and reliable scientific results from empirical studies could therefore save millions annually in funding to sustain trauma centres (Newgard, C. D., 2013a). Croskerry (2000) proposes a number of opportunities to overcome interdisciplinary, linguistic, and other historical obstacles to develop a sound approach to understanding how to think in EM, leading to a better awareness of cognitive processes and an improved capacity to teach effectively about cognitive strategies. However there is still limited evidence which suggests that strategies directed at encouraging both kinds of reasoning (System 1 vs System 2[12]) will lead to limited gains in accuracy. In practical terms, Dirik, H. F., et al. (2019) demonstrated that nurses can identify medication errors, but are reluctant to report them, with fear of the consequences being the main reason given. When errors are reported, it is likely to be to physicians and not nurses. In an attempt to capture and reduce the occurrence of an error, critical care practitioners are therefore encouraged to apply debriefings with colleagues to mitigate the adverse feeling after medical errors (Kaur, 2019); re-organise and re-design healthcare spaces (Kirk et al., 2022); request second opinions (Clayton, et al., 2022; Klein & Mccoll, G. et al. 2019), and adopt a positive attitude toward evidence-based practice, medical error literature, self-improvement and development (MAJID et al., 2011; Handler et al. 2000; Vickrey et al., 2010; Hartigan et al., 2020).

Ashby and Smith (2000) argue that the natural statistical framework should ideally be a Bayesian approach to accompany decision-making and should be incorporated in routine decision-making, whilst training programs and standardisation of processes to strengthen Triage Decision-Making (TDM) skills were suggested as implementation measures to improve sustainable under/over triage rates by Soola et al., (2022) and Escobar Jr., Morris (2016)

The recommendations featured above and in studies such as Singh et. al, (2016) proposed to the World Health Organization (WHO), call upon key stakeholders to

[12] Kahneman's thesis is a differentiation between two modes of thought: "System 1" is presented as fast, instinctive and emotional; "System 2" is slower, more deliberative, and more logical in "Thinking, fast and slow. (2011) New York :Farrar, Straus and Giroux,

come together from multiple disciplines to address the many common challenges and opportunities. A number of sources however, confirm that is unlikely that a ‘magic bullet’ is found and the need for a multifaceted approach is therefore demanded to understand and address the many systems and cognitive issues involved in ‘diagnosing’ diagnostic error (Singh, Schiff GD, Graber ML, *et al.*, 2017).

## *2.6 Research Questions and Hypotheses*

In organisations where recurrent critical decisions are taken, such as hospitals, and specifically within emergency departments, management would typically ask questions about the operational and administrative aspects related to the current patient volume, average wait time, resource shortage and safety issues, to name a few. These questions help management evaluate the effectiveness of current policies and procedures, identify areas for improvement and thereby resulting in a significant impact on staff performance.

On the basis of the research goals and review of the literature, the following questions, dealing with the performance aspects of the individual practitioners were developed to guide the research investigation:

> *i. To what extent do professional nurses differ in their judgement of emergency case scenarios?*
>
> *ii. To what extent do professional nurses vary in their own judgement of emergency case scenarios?*
>
> *iii. To what extent does personality play a role in judgemental variability?*

Following Itiel Dror's[13] series of noise audits (Kahneman et. al., 2021) and his credo that "wherever there's judgement there must be noise", two hypotheses were formed and tested. It was first hypothesised that professional nurses are more prone to make mistakes under time pressure when judging emergency cases, it was also envisaged that the aggregate error, in the form of variance from the true value for the experimental groups, will be higher than that of the control group. The ultimate scope was to record the extent and impact of intra and inter-subjective variability across different judgements. Secondly, it was also hypothesised that participants personality traits could possibly play a pivotal role in judgemental variability.

[13] Dror, I., Melinek, J., Arden, J. L., Kukucka, J., Hawkins, S., Carter, J., & Atherton, D. S. (2021). Cognitive bias in forensic pathology decisions. In Journal of Forensic Sciences (Vol. 66, Issue 5, pp. 1751–1757). Wiley. https://doi.org/10.1111/1556-4029.14697

# 3. Method

Preliminary data gathering and exploration of a poorly understood subject can be pursued through exploratory research. This approach aids in the formulation of more refined hypotheses and research questions for subsequent studies (Strauss & Corbin, 1990). Moreover, interdisciplinary research efforts can offer fresh insights into a research problem and may uncover previously unnoticed connections and insights.

In this case conducting medically-related research can take different paths, with researchers positioning themselves as either insiders, such as medical practitioners, or outsiders, such as non-practitioners. Insiders have direct access to patients and clinical settings enabling them to collect data efficiently, notwithstanding the fact that they must navigate ethical challenges, such as maintaining patient confidentiality (Brown, 2018). Outsiders, on the other hand, might face barriers in gaining access and should establish partnerships or rely on existing datasets; they may not face the same ethical dilemmas, but can provide a more objective, less biased viewpoint.

This study adopted an outsider's, non-practitioner stance and employed a comprehensive methodology to investigate any unwanted variability by emergency nurses' judgements of emergency cases in a simulated environment. The method incorporated a lab-type approach, combining Likert scales to measure data quantitatively and open-ended post-judgement questions to support the participants' choices. Through utilizing this multifaceted methodology, a deeper understanding of the participants' decision-making process can be achieved.

## *3.1 Study Design*

Experimental designs involve using several treatment groups, having each receive a unique treatment, and then measuring and comparing outcome. An experimental, blinded, randomised controlled trial using Simulation-Based Research (SBR) methods and involving a control group and two experimental groups was deemed best to address the hypotheses and fit the purpose of this study[14]. Creswell and Creswell (2017) stress the importance of this qualitative phase in exploratory

[14] Refer to Annexes Figures and Tables, Figure B.8 "Methodological Appropriateness"

research, highlighting how it provides the foundation for more structured, hypothesis-driven research.

The research utilised the implementation of a tailor-made web-application research software and sessions were carried out at the hospital administration building and University campus. The system was purposely programmed and customised, and it allowed participants to self-report and rate their mood, score triage judgements on fictitious emergency cases and provide a justification through open-ended responses, and finally share details about their personality traits. Participants were not allowed to interact with the implementation and academic personnel on the setup and configuration.

## *3.2 Sampling*

A voluntary response sampling technique was used as the Malta Emergency Nurses' Association's (MENA)[15] committee was formally contacted and to help recruit 24 emergency nurses currently working in Malta as Charge Nurses or Staff Nurses. Direct recruiting or 'hand-picking' was avoided to reduce instances of bias, namely social desirability bias. As to the inclusion and exclusion criteria, participants were required to be presently working at Mater Dei Hospital in Malta (the main hospital on the island). Roles eligible to participate in the study included Charge Nurses or Senior Staff Nurses. Students, research nurses and practitioners working in Gozo or hospitals other than Mater Dei as well as Ambulance staff were excluded.

MENA assisted by sending communications in the form of emails and triggered word-of-mouth, informing, and inviting its members occupying the role of emergency nurses to participate. Initially, no information about this list was provided (in line with data protection constraints). The communication contained official information about the study and a link to an online form asking potential respondents to submit their personal details, academic qualification, and work experience, and, in doing so, confirm their interest[16].

[15] The Malta Emergency Nurses Association (MENA), https://maltacvs.org/voluntary/the-maltese-emergency-nurses-association

[16] Refer to Annexes, C.3 – Participation form (and consultation)

A unique code was assigned to each participant to maintain anonymity. Upon filtering the list for eligible participants, personal characteristics (such as name, age, and gender) were eventually blinded to produce objective judgements at a later stage in the research, therefore reducing the chances of halo effect[17] and social desirability bias by assuring anonymity when answering questions. Ethics approval was sought from the Faculty Research Ethics Committee (FREC)[18] at the University of Malta and informed consent was obtained from participants at the beginning of each simulation session[19]. Participants contributed out of their time, and voluntarily. This neutral, non-polarised, incentive-free approach allowed for gather a pool of participants with specifically defined characteristics and with a genuine will to contribute.

## *3.3 Drafting and development of hypothetical vignettes*

A total of 15 synthetic patient cases were drafted and finalised by three consulting doctors, all specialising in emergency medicine[20] (5 cases assigned to each medic). Emergency triage level in the form of case priority[21] was assigned according to the Emergency Severity Index (ESI) and based on the triage scoring ratio identified from the data on casualty admissions provided by Mater Dei hospital management [22], for the period 2018-2020. It was also decided to exclude any reference or fictitious symptoms related to COVID-19 cases to circumvent any memory recall to ESI algorithms deployed to adapt and cater specifically to handle the COVID-19 situation. Paediatric cases were excluded since the statistics related to minors provided by the hospital's management indicated that their influence on the scores was negligible.

European hospital administrations, emergency departments and emergency nurses' associations were contacted to provide relevant statistics[23] which could help compare Malta's figures to the rest of Europe, however, given the incomplete, incongruent and unreliable data, no common trends were identified in casualty admissions or severity among EU Member States.

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[17] The Halo Effect is the tendency for an impression created in one area to influence opinion in another area, Thorndike, E.L. (1920).

[18] REDP Application ID FEMA-2021-00221

[19] Refer to Annexes, C.5 - "Consent Form(s)

[20] Refer to Annexes, B.3 – *"Collaborator Consent Forms"*

[21] Refer to Figure B.2: Emergency Nurses Association, ESI Triage Algorithm version 4

[22] Refer to Annexes, D.1 - *"ED Visits by ESI Categories"*

[23] Refer to Annexes, D.2 - *"EU27 Hospital ED Statistics"*

Details such as underlying conditions, medical history and vital signs were also included in the hypothetical vignettes; patient personal data and background information such as education, ethnic origin, age, gender expression and sexual orientation, genetic information, political opinion, and economic status were omitted to reduce the chance of any unwanted form of bias. To avoid the chance of priming participants the use of imagery was excluded, and, before implementing the vignettes in the web application, testing for reliability was carried out as is deemed essential to minimise potential sources of error in research projects to ensure the reliability and validity of findings (McHugh, 2012). Studies must therefore include procedures that measure agreement among the various data collectors, that is, interrater reliability. Two of the most common measures, Percentage Agreement and Cohen's Kappa were considered, and the former method was chosen since it was deemed that the consulting doctors had sufficient experience in serving in an emergency setting (approximately 5 to 8 years) and therefore little guessing was likely (Mc Hugh, 2012). Each consulting doctor validated the others' cases. A matrix was created [24] in which the columns represented the different raters - the rows represented cases drawn up by the raters; the cells in the matrix contained the scores the data collectors entered for each variable. An overall agreement level of 93% was achieved.

### *Development of a Tailor-made Web Application (Web App)*

The 12 cases for which full agreement was reached were subsequently included in a web application in vignette format. A fellow researcher voluntarily developed the application[25] using Python[26]; the web interface and client level processing were developed in HTML[27], CSS[28] and JavaScript[29]. In line with the research hypotheses, three separate modalities were developed within the application – one flow was free from any time constraints or distractions, the second included a time restriction of 18 minutes (90 seconds per case), whilst the third modality flashed coloured labelled plates as a distraction (the Stroop Effect) in addition to the time limit.

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[24] See Annexes, *"Table B.1: Interrater Agreement Exercise - Results"*

[25] Refer to Annexes B.3, *"Collaborator Consent Forms"*

[26] What is Python? Executive Summary, https://www.python.org/doc/essays/blurb/

[27] HTML (Hyper Text Mark-up Language), https://en.wikipedia.org/wiki/HTML

[28] CSS (Cascading Style Sheets), https://en.wikipedia.org/wiki/CSS

[29] JavaScript, https://en.wikipedia.org/wiki/JavaScript

## *3.4 Stress as emotional activation and protocols for stress induction*

To ensure both accurate physiological results and ethical treatment of research participants, it is preferred to create a controlled and manageable emotional stressor that induces significant emotional stress when studying the physiological effects of sudden arousing and negative emotional events (Brouwer & Hogervorst, 2014). Whereas stress is a widely used term and is defined in multiple ways, depending on the areas of study that address it, the term stressor refers to “any environmental demand that creates a state of tension or threat (stress) and requires change or adaptation (adjustment) (Morris, Maisto 2014).

Ortega Ferreira’s remarks (Ferreira, 2019) were taken into consideration when considering the criteria for environmental stimuli to transform into emotional activators. Novelty (Rose, 1980) unpredictability (Mason, 1968) and lack of control (Sapolsky, 1993) and threat of potential harm or loss (Blascovich, Tomaka,1996) were singled out in her 2019 study on the design of non-invasive procedures. This poses a challenge for researchers considering the need to create protocols for stress induction that meet all ethical standards and generate a sufficient level of stress to evaluate the effects of this variable memory, and should therefore be taken with great caution to avoid generating long-term negative effects on subjects.

### *Implementation of Time Pressure and Distraction Protocols*

Two tests which were designed to induce stress in humans and can be useful tools in simulation-based experiments are the Cold Pressor Task (CPT) and the Trier Social Stress Test (TSST). Both enjoy high acceptance by the scientific community and widespread use in psychology and neurosciences (Krischbaum et al. 1993; Coan, 2006). Alternative protocols are designed from a combination of traditional procedures or involve the execution of specific tasks (such as the Sing-a-song-Stress-Test and Montreal Imaging Stress Test). The Stroop Colour and Word Test (SCWT) which has demonstrated its easy and economical application, and effectiveness (Ortega Ferreira, 2019), consists of presenting plates on which the

words “YELLOW”, “RED”, “BLUE” and “GREEN” are written in different colours that do not correspond to the one express in the text.

The SCWT was deemed as the best option to serve this study, popping up as a fictitious distraction while participants judge emergency cases, thereby mimicking real-life scenarios (Figure A.4). The virtual nudge drives the participant to read the text, while trying to avoid mentioning the colour in which it is written to be able to proceed. This test is applied in different clinical and experimental contexts; in the case of the study of the effects of stress, it is used to demonstrate that it produces an increase in the reactivity of blood pressure (Gianaros, et al. 2005). Time pressure protocols (such as a countdown timer) typically involve imposing time constraints on participants as they complete a task or make a decision. Their use has also been found to elicit a range of physiological and psychological responses, including increased heart rate, heightened arousal, and decreased performance (Nater, et al., 2006; Staal, 2004).

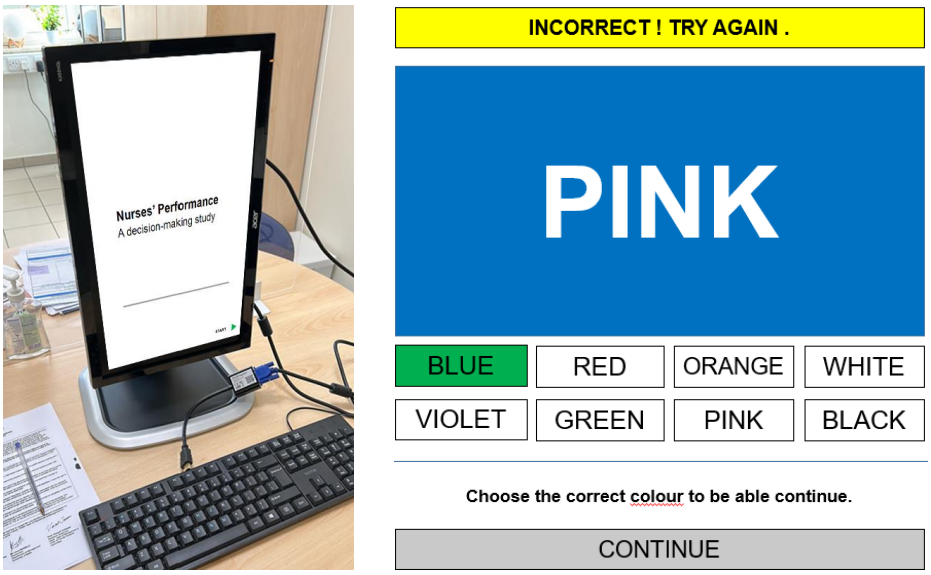



**Figure A.4 - An illustration of the experiment set-up (left) and the Stroop-styled prompt (right)**

## *3.5 Measuring the Effect of Mood and Personality*

While personality studies tend to focus on an individual's traits and behaviour within the context of their environment over an extended period of time, it is worth noting that our daily moods can also significantly affect our actions, thoughts, and emotions (Bower, 1978; Isen, & Daaubman, 1984; Larsen, et al., 2001). In dealing with perceptions and measures of personality, the Big Five Personality Traits (also

referred to as the Five Factor Model) of openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (Costa & McCrae, 1992) are widely accepted for describing human personality by academics and researchers. Empirical studies have demonstrated that these traits are relatively stable across time and cultures and can predict various outcomes such as job performance (Barrick & Mount, 1991), academic success and health (Poropat, 2009).

An alternative tool is the Myers-Briggs Type Indicator (MBTI); a personality assessment method based on the theories of Carl Jung (1923) which categorises individuals into one of 16 different personality types. It gained traction in the fields of career counselling and team building (Quenk, 1993), (Boyle, Saklofske, & Matthews, 2014), however in contrast with the Big 5 model, it measures four dimensions of personality: extraversion vs. introversion, sensing vs. intuition, thinking vs. feeling, and judging vs. perceiving (McCrae & Costa, 1989). As opposed to the Big 5 model, the MBTI is based on theoretical concepts and suggests that individuals can change their preferences over time (Pittenger, 2005) and have been criticised for lacking scientific validity and reliability (Pittenger, 1991; Martin, 1997).

Empirical research has demonstrated that both mood and personality can be measured through various methods, including self-report questionnaires such as the Newcastle Personality Test (NPT) (Nettle, 2007) and the Positive and Negative Affect Schedule (PANAS) or the Brief Mood Introspection Scale (BMIS) (James A Russell, 1980). NPT assesses personality across the Big Five domains. The test is built using a Likert-type rating scale, from 1 (strongly disagree) to 5 (strongly agree) where participants are asked to rate how strongly they agree or disagree with a series of statements about themselves. The statements are designed to assess various aspects of personality, such as behaviour, emotions, and attitudes[30].

The PANAS, developed by Watson, et al. (1988), is a widely used self-report questionnaire based on the assumption that positive and negative affect are separate constructs and can coexist in an individual (Jeff T Larsen, 2001; Eshkol Rafaeli, 2007). The questionnaire consists of two subscales, one for positive affect and one for negative affect. The foremost subscale includes items such as ‘enthusiastic’, ‘interested’, and ‘alert’, while the latter affect subscale includes items

[30] Refer to Figures and Tables, Figures B.6

such as ‘afraid’, ‘upset’, and ‘nervous’. Respondents are asked to rate how often they experienced each emotion in a given period (usually the past week).

Researchers have used both methods to investigate the effect of mood and personality on various outcomes, such as decision-making, cognitive performance, and physical health. One way to measure the effect of mood using PANAS is to administer the questionnaire before and after a mood induction task (Rowe et al., 2007) or compare scores on the questionnaire between groups (Vargas et al., 2019). For this study, the PANAS and the NPT were chosen as tools to measure participant characteristics. The latter was used to examine any effect or relationship of individual traits with other measures (case judgements); while the former served to obtain a pre-test baseline measure of the participants’ mood state across the three (3) groups.

## *3.6 Procedure*

Participants were instructed to assume the role of an Emergency Nurse who is preparing to see 12 patients in one of the country's main Hospital's Emergency Department, in a research exercise titled 'Emergency Nurses Performance – A Decision-Making Study'[31]; the terms 'diagnostic', 'prognostic' and 'errors' were excluded. Participants were advised to treat the session as they would in a real-life clinical scenario. Each participant was asked to judge and subsequently review 12 synthetic patient cases. The order of the cases was randomly assigned so that the possibility of learning the sequence and interaction between participants was reduced and the assigned experimental group/group type was never disclosed to the participants throughout the course of the study. Table A.1 demonstrates the order of procedures during the simulation sessions.

| **Activity** | **Control Group [C]**<br>Duration (minutes) | **Experimental Group I [E1]**<br>Time Limit Duration (minutes) | **Experimental Group II [E2]**<br>Time Limit + SCWT Duration (minutes) |
|---|---|---|---|
| a) Informed Consent and Introductions | < 5 | < 5 | < 5 |
| b) Participation Instructions (Welcome, Consent) | 2 | 2 | 2 |
| c) PANAS Mood Test | < 5 | < 5 | < 5 |
| d) Pause (Section separator) | < 1 | < 1 | < 1 |
| e) Practice Case Judgement | *Indefinite* *(until complete)* | 1.5 | 1.5 |
| f) Pause (Screen/Section separator) | < 1 | < 1 | < 1 |
| g) Emergency Case Judgement (12 cases) | *Indefinite* *(until complete)* | 18 | 18 |
| h) Pause (Section separator) | < 1 | < 1 | < 1 |
| i) Emergency Case Review (12 cases) | *Indefinite* *(until complete)* | *Indefinite* *(until complete)* | *Indefinite* *(until complete)* |
| j) Pause (Section separator) | < 1 | < 1 | < 1 |
| k) NEWCASTLE Personality Test | < 5 | < 5 | < 5 |
| ***Total*** | **~ 65 mins.** | **~ 55 mins.** | **~ 55 mins.** |

**Table A.1 - The order of procedures during the simulation sessions**

[31] Refer to Annexes C.2 – Information Letter, and Figures and Tables, Figures B.3 – B.6

All the inputs and participant submissions were recorded and saved on a server and aligned in a .csv[32] file ready to be exported and analysed. Before the session, the participants were verbally informed of the sequence of the study by the facilitator as per protocol[33]. Participants were instructed to read this document at the beginning of each session. A study facilitator was present throughout each session to ensure data collection procedures were adhered to and restart the session in case any technical issues or unwanted distractions arose. The session kicked off with the participants completing the mood introspection test. Participants in groups E1 and E2 were given 18 minutes to judge all cases i.e., an average of 1 minute and 30 seconds per patient (mimicking the real-life time pressure of an emergency nurse tasked with this responsibility). Cases appeared randomly on the screen. The sessions concluded with a personality test[34]. Taking into account all the study procedures, each session lasted approximately 1 hour.

[32] CSV = Comma-separated values file

[33] Refer to Annexes C.4, “Experiment Protocol”

[34] Refer to Figures and Tables, Figure B.6.

# 4. Results

## *4.1 Population description*

A total of fifteen eligible (15) professional emergency nurse practitioners participated in this study, out of a total number of forty-two (42)[35] who had officially confirmed their interest directly via the online form[36] or through MENA[37]. The pilot project was carried out across the span of 10 months (June 2022 to February 2023)[38]. Unfortunately, and due to various constraints and limitations which will be discussed further in the following chapter, both the response rate and the participation rate did not qualify as 'representative' of the whole Emergency Nurses population in Malta and Gozo. Given the exploratory and experimental nature it was deemed fit that the project should still move forward despite not reaching the initial desired participation rate of twenty-four (24) Emergency Nurse practitioners.

*

| | C | | | | | E1 | | | | | E2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sex** | F | F | F | M | M | F | M | M | M | M | M | M | M | F | M |
| **Age** | 26 | 26 | 30 | 29 | 35 | 27 | 30 | 25 | 28 | 29 | 39 | 31 | 25 | 28 | 34 |
| **Work XP - Healthcare (Years)** | 3 | 3 | 9 | 10 | 6 | 3 | 6 | 3 | 5 | 11 | 5 | 4 | 2 | 5 | 14 |
| **Work XP - Emergency (Years)** | 3 | 3 | 9 | 5 | 6 | 3 | 1 | 3 | 5 | 8 | 5 | 4 | 2 | 5 | 1 |
| **Academic Level** | 6 | 6 | 5 | 5 | 6 | 6 | 6 | 6 | 7 | 6 | 7 | 6 | 6 | 6 | 6 |
| **Role** | SN | SSN | SN | SN | SN | SN | SSN | SN | SN | SN | SSN | SN | SN | SN | SSN |
| **Study Recall (Yes/No)** | N | N | Y | N | Y | Y | N | N | N | N | N | N | N | N | N |

**Table A.2 - Demographic Data**

Five (5) participants were randomly allocated to each group (Table A.2). The eldest participant was 39 years old and the youngest was 25; the mean age was 29 (SD = 3.96 years). Five (5) identified as female, whilst ten (10) were male. All participants practised in an emergency setting during the time the study was conducted[39]. Twelve out of the fifteen participants (n = 12, 80%) had at least 5 years of experience as healthcare practitioners; ten participants (n = 10, 67%) had at least 5 years of experience as emergency nurses. Eleven nurses performed the role of Staff Nurse (n = 11, 73%) while four occupied the role of Senior Staff Nurse (n = 4,

[35] 42 interested participants comprising 37 working at Mater Dei Hospital, and 5 at Gozo General Hospital.

[36] Refer to Annexes, C.3 - *"Participation Form (and consultation)"*

[37] The Maltese Emergency Nurses Association

[38] Refer to Figures and Tables, Figure B.1 - Research Project Timeline

[39] Student and/or practice nurses did not qualify to participate and were therefore excluded.

* Note: C, E1 and E2 denote abridged references to the terms Control, Experiment 1 (E1) and 2 (E2)

27%). All participants were academically qualified at EQF[40] Level 6 or higher except for 2 participants (MQF Level 5); the majority (n = 11, 73%) did not remember participating in similar research studies.

| | C | | | | | E1 | | | | | E2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PANAS +VE | 38 | 27 | 38 | 38 | 31 | 40 | 31 | 27 | 33 | 39 | 33 | 31 | 37 | 36 | 35 |
| PANAS -VE | 11 | 11 | 13 | 14 | 14 | 13 | 19 | 23 | 14 | 15 | 12 | 10 | 12 | 10 | 12 |

**Table A.3 – Positive and Negative Affect Scores (Mood) at Baseline**

Mood state was considered as a variable, which could affect the performance outcomes of the case judgements, so upon commencing the sessions, participants were asked to rate their current mood state (via the BMIS) and in response to the question 'How are you feeling right now?' an overall mean score of 34 reflected a general tendency towards high positive effects, whereas, with regards to levels of negative affects, a mean score of 14 was recorded among all the groups.

## *4.2 Professional nurses' differences in their judgement of emergency case scenarios*

Variability can be seen at many levels; in this case, inter-subjective variability was the main focus in an attempt to capture the extent of any differences in judgement among the different groups, whilst intra-subject variability was considered to capture the extent of variation of the individual judgement of professional nurses across all the cases.

[40] European Qualifications Framework (EQF), https://europa.eu/europass/en/european-qualifications-framework-eqf

| | C | | | | | E1 | | | | | E2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Case 1 - Priority 1 | 0 | 0 | -1 | 0 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Case 2 - Priority 2 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | -1 | 0 | 0 | 0 |
| Case 3 - Priority 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Case 4 - Priority 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Case 5 - Priority 2 | 0 | -1 | 0 | -2 | 0 | 0 | 0 | -1 | 0 | 0 | -1 | -2 | 0 | 0 | 0 |
| Case 6 - Priority 2 | -1 | 0 | -1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Case 7 - Priority 3 | -1 | 0 | 1 | -1 | 0 | 1 | 1 | 1 | -1 | -1 | 0 | -1 | 0 | 1 | -1 |
| Case 8 - Priority 3 | 0 | 0 | 0 | 0 | -2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Case 9 - Priority 3 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| Case 10 - Priority 4 | 0 | 2 | 0 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 2 | 2 |
| Case 11 - Priority 4 | -1 | 1 | 0 | 0 | -1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Case 12 - Priority 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| EXTRAVERSION | 3 | 2 | 7 | 2 | 7 | 4 | 10 | 7 | 8 | 8 | 6 | 6 | 6 | 9 | 9 |
| NEUROTICISIM | 9 | 7 | 4 | 6 | 3 | 8 | 4 | 8 | 6 | 7 | 7 | 7 | 4 | 6 | 7 |
| CONSCIENTIOUSNESS | 2 | 8 | 7 | 7 | 8 | 7 | 7 | 5 | 7 | 5 | 9 | 8 | 5 | 5 | 7 |
| AGREEABLENESS | 14 | 10 | 13 | 11 | 13 | 12 | 15 | 15 | 13 | 14 | 12 | 15 | 9 | 12 | 12 |
| OPENNESS | 14 | 8 | 8 | 5 | 6 | 9 | 11 | 9 | 10 | 13 | 10 | 9 | 7 | 11 | 12 |

**Table A.4 – Judgement Deviations from the True Value and Personality Trait Scores from the NPT**

Overall, a total of 22 errors, in the form of variance from the stipulated triage score, were captured for the control group (C), more than E1 and E2, with sixteen (16) and fourteen (14) respectively. Cases with highest rate of variance (disagreement with consulting doctors' priority assignment) were cases 7, 9, and 10. Fewer errors were detected for group E2. Notwithstanding the data above, no significant correlations or findings related to inter-subjective variability could be inferred. A significance level was achieved when the Greenhouse-Geisser [41] test was applied to assess intra-subjective variability. It resulted that participants did vary individually in their own judgement consistently across all cases and among all groups (Sign. <.001, Effect size = .328). The findings from the qualitative analysis which follow, corroborate with this finding.

Concerning the scores on personality traits, conscientiousness and agreeableness were the two traits which characterised participants' personalities overall, followed by extraversion. Openness and neuroticism were the traits which accumulated the lower NPT scores in aggregate and among all groups. It cannot be inferred or

[41] The Greenhouse-Geisser test is used to assess the change in a continuous outcome with three or more observations across time or within-subjects. In most cases, the assumption of sphericity is violated for this type of within-subjects analysis and the Greenhouse-Geisser correction is robust to the violation. https://www.scalestatistics.com/greenhouse-geisser.html

concluded that findings related to personality had any direct effect on the observed variances.

## *4.3 Qualitative Data Analysis*

Qualitative methods are often exploratory in nature: they are used to gain a better understanding of underlying feelings, opinions or motivations. Thus, qualitative methods are particularly useful in obtaining stakeholder perspectives in their own words (Can J, 2015; Bradshaw, C et al., 2017). Jennings (2005) identified numerous ways by which research of open-ended responses and feedback materials may be analysed. This study adopted content analysis as a secondary analysis tool to sustain the primary quantitative findings. This research tool is often employed in the early stages of exploratory research to gain a deep understanding of a topic, identify variables, and frame subsequent quantitative investigations (Denzin & Lincoln, 2018).

Participants were encouraged to provide unstructured, narrative responses, offering a rich source of qualitative data.

The figures in Table A.5, relate to the length of each case justification representing the composition of the full responses, which were extracted from the web application; responses were listed, and occurrences were recorded.

| | C | E1 | E2 |
|---|---|---|---|
| Total Characters | 5,790 | 9,999 | 6,920 |
| Average Words per Case | 21 | 35 | 25 |

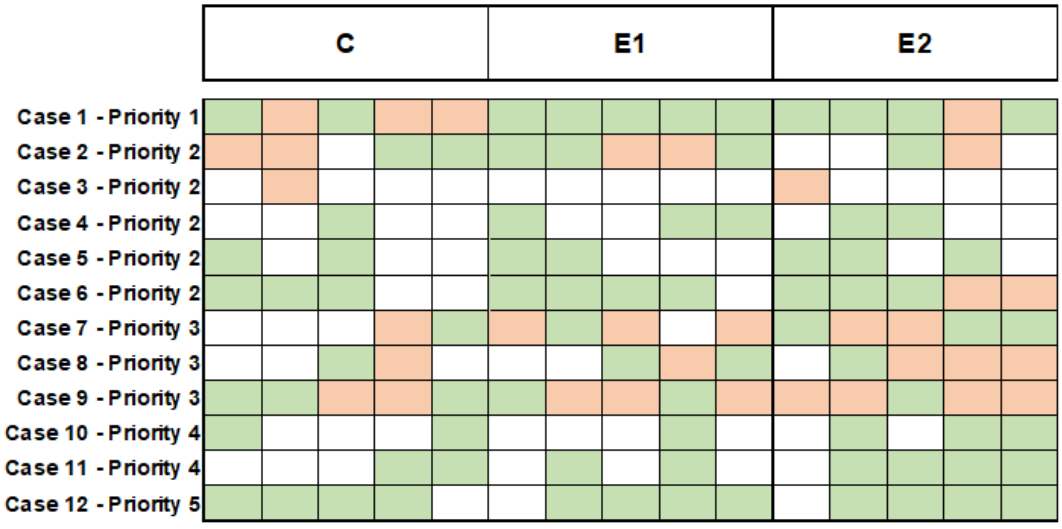
**Table A.5 – Total characters and average words used per case by each group to justify judgements**

As a general first observation, when the descriptive data were analysed, it resulted that fewer words per case justification were used by participants in the Control group (n = ~21) than by participants in E1 (n = ~35) and E2 (n = ~25)[42] .

[42] Refer to Annex H.1, 'Participant Responses'. The calculation was based on the statistic that the average word in the English language is 4.7 characters (http://norvig.com/mayzner.html).

## *4.4 Consistency in Justifying Judgements*

Eighty-one (n= 81) reasons out of 180 (~45%) which were submitted to justify case judgements, and extracted from the open-ended responses, contained consistent elements - such as ‘requires oxygen support’, ‘not urgent’, ‘requires imaging/scan’, ‘does not require more than one resource’, ‘dermatological referral’ – whereas 18% of the reasons given across the three groups (n = 33) consisted of alternate reasons. This is illustrated in Table A.6. By contrast, 18% consisted of an alternate reason. Seventy-six reasons submitted (42%) were different from both a possible correct and an alternate justification. Groups E1 and E2 were more consistent in their reasoning than the Control group, with E2 being the clearest in keeping to consistent or possible alternate reasons for their judgement. Case numbers 1, 5, 6, 9, 11 and 12 received the reasons with the most consistent or alternate justifications for the case judgement[43].




| | C | E1 | E2 |
|---|---|---|---|
| Consistent | 23 | 29 | 29 |
| Alternate | 10 | 9 | 14 |
| Other | 27 | 22 | 27 |

**Table A.6 – Type of Justifications given across all cases and groups**

[43] Refer to Annex H.1, “Participant Responses” for detailed responses.

### *4.5 Observations outside the main research scope*

In addition to the findings outside the main scope of the study, the session duration for each cohort was considered as illustrated in the box plot (Figure A.5). It was observed that the duration for E2 varied between 24 minutes and 48 minutes with a median duration of approximately 23 minutes; E1 between 24 minutes and 48 minutes with a median duration of approximately 36 minutes; and C between 16 minutes and 41 minutes, with a median duration of approximately 24 minutes.

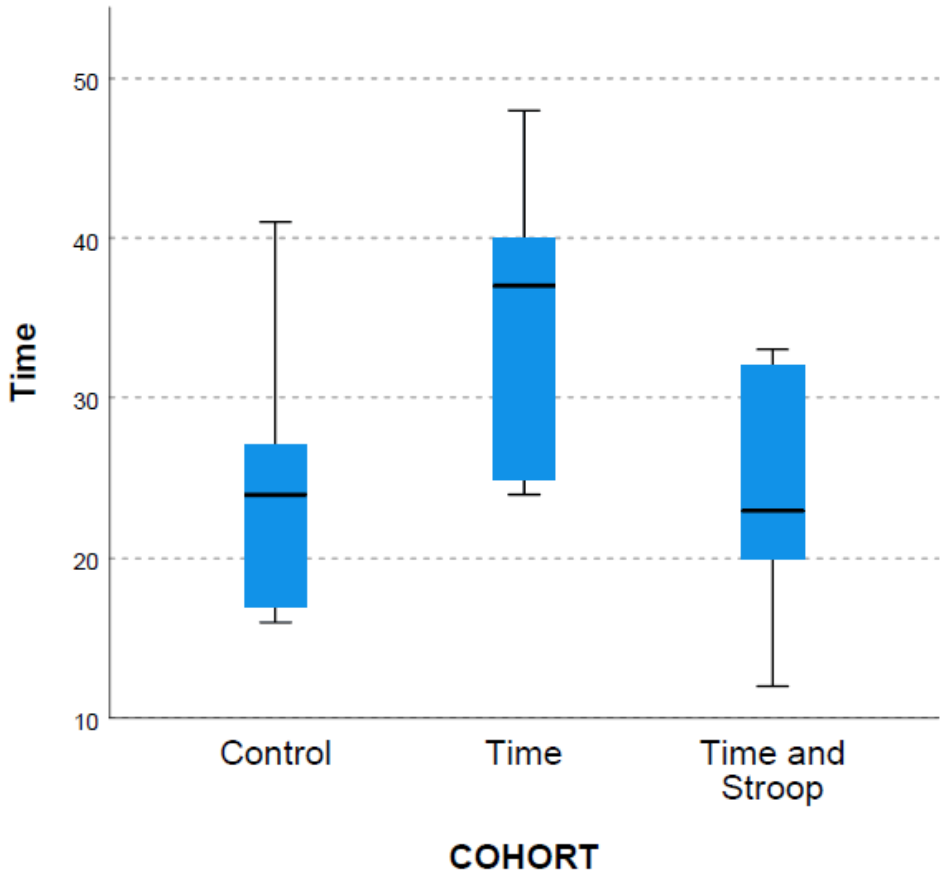



**Figure A.5 – Minimum, Maximum and Median Time Taken for each Group**

## *4.6 Summary*

The results obtained in this dissertation provide a foundation for the subsequent discussion, shedding light on the research questions and hypotheses that were initially posed. The limited resources, sample size and short duration of the study were notable constraints that may have compromised the validity of our conclusions. Consequently, the acceptance of both hypotheses should be partially withheld, until further research investigations are carried out. By linking the results to existing literature and theoretical frameworks, the discussion section will provide a deeper understanding of the research topic, putting forth implications of the findings. Furthermore, the discussion will not only highlight the contributions made by this study but also identify potential avenues and implications for further research, thereby ensuring the progression of knowledge in the field.

# 5. Discussion

The complexity of hospitals as multifaceted organizations necessitates the use of simulations to understand and evaluate their operations and multidimensional phenomena. This complexity has far-reaching implications for delivery of patient care, organisation structure, hierarchies, workflows and resource management, and can be attributed to several factors, including the diversity of healthcare services provided, the interaction of various stakeholders and the intricate web of regulations and policies, to ensure patient safety and quality of care. Compliance with these regulations demands a significant allocation of resources, adding another layer of complexity to hospital management.

It is imperative therefore, to recognise that simulations and simulation-based research in this domain may fall short of replicating the intricate real-world dynamics. As articulated by Sterman (2000), such models often simplify reality, omitting numerous nuanced interactions, which can lead to oversights in decision-making. Furthermore, Van Breda and Verbraeck (2014) emphasise that the accuracy of simulations depends on the quality of data and underlying assumptions. The limitations in replicating the real world, acknowledged by Pidd (2004), underscore the challenge of incorporating all variables, rendering complete emulation an elusive goal. Researchers and policymakers, therefore, should approach simulation-based findings with caution, keeping in mind the inherent discrepancies between these models and the complex reality of hospital operations.

## *5.1. Interpretation of Key Findings*

This dissertation embarked on a profound examination of hypotheses that, despite initial promise, did not find substantial empirical confirmation. This discussion aims to contribute to the scholarly dialogue by shedding light on the intricate relationship between theory and reality, acknowledging the humbling nature of unmet expectations, and emphasizing the importance of future research endeavours. Results unveiled variances in judgements from the selected sample in a simulated environment. Errors were ‘captured’, thereby providing management and stakeholders (both practitioners and non-practitioners) in healthcare with valuable

insights and an opportunity to grasp the potential problematics to delve deeper into investigating root cause analysis.

### Professional nurses' difference in their judgement of fictitious emergency cases

Confounders (e.g., time pressure) increase the chances of error in judgement, however, one should not ignore the fact that there could be alternative explanations. In this case, Yerkes-Dodson Law, alternatively known as the Inverted U Theory could possibly justify the fact that under time pressure and distractions, participants perform better. The Yerkes-Dodson Law suggests that performance increases with mental arousal (stress) but only up to a point: when an individual's level of stress is too low or too high, their performance deteriorates (Yerkes RM, Dodson JD, 1908).

### The role of personality in judgemental variability

Not enough data were gathered to infer whether traits contributed in a way to better performance under time pressure or vice versa, however, nurses frequently share common personality traits (Cupit & Sukal 2015). In this case, conscientiousness, agreeableness, and extraversion. An agreeable person tends to be ready to make sacrifices and is sympathetic, and benevolent. Conscientious individuals tend to be efficient and responsible, and their actions are orderly, accurate, and sensible (Digman, 1990). A neurotic individual is frequently upset, experiences a negative temper, and is prone to depression. Whereas a study found that nurses with neuroticism and introverted traits are more exposed to burnout in the intensive care unit (Ntantana, et al., 2017). In this case, neuroticism was one of the reported lower scores among all groups which could possibly indicate that the participants are well-trained to perform the task or that their personality traits fit the bill.

## *5.2 Opportunities and Implications for Future Research*

### Inconclusive results

Inconclusive research findings are a recurring facet of the scientific process. They serve as catalysts for learning and improvement, often leading to more refined and robust research in the future. Researchers are encouraged to perceive inconclusiveness as an integral part of the ongoing pursuit of knowledge, rather than as a shortcoming. When confronted with inconclusive findings, researchers should be willing to reassess the foundational assumptions of their research review and refine their research design, methods and data collection techniques; enhancements might therefore involve increasing the sample size, improving measurement instruments or employing alternative statistical methodologies to increase the likelihood of achieving conclusive findings (Bryman, 2016) – an open-minded approach to questioning initial hypotheses, therefore, is essential (Ponterotto & Grieger, 2007),

Further studies could aim to address the limitations or gaps observed in the existing research, thereby extending the knowledge base on the subject matter (Charmz, 2014). Tracking subjects over an extended period for example (longitudinal research), can reveal temporal trends and patterns that may be obscured in shorter-term investigations (Fitzmaurice et al., 2011). The analysis of open-ended responses enables the identification of emerging themes and patterns (Saldana, 2015). Moreover, employing meta-analysis or carrying out systematic reviews can enhance the robustness of conclusions by synthesizing data from various sources (Cooper et al. 2009). Finally communicating inconclusive results through academic publications is vital; such a practice prevents unnecessary duplication of research efforts and fosters knowledge accumulation. Scientific dialogue is therefore encouraged together with collaboration from within the academic community (Pautasso, 2013).

A further point to note is the measurement of personality traits through Likert scale ratings. Here ratings may be affected by the respondent's wish to provide a socially desirable response, and, in differing contexts, this may cause them to make ratings toward the positive end of rating scales (acquiescence), toward the extremes of scales (extremity) or toward the middle of scales (moderation) . Response bias is particularly problematic when comparisons are made between mean scores obtained from samples drawn from different cultural or national groups (Johnson,

Shavitt, & Holbrook, 2011). Although the statements were randomly assigned (positive vs. negative), the study failed to assign the elements in the BMIS and NPA in reverse direction, thereby increasing the chance of response bias. Furthermore, the reliability of measures on different occasions (temporal stability) is unknown since the sessions were administered only once, with no intention of 'retesting' over time.

**Challenges faced as non-practitioners**

The study has its limitations and various elements could distort the outcomes and conclusions if not given consideration. It is therefore suggested that researchers, managers or decision makers take the following limitations into consideration before embarking on similar initiatives.

Having managed to gain access to organisational information, thanks to the Hospital's Administration and collaborating Healthcare professionals Europe-wide the utmost was done to acquire good quality data; the trustworthiness of the sources is openly stated, however, the majority were reluctant to share information related to Admissions or Triage-related statistics. Unfortunately, the sample of participants did not qualify as representative for the whole population of professional Emergency Nurses working at the Emergency Department in Malta (Europe), which stood at around 130 nurses during the year 2022. Therefore any findings should not be interpreted and are not generalizable to the whole population. Notwithstanding this, ED and Hospital Management, as well as MENA were supportive of the project. To add to the fact that nurses' work involved their commitment to a challenging roster, the healthcare sector in Malta, endured a turbulent post-pandemic period, with seemingly high labour turnover and recurring enforcement of sectorial directives locally, which at times lead to industrial actions (in the form of strikes); this proved more difficult to get through communication-wise.

On one hand, by taking a random sample of the population, selection bias was reduced, however, control of when and who best to ask for the purpose of recruiting participants was limited; on other hand, 'blanket' spamming with email messages among various organisations (with the intention of recruiting as many participants as possible) could have possibly increased the likelihood of social desirability bias, given that this initiative could have triggered a motivational effect on participants as

a result of the interest shown, and having generated word-of-mouth. Contact with study participants was limited only to serve in setting appointments and phone calls to coordinate the sessions, which itself proved to be a challenging task, since practitioners commence their shift at 0700 hrs and finish at around 1900 hrs, rotating on a day-night-rest-off basis. A vast number had personal and academic commitments besides their work, and having to chase potential participants could have added unwanted pressures and biases, pre-experiment. The study was faced with the challenge of dealing with the limited time in hand to develop research software in a matter of weeks and prepare for the eventual research sessions; working remotely was not always ideal. Sessions were projected to commence during February 2022, however, due to delays and time constraints in developing the software, dealing with industrial actions in the healthcare sector and navigating a pandemic and post-pandemic environment, participant attrition was inevitable. Hence, the amount of time required to complete the project was underestimated.

## *5.3 Contribution to Knowledge, Theory and Practice*

As non-practitioners,  outsiders bring fresh perspectives to medical research, challenging established norms and suggesting innovative solutions (Smith, 2018). Their position, external to the clinical environment allows them to view problems with a different lens, often leading to novel insights. This contributes to expanding the body of knowledge in the medical field by introducing new paradigms and ideas, via interdisciplinary collaboration with experts from other fields. By uncovering new evidence and perspectives, non-practitioners help shape clinical guidelines and healthcare policies, translating theoretical insights into tangible changes in medical practice (Clark, 2020). Their work is integral in bridging the gap between theory and practical applications and the synergies between these two groups underscores the importance of a collaborative approach for the betterment of healthcare knowledge, theory, and practice.

Brainstorming was carried out successfully on the possibilities of executing the project, taking into account the professional consultation from doctors and nurses whilst asking unbiased and un-polarised professional associations/sources for support. Notwithstanding the fact that no similar pilot studies were found, and therefore the possibility to compare results did not materialise, a number of important themes related to management and effective decision-making emerged.

Subsequently, a tailor-made prototype software based on international standards and recommendations for noise audits (Kahneman, et al., 2021) was designed, tested and used without any glitches. The tool (Web App) can be further enhanced to serve various sectorial needs and adapted to diverse areas such a, risk, finance, insurance, etc.

Health practitioners became more aware of the impact of their work and the interdisciplinary relationships between their practice and the role of social sciences, management and the potential of information technology. As a testament to this, positive feedback was received throughout the sessions from participants and collaborators. The potential future development at scale of the web application could enhance training and re-training processes for prospective and acting emergency nurses (improvement of the interface and usability) to accommodate research needs, thereby facilitating access to data and data analysis of critical decisions in a synthetic environment. A lexicon of terms linked with triage, evidence-based management, and contacts from hospitals and statistics offices from EU27 [44] was saved in a database for future use.

## *5.4 Conclusion*

The best available evidence was taken into consideration, however, the findings have been deemed to be speculative until further studies investigate the phenomena explored. Overall, the initiation and setting up of a simulation-based research project as a successful process by closely adhering to the guidelines set by D. Kahneman and colleagues (2021), despite the various challenges faced as an 'outsider-initiative' throughout. Following backing from medical consultants, fictitious cases presented in form of vignettes can be further enhanced to mimic more realistic cases. Despite the partial acceptance of the hypotheses, the study still demonstrated that cognitive errors can be identified and classified, and that they can produce serious issues. Classification of cognitive errors is a step toward a deeper understanding of the epidemiology, causes, and prevention of diagnostic errors. Outcomes could be beneficial for healthcare and the nursing practice in general. Staff reporting medication errors should be supported, not punished, and the information provided used to improve the system. Through this research project and

[44] Abbreviation of European Union (EU) which consists of 27 countries

industry analysis, a gap in the local healthcare sector was identified, and not only, since other professionals from various domains can learn and adapt this cognitive assessment tool to serve as a training resource.

For the aforementioned reasons therefore, future research which investigates the causes and consequences of unwanted variability with a particular focus on the context of acute emergency settings is encouraged, in conjunction with the effectiveness of interventions aimed at mitigating these risks. These interventions have shown some promise in reducing error and improving diagnostic accuracy (Croskerry, et al. 2013). It is hoped that this study will serve as a blueprint for future reference; ultimately, a better understanding of the observed phenomena will lead to improved patient safety and outcomes.

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## Figures and Tables

### *Figure B.1 - Research Project Timeline*

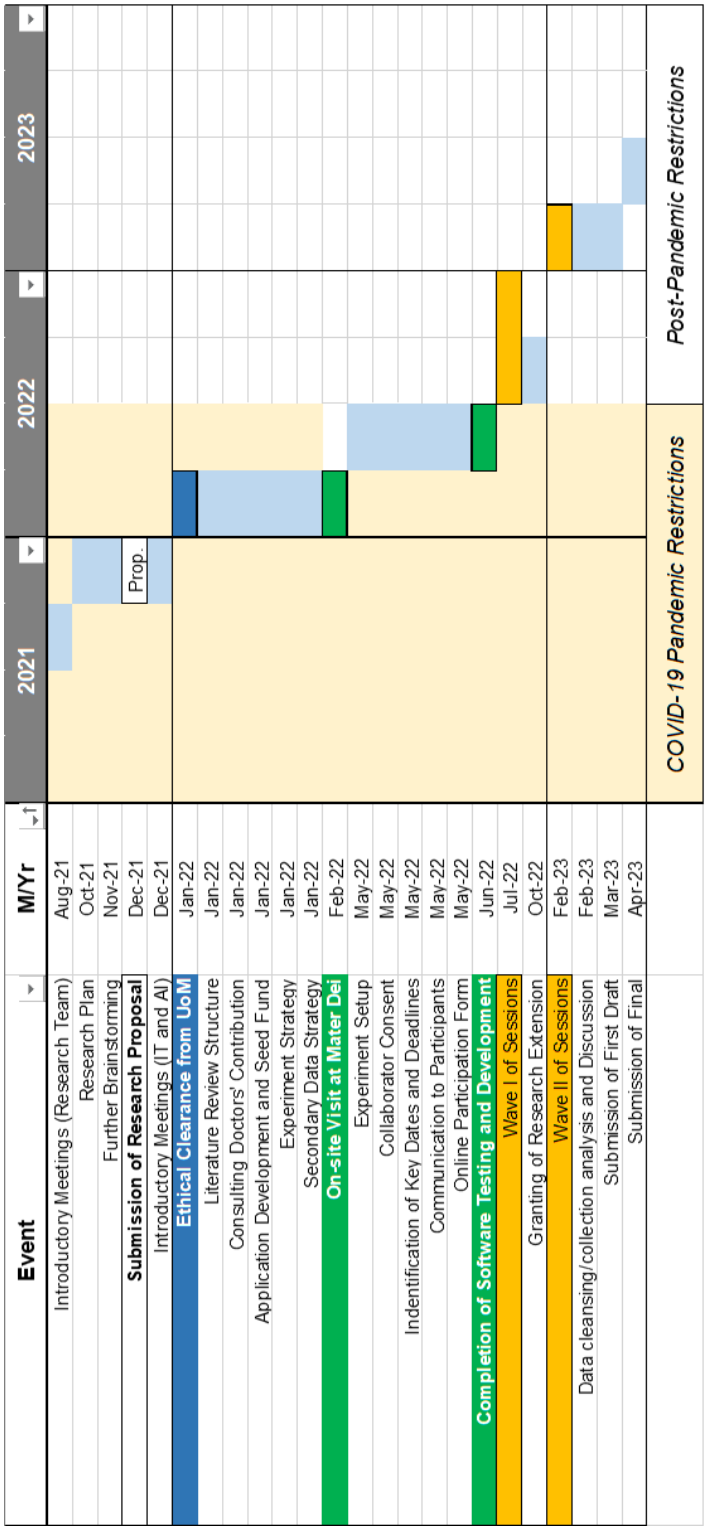


***Figure B.2 - Emergency Nurses Association, ESI Triage Algorithm version 4***

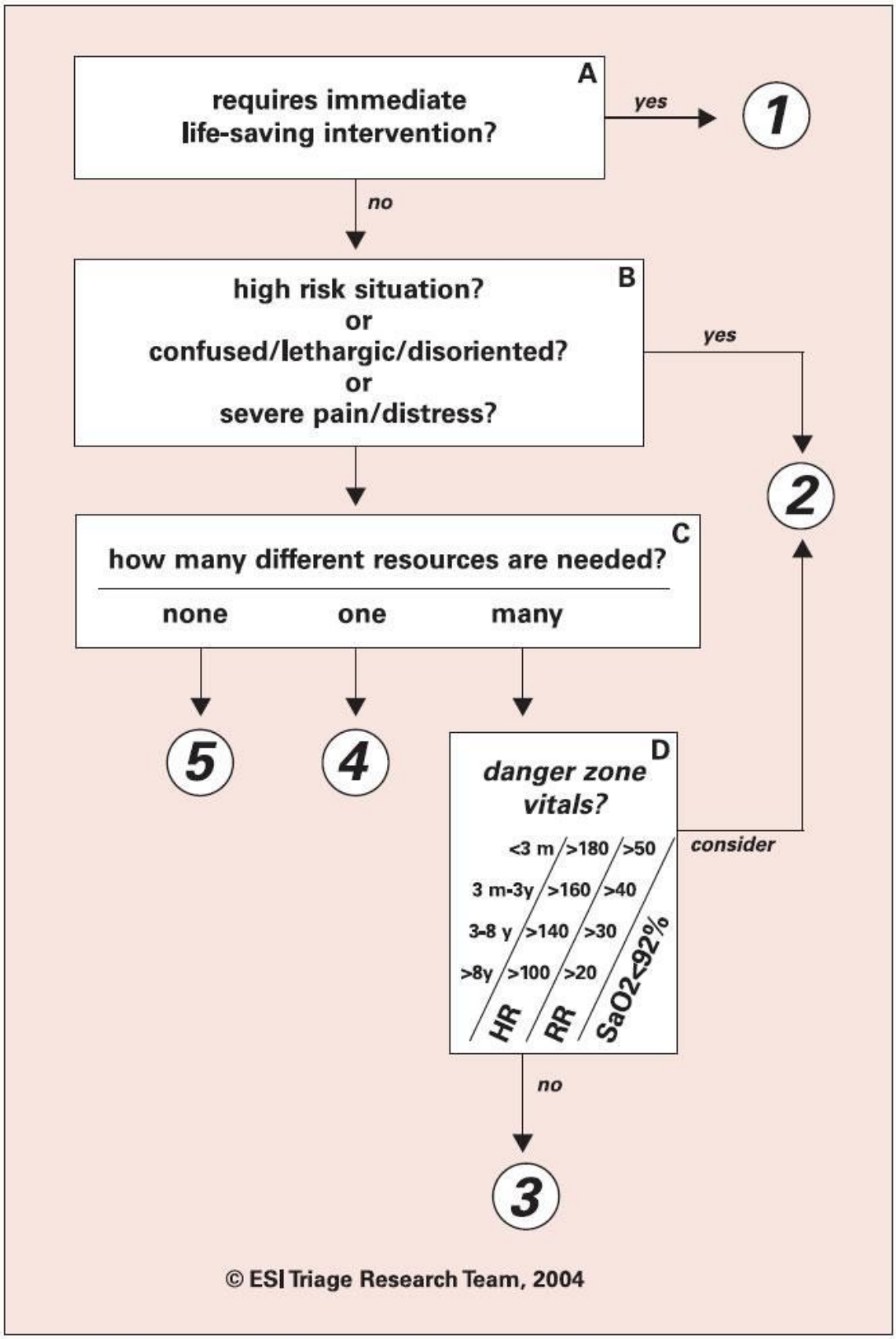


***Figure B.3 - Brief Mood Introspection Scale***

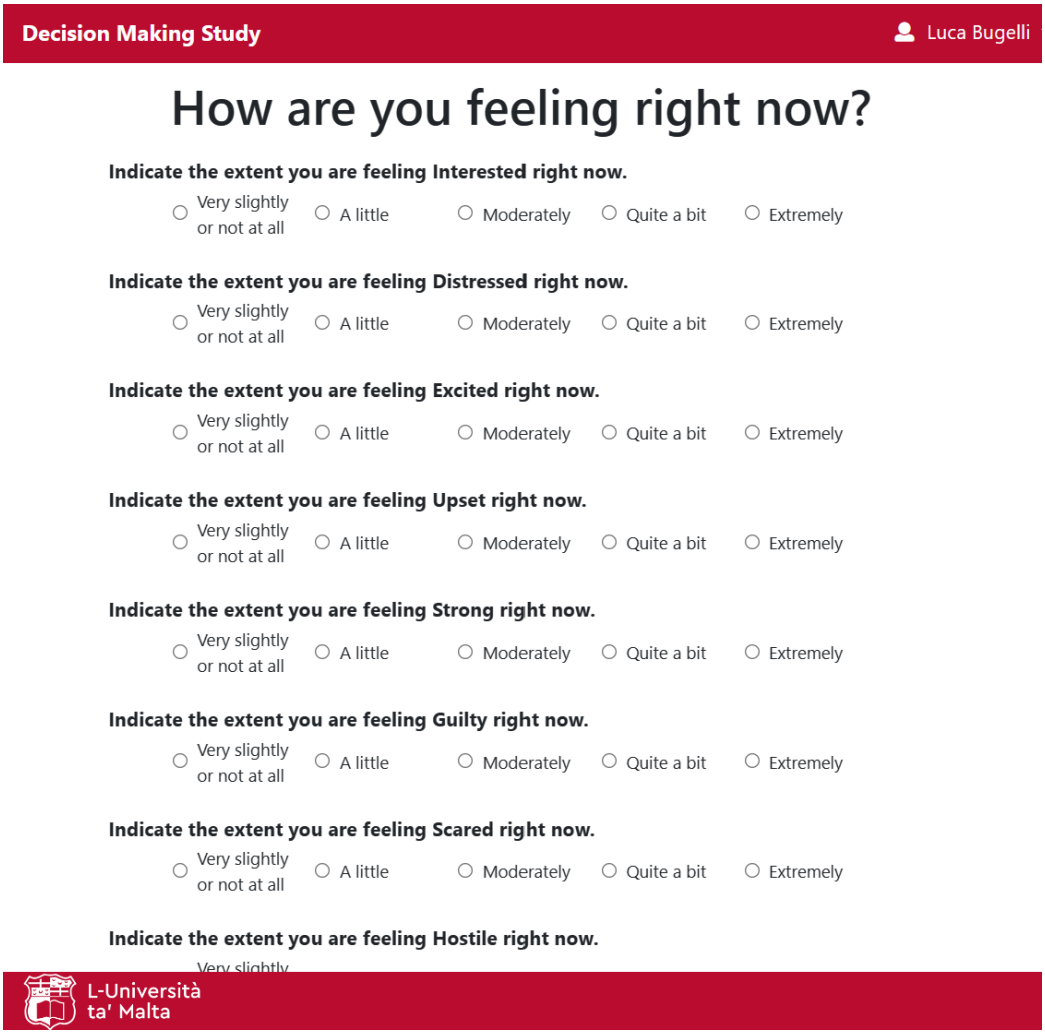


***Figure B.4 - Emergency Case Vignette Review (Test)***

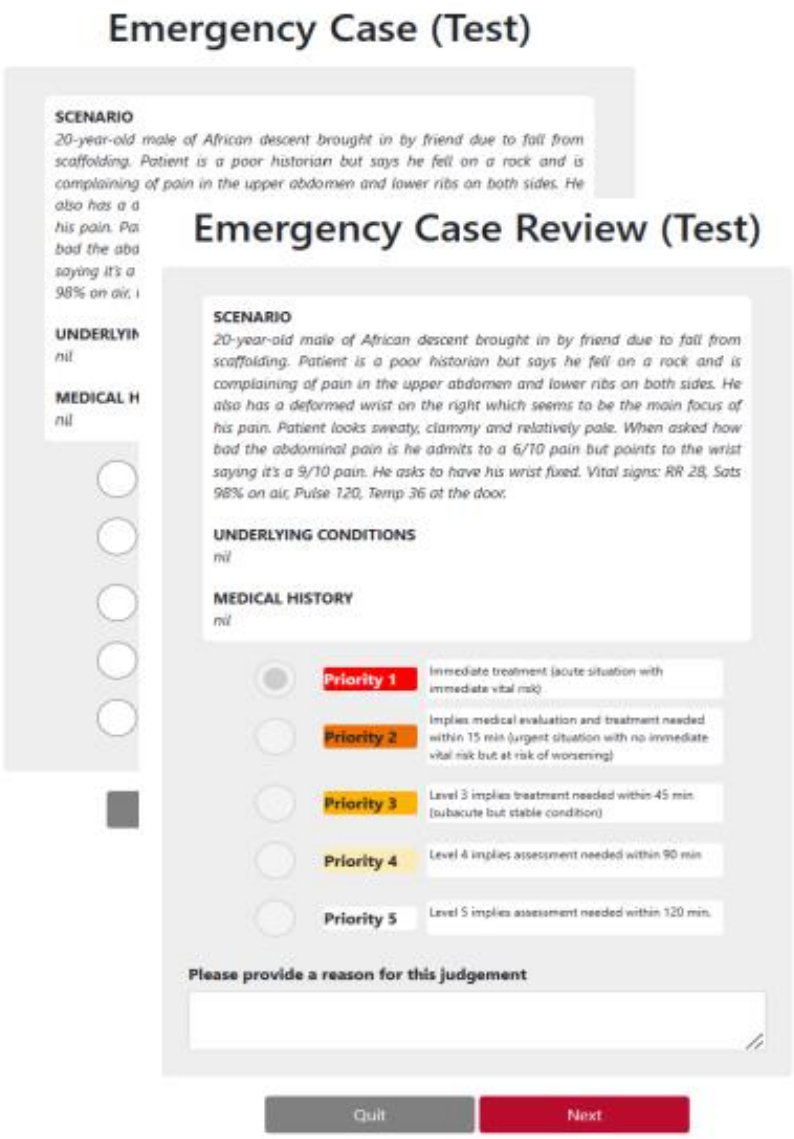


***Figure B.5 - Emergency Case Vignette and Case Review***

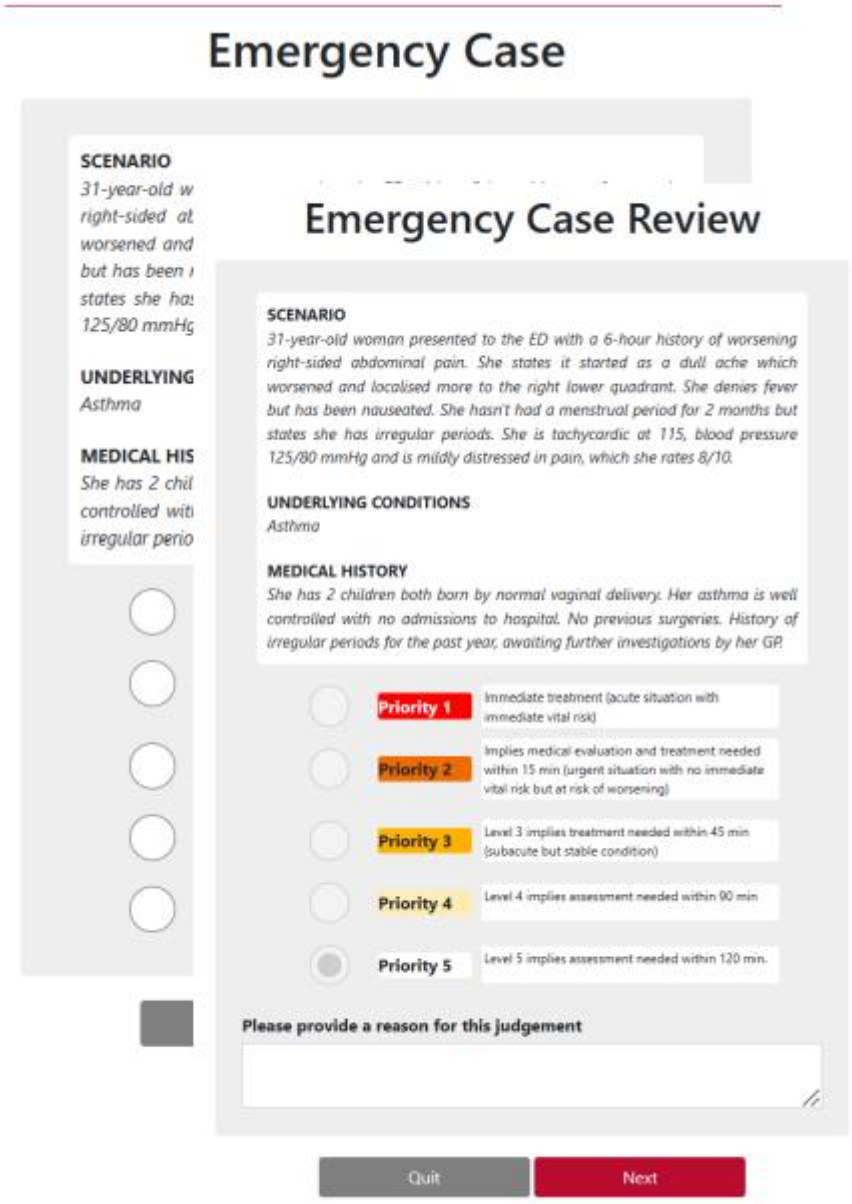
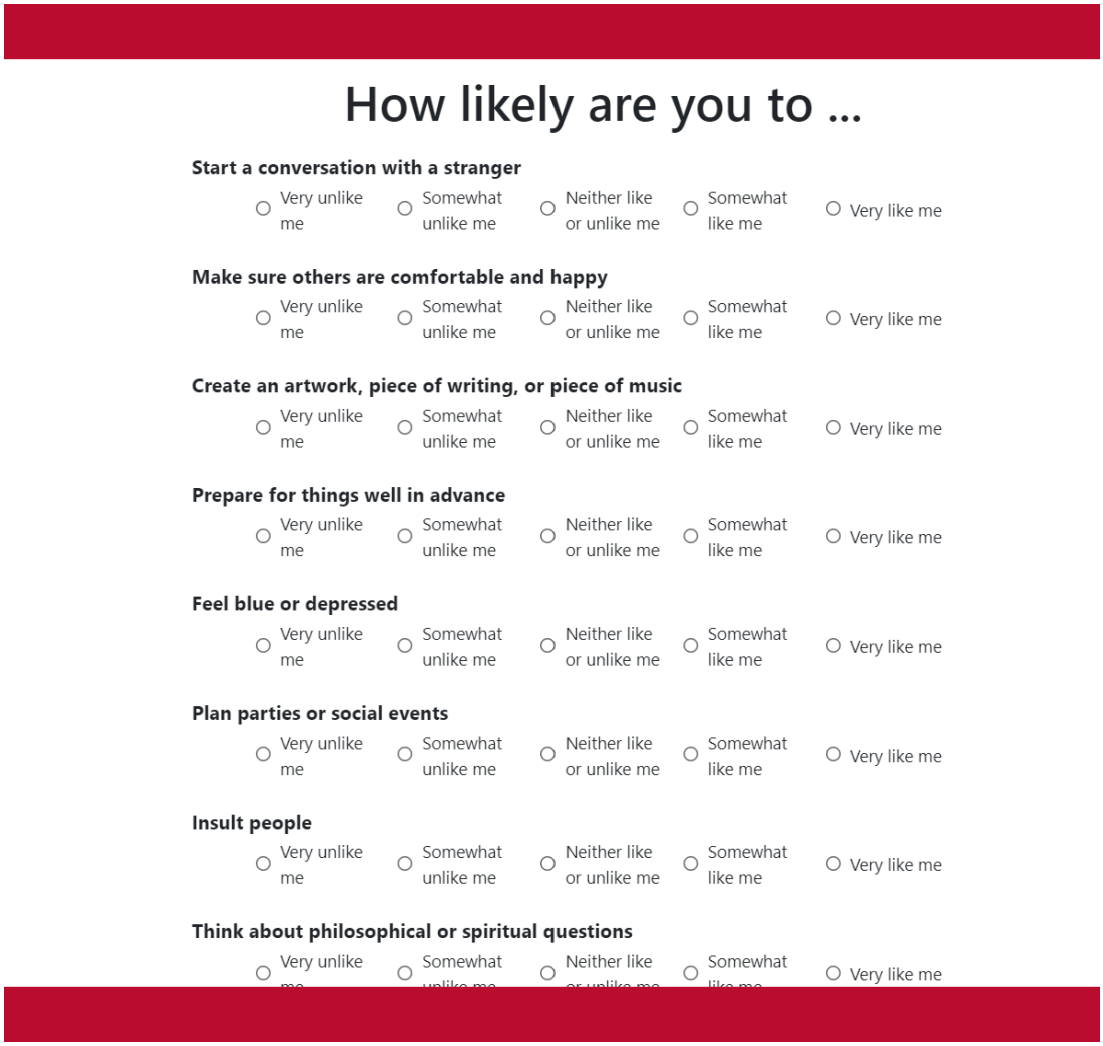


***Figure B.6 - Newcastle Personality Test***



# How likely are you to ...

**Start a conversation with a stranger**

Very unlike me | Somewhat unlike me | Neither like or unlike me | Somewhat like me | Very like me

**Make sure others are comfortable and happy**

Very unlike me | Somewhat unlike me | Neither like or unlike me | Somewhat like me | Very like me

**Create an artwork, piece of writing, or piece of music**

Very unlike me | Somewhat unlike me | Neither like or unlike me | Somewhat like me | Very like me

**Prepare for things well in advance**

Very unlike me | Somewhat unlike me | Neither like or unlike me | Somewhat like me | Very like me

**Feel blue or depressed**

Very unlike me | Somewhat unlike me | Neither like or unlike me | Somewhat like me | Very like me

**Plan parties or social events**

Very unlike me | Somewhat unlike me | Neither like or unlike me | Somewhat like me | Very like me

**Insult people**

Very unlike me | Somewhat unlike me | Neither like or unlike me | Somewhat like me | Very like me

**Think about philosophical or spiritual questions**

Very unlike me | Somewhat unlike me | Neither like or unlike me | Somewhat like me | Very like me

## *Figure B.7 - Sample Size Calculation*

Sample size calculator[45] and Research questions planning [46]

Sample size calculator

| | | |
|---|---|---|
| What margin of error can you accept?<br>5% is a common choice | 5 % | The margin of error is the amount of error that you can tolerate. If 90% of respondents answer *yes*, while 10% answer *no*, you may be able to tolerate a larger amount of error than if the respondents are split 50-50 or 45-55.<br>Lower margin of error requires a larger sample size. |
| What confidence level do you need?<br>Typical choices are 90%, 95%, or 99% | 95 % | The confidence level is the amount of uncertainty you can tolerate. Suppose that you have 20 yes-no questions in your survey. With a confidence level of 95%, you would expect that for one of the questions (1 in 20), the percentage of people who answer *yes* would be more than the margin of error away from the true answer. The true answer is the percentage you would get if you exhaustively interviewed everyone.<br>Higher confidence level requires a larger sample size. |
| What is the population size?<br>If you don't know, use 20000 | 130 | How many people are there to choose your random sample from? The sample size doesn't change much for populations larger than 20,000. |
| What is the response distribution?<br>Leave this as 50% | 50 % | For each question, what do you expect the results will be? If the sample is skewed highly one way or the other,the population probably is, too. If you don't know, use 50%, which gives the largest sample size. See below under **More information** if this is confusing. |
| Your recommended sample size is | **98** | This is the minimum recommended size of your survey. If you create a sample of this many people and get responses from everyone, you're more likely to get a correct answer than you would from a large sample where only a small percentage of the sample responds to your survey. |

| *Research question* | *Randomised controlled studies* | *Controlled longitudinal studies* | *Cross-sectional surveys* | *Qualitative research* |
|---|---|---|---|---|
| Effectiveness: does it work?, does A work better than B? | ++ | + | - | -- |
| Explanation : how does it work, why does it work? | -- | - | + | ++ |
| Context: in what circumstances does it work, for whom? | -- | - | + | ++ |
| Safety: will it do more good than harm? | ++ | + | + | + |
| Acceptability: will the target group accept the intervention / new method of working? | -- | - | + | ++ |
| Prevalence: how often is this intervention / method applied / implemented? | -- | -- | ++ | -- |
| Appropriateness: is this the right intervention / method for this target group? | -- | - | + | ++ |

[45] Link: http://www.raosoft.com/samplesize.html

[46] Link: https://www.cebma.org/wp-content/uploads/Which-design-for-which-question.png

## *Figure B.8 - Methodological Appropriateness*

Methodological appropriateness: Which design for which question?

| Purpose | Example | RCT | CBA | BA | Contr | Cross | Qual |
|---|---|---|---|---|---|---|---|
| Effect, impact | Does A have an effect/impact on B?<br>What are the critical success factors for A?<br>What are the factors that affect B? | A | B | C | C | D | na |
| Prediction | Does A precede B?<br>Does A predict B over time? | A | A | A | D | D | na |
| Association | Is A related to B?<br>Does A often occur with B?<br>Do A and B covary? | A | A | A | A | A | na |
| Difference | Is there a difference between A and B? | A | A | A | A | A | na |
| Frequency | How often does A occur?<br>How many people prefer A? | na | na | na | na | A | na |
| Attitude, opinion | What is people's attitude toward A?<br>Are people satisfied with A?<br>Do people agree with A? | na | na | na | na | A | C |
| Experience, perceptions, feelings, needs | What are people's experience with A?<br>What are people's feelings about A?<br>What are people's perceptions about A?<br>Why do people (think they) need to do/use A? | na | na | na | na | B | A |
| Exploration, theory building | Why does A occur?<br>Why is A different from B?<br>In what context does A occur? | na | na | na | na | B | A |

RCT = Randomized controlled trial; CBA = Non-randomized controlled before-after study; BA = Before-after study; Contr = Controlled study; Cross = Cross-sectional study; Qual = Qualitative study; na = not appropriate

Source: https://cebma.org/faq/what-are-the-levels-of-evidence/

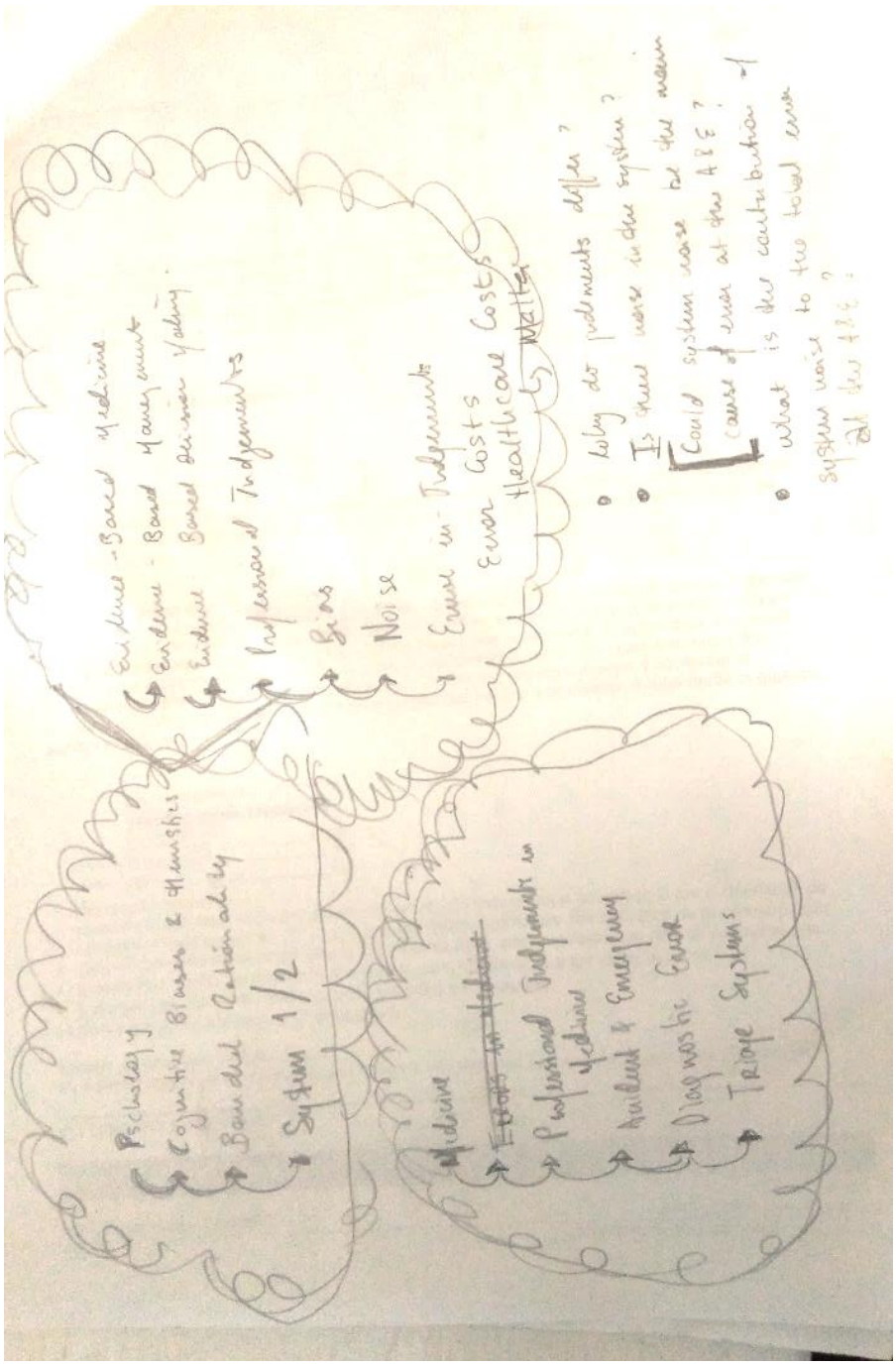
***Table B.1 Interrater Agreement Exercise - Results***

| Case # | ESI | DOC_01 | DOC_02 | DOC_03 | % Agreement |
|---|---|---|---|---|---|
| Case 1 | 1 | 1 | 1 | 1 | 100% |
| Case 2 | 1 | 1 | 1 | 0 | 67% |
| Case 3 | 2 | 1 | 1 | 1 | 100% |
| Case 4 | 2 | 1 | 0 | 1 | 67% |
| Case 5 | 2 | 1 | 1 | 1 | 100% |
| Case 6 | 2 | 1 | 1 | 1 | 100% |
| Case 7 | 2 | 1 | 1 | 1 | 100% |
| Case 8 | 2 | 1 | 1 | 1 | 100% |
| Case 9 | 3 | 1 | 1 | 1 | 100% |
| Case 10 | 3 | 1 | 1 | 1 | 100% |
| Case 11 | 3 | 1 | 1 | 1 | 100% |
| Case 12 | 4 | 1 | 1 | 1 | 100% |
| Case 13 | 4 | 1 | 1 | 1 | 100% |
| Case 14 | 4 | 1 | 0 | 1 | 67% |
| Case 15 | 5 | 1 | 1 | 1 | 100% |
| | | 15 | 13 | 14 | 93% |

# Annexes

## *A. Research Proposal Brainstorming*

### A.1 – Brainstorming Mind Map



## A.2 – Brainstorming dissertation Scope, Structure and Terminology


PROPOSAL
Noise in Transfer-Based Decisions
Situation under observation
Research content details
Scope
Literature review
Methodology
Background info
(Underlying Problem)
Use of topics
Objectives
Topics
Strategy
Given the research we will carry out Experiment
Psychology
Behavioural Science
Bounded Rationality
Cognitive Bias
Psychology
Psychological Science
Psychological Science
Psychological Science

## A.3 – Draft experiment plan and expected outcomes

I confirm that this is the proposed for the MA by Research submitted by Luca Bugelli

L-Università ta' Malta | Master's by Research **Proposal**

**Student and Project Details**

| | |
|---|---|
| Student: | Luca BUGELLI |
| ID Card: | 0159691M |
| Course: | Master of Arts in Evidence-based Management and Effective Decision Making |
| Supervisor: | Professor Vincent CASSAR |
| Faculty: | Faculty of Economics, Management and Accountancy |

**Proposed title**

Noise in triage-based decisions: an exploratory study.

**Situation under observation / Description of the topic being investigated**

Humans tend not to undertake a full cost-benefit analysis to determine the optimal decision, but rather, choose an option that fulfils their adequacy criteria; the healthcare professionals sustaining the triage system in an Accident and Emergency (A&E) are not immune to this. Given that the A&E department is among the first areas where diagnoses is determined, decisions at this initial stage are critical to the patients' chances of survival. Indeed, a 2012 study[1] carried out by the Department of Neurology at the Johns Hopkins Hospital concluded that "diagnostic errors appear to be the most common, most costly and most dangerous of medical mistakes" reinforcing the indications that wrong diagnoses account for the most severe cases of patient harm.

**Research content details**

In his recent publication co-authored with Olivier Sibony and Cass Sunstein, Nobel Prize winner and psychologist Daniel Kahneman coins the term 'Noise' to describe unwanted variability and presents us with case studies emerging from the legal and medical fields to sustain his arguments, ultimately demonstrating that "absence of consensus" in these areas is "the norm".

This study will seek to unearth the best available evidence and literature surrounding the concept of 'bounded rationality', decision-making, heuristics and cognitive bias to date, allowing the researchers to use 'what we already know' to back up and make the case for further exploratory research.

[1] Saber Tehrani AS, Lee H, Mathews SC, Shore A, Makary MA, Pronovost PJ, Newman-Toker DE. 25-Year summary of US malpractice claims for diagnostic errors 1986-2010: an analysis from the National Practitioner Data Bank. BMJ Qual Saf. 2013 Aug;22(8):672-80. doi: 10.1136/bmjqs-2012-001550. Epub 2013 Apr 22. PMID: 23610443.

Department of Management
FEMA

## Scope

### *RESEARCH OBJECTIVES AND PRACTICAL RELEVANCE*

The study, which in its totality, is expected to last for 12 months starting October 2021, is intended to gain a better grasp in understanding the extent of the variability in judgements taken by emergency nurses, thus serving as a referential exploratory exercise for further research in the field. It is expected that the results emanating from the experiment will unveil variances in judgements from the selected sample, giving indications on the zone of tolerance for errors within an A&E, providing the research team and hospital management with an opportunity to mitigate the possibility of having 'false negatives' in the system. Thereby potentially saving lives and reducing healthcare management costs.

## Literature Review

### *TOPICS*

Topics emanating from the medical field, such as healthcare management and triage systems will be researched in support of the context in which the experiment will be carried out. The notion of bounded rationality in heuristics and cognitive biases; decision making, personality traits, will be researched before focusing on the main topic that of 'System Noise' and the underlying themes investigated by Daniel Kahneman et al. which will feature as the main research area in this study.

### *SOURCES*

Research for most reliable type of studies and outcomes (Systematic Reviews, Meta-analysis, Randomized Controlled Trials) will be conducted in most relevant databases for the field of management and psychology, namely ABI/INFORM Global (from ProQuest), Business Source Elite (EBSCO) and PsycINFO. PubMed will be used to search for evidence emanating from the healthcare field.

### *RESEARCH QUESTIONS*

The study will seek to answer three questions, namely:

1. To what extent do professional nurses differ in their judgement of emergency case scenarios?
2. To what extent do professional nurses vary in their own judgement of emergency case scenarios?
3. To what extent does personality play a role in judgemental variability?

## Methodology

### *RESEARCH DESIGN AND STRATEGY*

The research team, will collaborate hospital management, doctors and consultants to address the research questions, by carrying out an experimental 'noise audit' with nurses working at the A&E

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department. This will be done via setting up an experiment (see Appendix A) involving 24 nurses and 3 doctors; results from which are expected to address the research questions.

The study will be classified as exploratory and experimental, and the following is a step-by-step summary of the research strategy:

i. The research team will randomly select twenty-four (24) nurses from a pool of emergency nurses and invite them to take part in this study. The participants will be asked to fill in a questionnaire to capture elements of bias (before the experiment) which will later serve the to investigate the 'Total System Error' phenomenon further.

ii. Meanwhile three (3) Medical Doctors will help the research team write-up twelve (12) fictitious emergency cases based on real scenarios and assign a realistic ESI (Emergency Severity Index) score to each, reflective of the correct priority which should be when triaging patients - one (1) being the highest to five (5) lowest. These will be inputted in a specialized software programme built to serve the experiment.

iii. A designated area at University of Malta will be identified to carry out the experiment (set up will include desks, computers, software, etc.).

iv. On the day, eight (8) participants will form part of the Control Group A, having no time pressure to review the cases, another group will be assigned to the Experimental Group (B) dealing with distractions, and another will be allocated to group C – under time pressure with distractions. Both groups will be asked to self-respond to a questionnaire in an attempt to capture their mood and personality traits (Big 5 personality test) – this will later serve to estimate 'Pattern Noise'.

v. Level Noise will eventually be calculated by squaring the sum of variances. It is expected that the aggregate variance within Group B will be higher when compared to control Group A, given the pressure/time constraint elements.

***RATIONALE OF SAMPLE SELECTION***

The number of nurses currently serving as emergency nurses in Malta (around 100), therefore the research team considers recruiting a 24 nurses representing the whole population.

***DATA ANALYSIS TOOLS***

The research team does not envisage that the study will involve complex statistical computations. Hence, the use of spreadsheets to plot tables, calculate formulae and plot any respective charts and graphs sho is deemed adequate

***LIMITATIONS***

The research team is aware that the study has various limitations and that various elements (such as methodological bias, various confounders, placebo effect, social desirability bias etc. could distort the outcomes and conclusions if not given due consideration.

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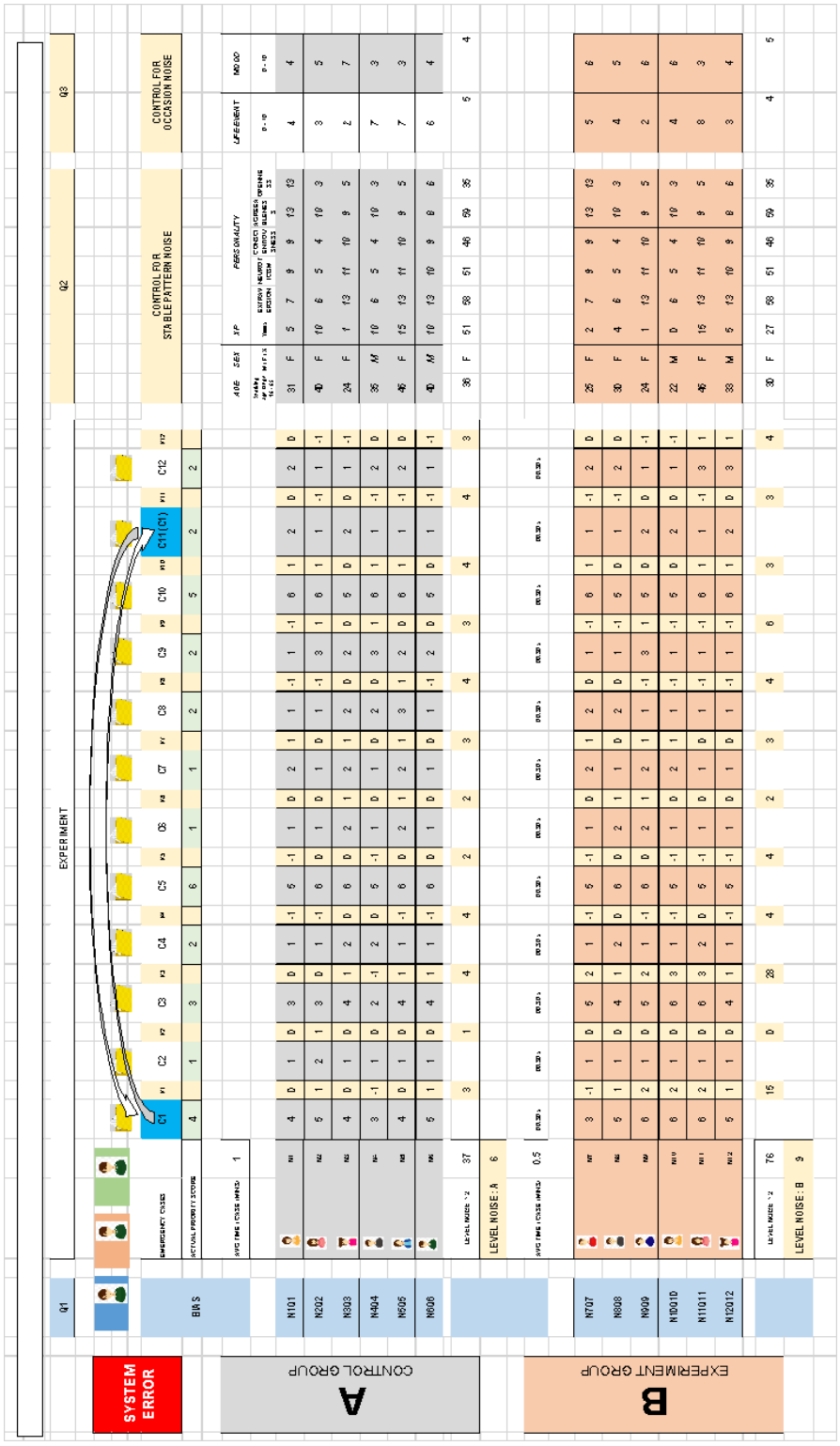
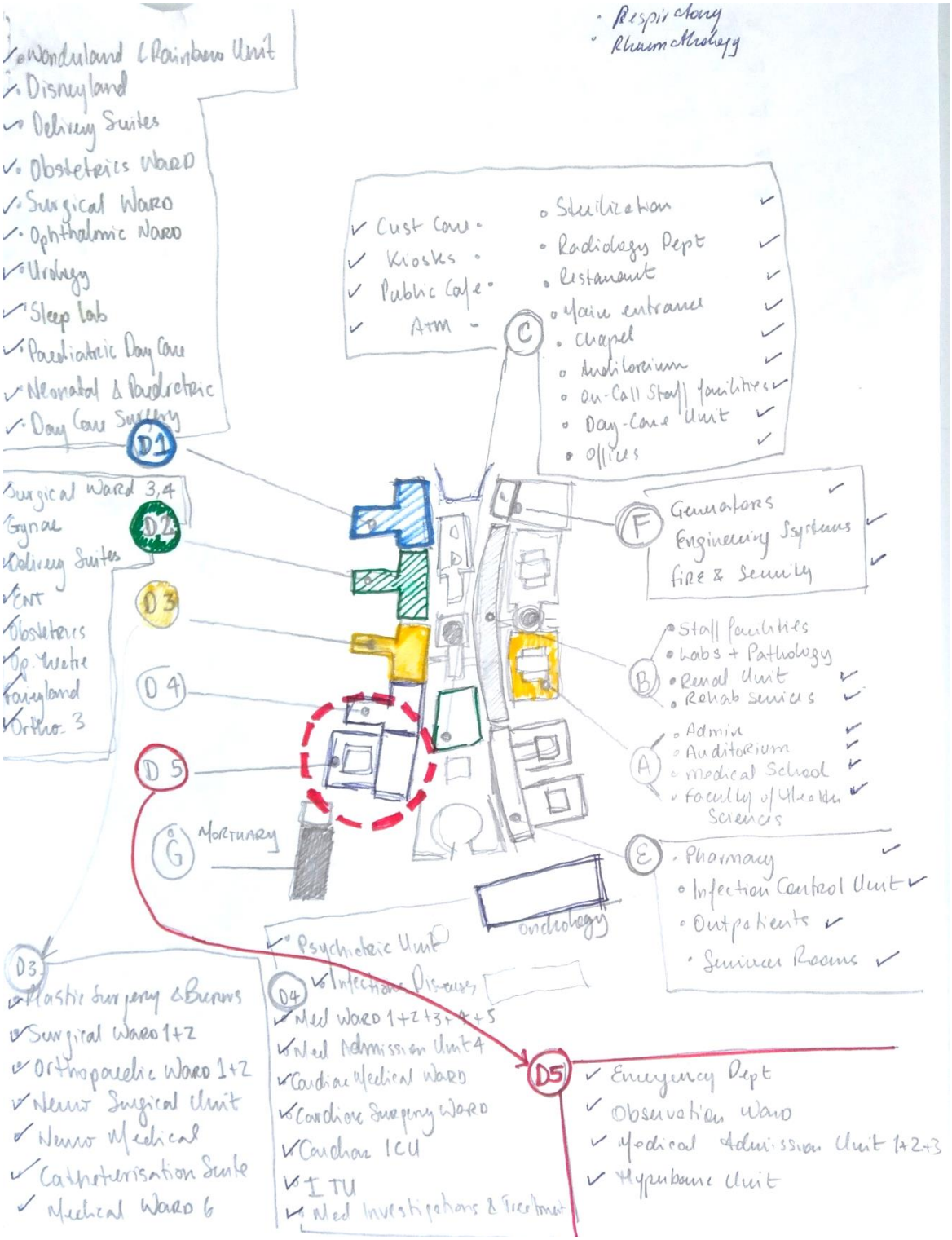
FEMA

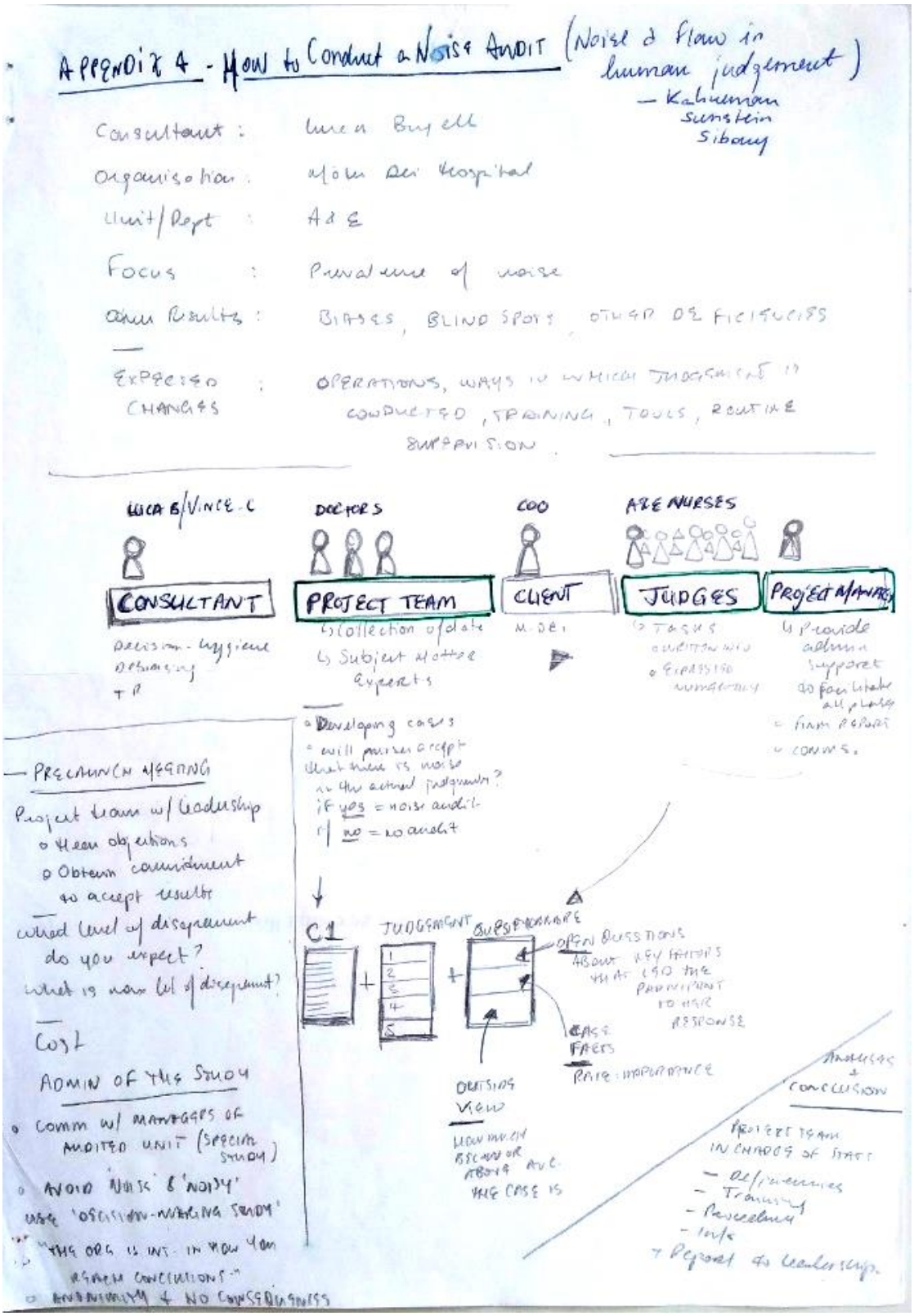
## A.4 – Draft Experiment Plan and Expected Outcomes



## A.5 – Hospital Plan



## A.6 – Noise Audit Structure



# *B. Ethics clearance and Collaborator Consent*

## B.1 – University Research Ethics Committee Application Form

L-Università ta' Malta

### Research Ethics and Data Protection Form

University of Malta staff, students, or anyone else planning to carry out research under the auspices of the University, must complete this form. The UM may also consider requests for ethics and data protection review by External Applicants.

Ahead of completing this online form, please read carefully the University of Malta Research Code of Practice and the University of Malta Research Ethics Review Procedures. Any breach of the Research Code of Practice or untruthful replies in this form will be considered a serious disciplinary matter. It is advisable to download a full digital version of the form to familiarise yourself with its contents (https://www.um.edu.mt/media/um/docs/research/urec/URECAReplica.docx). You are also advised to refer to the FAQs (https://www.um.edu.mt/research/ethics/faqs).

#### Part 1: Applicant and Project Details

#### Applicant Details

**Name:** Luca

**Surname:** Bugelli

**Email:** luca.bugelli.09@um.edu.mt

**Applicant Status:** Student

**Please indicate if you form part of a Faculty, Institute, School or Centre:** * Faculty of Economics, Management & Accountancy

**Department:** * Management

**Principal Supervisor's Name:** * Vincent Cassar

**Principal Supervisor's Email:** * vincent.cassar@um.edu.mt

**Co-Supervisor's Name:**

**Course and Study Unit Code:** * Master of Arts in Evidence-Based Management

**Student Number:** * 159691M

#### Project Details

**Title of Research Project:** * Capturing noise: The unwanted variability in triage-based decisions

**Project description, including research question/statement and method, in brief:** *

The study, which in its totality, is expected to last for 12 months starting October 2021, is intended to gain a better grasp in understanding the extent of the variability in judgements taken by emergency nurses, thus serving as a referential exploratory exercise for further research in the field. It will seek to unearth the best available evidence and literature surrounding the concept of 'bounded rationality', decision-making, heuristics and cognitive bias to date. Results emanating from the experiment are expected to unveil variances in judgements from a selected sample of emergency nurses, giving indications on the zone of tolerance for errors within a hospital's emergency department, providing the research team and healthcare stakeholders with an opportunity to mitigate the possibility of unwanted variability and 'false negatives' in the system; thereby potentially saving lives and reducing healthcare management costs. With regards to the research questions there are 3 : i. To what extent do professional nurses differ in their judgement of emergency case scenarios? ii. To what extent do professional nurses vary in their own judgement of emergency case scenarios? iii. To what extent does personality play a role in judgemental variability?

**Will project involve collection of primary data from human participants?** Yes / Unsure

**Explain primary data collection from human participants:**

**a. Salient participant characteristics (min-max participants, age, sex, other):** *

The research team will be inviting adult, graduate/full/part-time/experienced/non-experiences nurses to this study. The minimum participants required are 8 while the max. stands at 24. People identifying as Male/Female/Other can participate and the age range/limit is set between 18-65 .

**b. How will they be recruited:** *

A communication in the form of an invitation to participate in a 'decision-making study' will be sent to interested participants. The research team envisages recruiting interested participants through recommendations from doctors and associations assisting the researchers and via official UOM communications (such as website/email marketing).

**c. What they will be required to do and for how long:** *

Participants will be required to visit the University of Malta physically (COVID-restrictions permitting) and participate in a computer-based task using on a computer/tablet or touchscreen. The duration of session may last between 30mins up to a maximum of 1 hour, depending on the group they will be assigned to.

**d. If inducements/rewards/compensation are offered:** *

The research team plans to recruit participants on a voluntary basis.

**e. How participants/society may benefit:** *

This conclusions from this exploratory study could be of interest to local stakeholders such as public and private hospitals, clinics, healthcare unions and healthcare management professionals and policy-makers, as well as aspiring medical doctors and consultants.

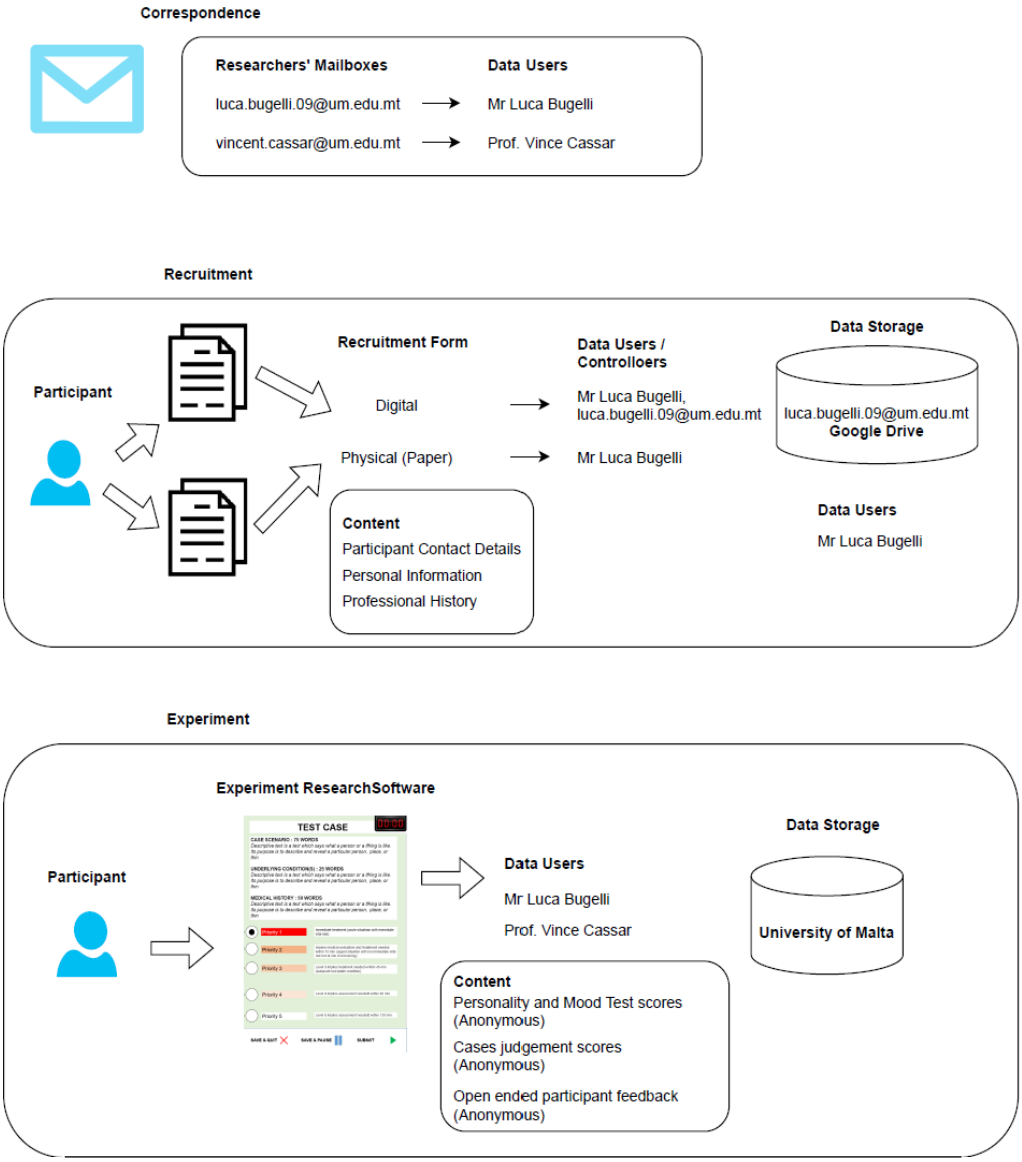
**f. If participants are identifiable at any stage of the research:** *

Participant's identity will remain undisclosed throughout the duration of the study. It will only be at invitation stage where the research team will need to know names and contact details for to be able to invite the nurses to participate .

**g. The manner in which you will manage and store the data:** *

The research team envisages collecting primary data from a tailor-made research computer program in the form of i) scores/ratings and open ended questions on fictitious emergency cases, ii) anonymous personality test/questionnaires.

## B.2 – Research Data Map



## B.3 – Collaborator Consent Forms (Doctors, Software Developer)

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**COLLABORATOR**

**Consent Letter**

---

I express my willingness to serve as a collaborator to the proposed study entitled '**Capturing noise: the unwanted variability in triage-based decisions**' in the domain of **Evidence-based Management and Effective Decision-Making** proposed by Mr Luca Bugelli, researcher at the Department of Management, University of Malta.

The collaboration includes drafting of **5 fictitious hospital emergency cases as well as eventual cross-checking and validation** among another two medical professionals, equally contributing to this study.

I assure that I will provide valid, scientific inputs, technical expertise and research assistance for the proposed collaborative research activities on a voluntary basis and that the fictitious cases and my contribution/s are in no way related to real cases or to the participants of the study (emergency nurses).

[redacted]

**Mr Luca BUGELLI**
Researcher
University of Malta
Department of Management

[redacted]

**Dr Martina BUGELLI MD, DTM&H**
Collaborator

L-Università ta' Malta

**COLLABORATOR**

**Consent Letter**

---

I express my willingness to serve as a collaborator to the proposed study entitled '**Capturing noise: the unwanted variability in triage-based decisions**' in the domain of **Evidence-based Management and Effective Decision-Making** proposed by Mr Luca Bugelli, researcher at the Department of Management, University of Malta.

The collaboration includes drafting of **5 fictitious hospital emergency cases as well as eventual cross-checking and validation** among another two medical professionals, equally contributing to this study.

I assure that I will provide valid, scientific inputs, technical expertise and research assistance for the proposed collaborative research activities on a **voluntary basis** and that the fictitious cases and my contribution/s are in no way related to real cases or to the participants of the study (emergency nurses).

[redacted]

**Mr Luca BUGELLI**
Researcher
University of Malta
Department of Management

[redacted]

**Dr Pierre Agius MD**
MRCEM FEBEM PgCert
Specialist in Emergency Medicine
Collaborator

L-Università ta' Malta

**COLLABORATOR**

**Consent Letter**

---

I express my willingness to serve as a collaborator to the proposed study entitled '**Capturing noise: the unwanted variability in triage-based decisions**' in the domain of **Evidence-based Management and Effective Decision-Making** proposed by Mr Luca Bugelli, researcher at the Department of Management, University of Malta.

The collaboration includes drafting of **5 fictitious hospital emergency cases as well as eventual cross-checking and validation** among another two medical professionals, equally contributing to this study.

I assure that I will provide valid, scientific inputs, technical expertise and research assistance for the proposed collaborative research activities on a voluntary basis and that the fictitious cases and my contribution/s are in no way related to real cases or to the participants of the study (emergency nurses).

[redacted]

**Mr Luca BUGELLI**
Researcher
University of Malta
Department of Management

[redacted]

**Dr Andrea FENECH MD (Melit) MRCEM (UK) FEBEM**

Collaborator

L-Università ta' Malta

**COLLABORATOR**

**Consent Letter**

---

We express our willingness to serve as collaborators to the proposed study entitled '**Capturing noise: the unwanted variability in triage-based decisions**' in the domain of **Evidence-based Management and Effective Decision-Making** proposed by Mr Luca Bugelli, researcher at the Department of Management, University of Malta.

The collaboration includes assisting the research team in **setting up the appropriate software application** to serve the experiment.

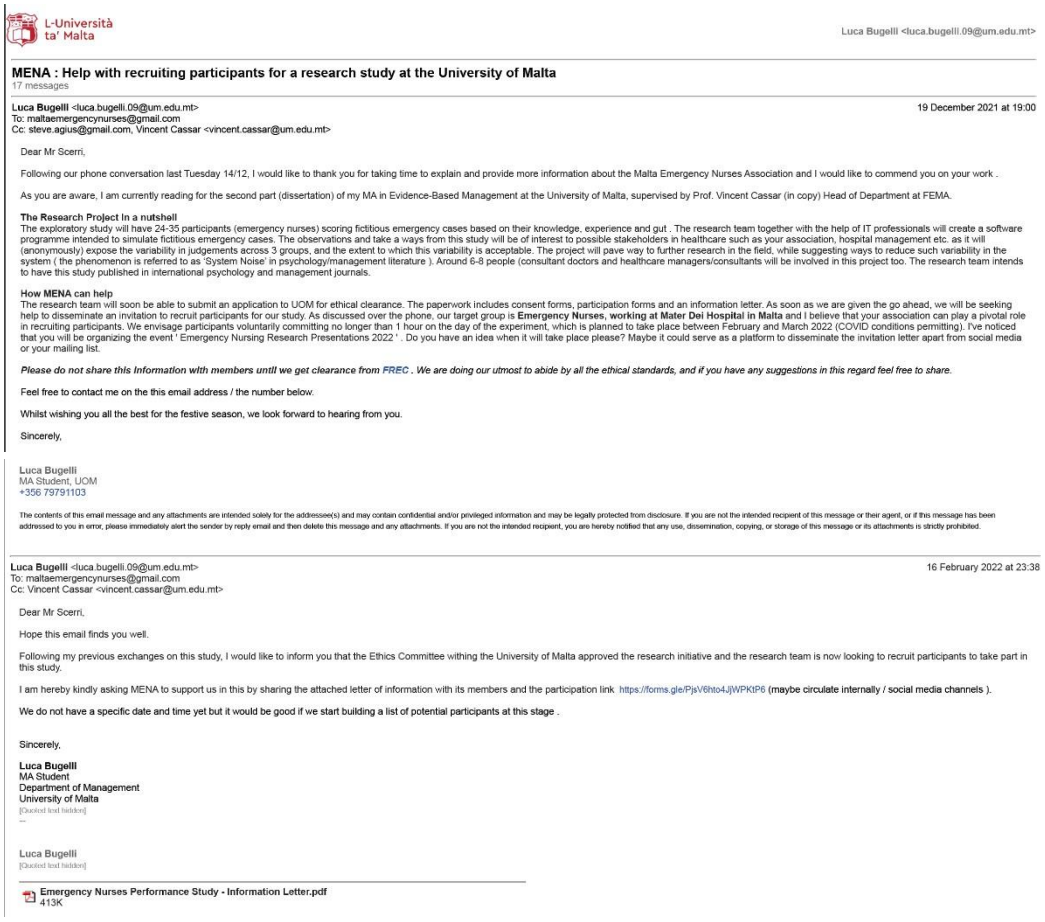
We assure that we will provide valid information technology, technical expertise and research assistance for the proposed collaborative research activities on a voluntary basis. All collected data will not be utilised outside the scope of this experiment.

**Mr Luca BUGELLI**
Researcher
University of Malta
Department of Management

**Dr Joel AZZOPARDI**
B.Sc.(Hons)(Melit.),Ph.D.(Melit.)
Collaborator

# *C. Participant Information/Experiment*

## C.1 – Malta Emergency Nurses Association, Request for Recruitment of Participants



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Luca Bugelli <luca.bugelli.09@um.edu.mt>

**MENA : Help with recruiting participants for a research study at the University of Malta**
17 messages

**Luca Bugelli** <luca.bugelli.09@um.edu.mt> 19 December 2021 at 19:00
To: maltaemergencynurses@gmail.com
Cc: steve.agius@gmail.com, Vincent Cassar <vincent.cassar@um.edu.mt>

Dear Mr Scerri,

Following our phone conversation last Tuesday 14/12, I would like to thank you for taking time to explain and provide more information about the Malta Emergency Nurses Association and I would like to commend you on your work .

As you are aware, I am currently reading for the second part (dissertation) of my MA in Evidence-Based Management at the University of Malta, supervised by Prof. Vincent Cassar (in copy) Head of Department at FEMA.

**The Research Project In a nutshell**
The exploratory study will have 24-35 participants (emergency nurses) scoring fictitious emergency cases based on their knowledge, experience and gut . The research team together with the help of IT professionals will create a software programme intended to simulate fictitious emergency cases. The observations and take a ways from this study will be of interest to possible stakeholders in healthcare such as your association, hospital management etc. as it will (anonymously) expose the variability in judgements across 3 groups, and the extent to which this variability is acceptable. The project will pave way to further research in the field, while suggesting ways to reduce such variability in the system ( the phenomenon is referred to as 'System Noise' in psychology/management literature ). Around 6-8 people (consultant doctors and healthcare managers/consultants will be involved in this project too. The research team intends to have this study published in international psychology and management journals.

**How MENA can help**
The research team will soon be able to submit an application to UOM for ethical clearance. The paperwork includes consent forms, participation forms and an information letter. As soon as we are given the go ahead, we will be seeking help to disseminate an invitation to recruit participants for our study. As discussed over the phone, our target group is **Emergency Nurses, working at Mater Dei Hospital in Malta** and I believe that your association can play a pivotal role in recruiting participants. We envisage participants voluntarily committing no longer than 1 hour on the day of the experiment, which is planned to take place between February and March 2022 (COVID conditions permitting). I've noticed that you will be organizing the event ' Emergency Nursing Research Presentations 2022 ' . Do you have an idea when it will take place please? Maybe it could serve as a platform to disseminate the invitation letter apart from social media or your mailing list.

***Please do not share this Information with members until we get clearance from FREC . We are doing our utmost to abide by all the ethical standards, and if you have any suggestions in this regard feel free to share.***

Feel free to contact me on the this email address / the number below.

Whilst wishing you all the best for the festive season, we look forward to hearing from you.

Sincerely,

**Luca Bugelli**
MA Student, UOM
+356 79791103

The contents of this email message and any attachments are intended solely for the addressee(s) and may contain confidential and/or privileged information and may be legally protected from disclosure. If you are not the intended recipient of this message or their agent, or if this message has been addressed to you in error, please immediately alert the sender by reply email and then delete this message and any attachments. If you are not the intended recipient, you are hereby notified that any use, dissemination, copying, or storage of this message or its attachments is strictly prohibited.

**Luca Bugelli** <luca.bugelli.09@um.edu.mt> 16 February 2022 at 23:38
To: maltaemergencynurses@gmail.com
Cc: Vincent Cassar <vincent.cassar@um.edu.mt>

Dear Mr Scerri,

Hope this email finds you well.

Following my previous exchanges on this study, I would like to inform you that the Ethics Committee withing the University of Malta approved the research initiative and the research team is now looking to recruit participants to take part in this study.

I am hereby kindly asking MENA to support us in this by sharing the attached letter of information with its members and the participation link https://forms.gle/PjsV6hto4JjWPKtP6 (maybe circulate internally / social media channels ).

We do not have a specific date and time yet but it would be good if we start building a list of potential participants at this stage .

Sincerely,

**Luca Bugelli**
MA Student
Department of Management
University of Malta
[Quoted text hidden]
--

**Luca Bugelli**
[Quoted text hidden]

**Emergency Nurses Performance Study - Information Letter.pdf**
413K

## C.2 – Information Letter

L-Università ta' Malta

**EMERGENCY NURSES' PERFORMANCE**
**A decision-making study**

**Information letter – February 2022**

We are a research group from the Faculty of Economics Management and Accountancy (FEMA) at the University of Malta, investigating Nurses' Performance within an Accident and Emergency Department. In this stage of our research, we are trying to recruit a group of Accident and Emergency Nurses to participate in a task-oriented experiment on a voluntary basis.

**Research Aims and Objectives**

The study is intended to gain a better grasp in understanding the extent of the variability in judgements taken by Emergency Nurses, thus serving as a referential exploratory exercise for further research. Results emanating from the study will unveil various insights which will help the respective stakeholders in the healthcare field reduce the incidence of loss of life and reduce healthcare management costs. The study is backed up by research in the fields of Evidence-based Management and Psychology, and is part of a broader research exercise at the University of Malta throughout the academic year 2021-2022.

**Procedure**

We will ask you to fill in a consent form, work on a computer-based task, and finally fill in a short questionnaire. Please be aware that the computer-based task might contain explicit information and all information you provide will remain confidential and will not be associated with your name.

**Date, time and venue**

The process will take no longer than 1 hour and will take place at the University of Malta, Msida. Exact time and date will be communicated to you at a later stage.

**Your participation**

If you would like to participate, please fill in the participation form ( https://forms.gle/PjsV6hto4JjWPKtP6 ) and if you have any questions, do not hesitate to contact us; we will be more than happy to give you more details. When this study is complete you will be provided with the results.


**Mr Luca BUGELLI**
Researcher
Master of Arts in Evidence-Based Management & Effective Decision Makin
Department of Management
University of Malta

**Prof. Vincent CASSAR**
Research Supervisor
Head - Dept of Management & Chair of Faculty Doctoral Committee
University of Malta

## C.3 – Participation Form (and consultation)

L-Università ta' Malta

**EMERGENCY NURSES' PERFORMANCE**

**Participation Form**

---

| | |
|---|---|
| **Name** | |
| **Surname** | |
| **Date of Birth (DD / MM / YYYY)** | |
| **Sex ( F / M /O)** | |
| **E-Mail Address** | |
| **Contact Number** | |
| **Current Professional Role** | Charge Nurse, Acting Charge Nurse, Senior Staff Nurse, Staff Nurse, Nursing Student, Other |
| **Years of Experience in the role** | |
| **Years of Experience as a Health Practitioner** | |
| **Highest Level of Qualification** | Doctoral Degree (MQF/EQF Level 8), Master of Science in Nursing (MQF/EQF Level 7), Bachelor of Science, (Hons.) in Nursing (MQF/EQF Level 6), Undergraduate Diploma (MQF/EQF Level 5) |
| **Qualification(s) Description** | |
| **Are you currently serving/employed as an Emergency Nurse?** | YES / NO |
| **Have you ever participated in similar studies** | YES / NO |
| **If YES, please give a brief description of the study** | |

The information you provide in this study is for our research only and it will be kept private. We will not provide any information about your answers or contact details to any third parties. The information recorded is confidential, your name will not be included in the analysis of the data. The information about you in our analysis will have a number on it instead of your name. Only the researchers will know what your number is and we will secure that information with a lock and key

☐ I understand that all information will be kept confidential and my identity will not be associated with any research findings.

☐ I understand that any personal data collected during the course of the research, such as contact details, shall be processed fairly and lawfully and shall not be retained for a period longer than necessary, and that under the General Data Protection Regulation (GDPR) and national legislation, I have the right to access, rectify, and where applicable, ask for the data concerning me to be erased.

## C.3.1 – Participation Form Consultation

**The Maltese Emergency Nurses Association** <maltaemergencynurses@gmail.com> Thu, 17 Feb 2022, 22:32
to me, Vincent

Dear Mr. Bugelli,

I'm just going through the questionnaire and although I know it is difficult to change the questions, may I suggest some small changes before dissemination;

Q5: Better to use 'Are you Currently Practicing in an Emergency Setting' instead of 'Emergency Nurse Practitioner - This term does not exist in Malta.
Q6: Pre-Hospital Nurses (Mosta & Paola) do not exist any longer (since a week or 2 weeks ago)
Q6: Student Nurses cannot be considered as practicing in an Emergency Setting.

Thanks

Kenneth Scerri
The Maltese Emergency Nurses' Association
VO/1377

The Maltese Emergency Nurses' Association

**The Maltese Emergency Nurses Association** <maltaemergencynurses@gmail.com>
to me, Vincent

Yes.

Also if possible, to replace A&E Department (Accident & Emergency Department) to ED (Emergency Department).
The nomenclature A&E Dept. should have been obsolete for approximately 30yrs according to the Platt Report, however unfortunately still being used in Malta.

Thanks & gd evening

Kenneth Scerri
The Maltese Emergency Nurses' Association
VO/1377

The Maltese Emergency Nurses' Association

## C.4 – Experiment Protocol

L-Università ta' Malta

**EMERGENCY NURSES' DECISION-MAKING STUDY**
**Protocol v0.2**

*Fill in in block letters*

| | |
|---|---|
| **Facilitator name and surname** | |
| **Date** | |
| **Venue** | |

*Tick as appropriate*

| **Equipment needed** | | **On the spot checks** | |
|---|---|---|---|
| | Monitor (Portrait orientation) | | Is room clean? |
| | Computer | | Is room distraction free? |
| | Mouse | | Is apparatus functional? |
| | Consent form | | Is the room well lit? |
| | Pen (Blue) | | |
| | Office chair | | |
| | List of participants for the day and timeslot | | |

### WELCOME MESSAGE

"Welcome and thank you for participating in this study. You will be working on a computer-based task, where, after filling in the consent form you will be asked to complete a short questionnaire, judge emergency cases, and finally fill in another questionnaire. The process has to be distraction-free, so we are kindly asking you to switch off and hand over your mobile device/s to the facilitator. Please be aware that the computer-based task might contain explicit information and all information you provide will remain confidential and will not be associated with your name. The exercise will not take longer than 45 minutes. If you feel the need to visit the restroom, please do it now. You are free to ask any questions."

### CONSENT

"Please fill in, sign and hand in the consent form before clicking starting – Thank you for filling in the consent form, you can now proceed by entering your unique participant code and clicking START TEST - follow the on-screen instructions throughout."

- **Exercise starts as soon as consent is given/complete, all the questions clarified and participant is in a serene state of mind**
- **Can the participant quit anytime during the experiment?** Yes, the participant can quit at any moment throughout the experiment as informed in the information letter.
- **What happens if the participant experiences psychological or emotional discomfort**? In this case the facilitator and researchers will assist the participant in getting professional help from organisations such as the Richmond Foundation (VO/0017) on 1770, the national Support line on 179, or The EU Emotional Support Helpline on 116 123 for further assistance.

## C.5 – Consent Form(s)

L-Università ta' Malta

**EMERGENCY NURSES' PERFORMANCE**
**A decision-making study**

**Consent**

---

This study will first require you to participate in a fill in a short questionnaire, followed by a computer-based task and a personality test. Nothing that you tell us by filling in the questionnaire will be shared with anybody outside the research team, and nothing will be attributed to you by name. Your identity will remain undisclosed at all times. Learning and outcomes from this study will be published and each participant will receive a summary of the results. The information you provide is for research purposes only and it will be kept private and we will not provide any information about your answers or contact details to any third parties. Your name will not be included in the analysis of the data and will be replaced by a unique code. If you decide to give us your email for further contact, it will only be accessed by the main researcher.

***Please indicate with your signature and check boxes below that you understand your rights and agree to participate in the study. We will ensure that each person signing the written consent is given a copy of that form.***

I, the undersigned, give my consent to take part in the study conducted by Luca BUGELLI and Prof. Vincent CASSAR at Department of Management, University of Malta. This consent form specifies the terms of my participation in this research study.

☐ I understand that I have been invited to participate in a task-based experiment about quality decision-making and I am aware that the trial will take approximately 1 hour.

☐ I have been given written and/or verbal information about the purpose of the study and any questions that I had were answered fully and to my satisfaction.

☐ I understand that my participation is strictly voluntary and I may discontinue participation at any time without giving a reason. I understand the researchers will delete the data if I choose to discontinue, quit or complete the study.

☐ I also understand that I may choose to decline to answer any questions asked. In the event that I choose to withdraw from the study, any data collected from me will be destroyed.

☐ I understand that, under the General Data Protection Regulation (GDPR) and national legislation, I have the right to access, rectify, and where applicable, ask for the data concerning me to be erased.

☐ I understand that all information will be kept confidential and my identity will not be associated with any research findings. Any personal data collected during the course of the research, such as contact details, shall be processed fairly and lawfully and shall not be retained for a period longer than necessary.

☐ I understand that all data collected will be stored in an anonymized form in digital format on completion of the study and following publication of results/within 1 year of completion of the study.

☐ I understand that if I experience any psychological or emotional discomfort generated by the computer, the researchers will assist me in getting professional help from organisations such as the Richmond Foundation (VO/0017) on 1770, the national Support line on 179, or The EU Emotional Support Helpline on 116 123 for further assistance.

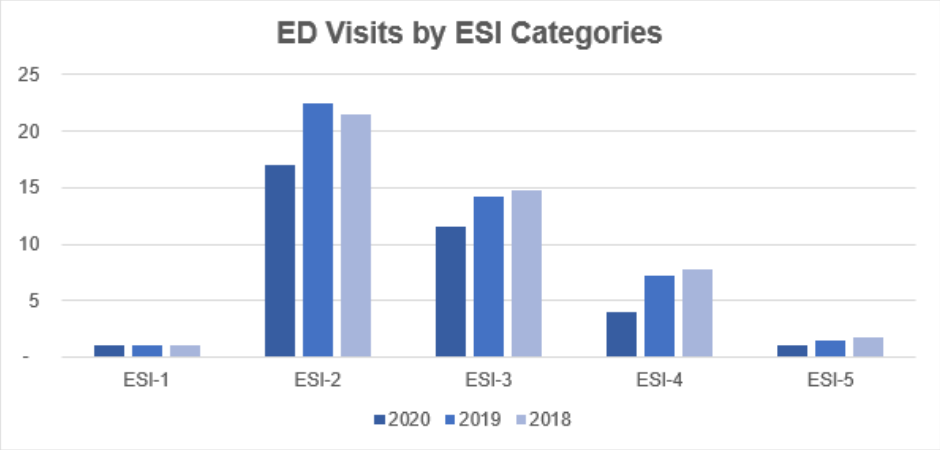
If you have any further questions please feel free to contact Mr Luca BUGELLI, Research Investigator on luca.bugelli.09@um.edu.mt or Prof. Vincent Cassar, FEMA Head of Department of Management on vince.cassar@um.edu.mt, +356 2340 3479.

| | | |
|---|---|---|
| **Participant Name and Surname** | **Mr Luca BUGELLI**<br>Researcher<br>Department of Management<br>University of Malta | **Prof. Vincent CASSAR**<br>Research Supervisor<br>Head - Dept of Management &<br>Chair of Faculty Doctoral Committee |

## *D. Statistics (Secondary Data)*

### D.1 – ED Visits by ESI Categories (indexed)

Mater Dei Hospital, Malta - Europe




| Year / Level | ESI-1 | ESI-2 | ESI-3 | ESI-4 | ESI-5 | |
|---|---|---|---|---|---|---|
| 2020 | 1 | 17 | 12 | 4 | 1 | 35 |
| 2019 | 1 | 23 | 14 | 7 | 2 | 47 |
| 2018 | 1 | 22 | 15 | 8 | 2 | 47 |
| Total for 18'-20' | 3 | 61 | 41 | 19 | 4 | 128 |
| %Triage Cases /Total | 2% | 48% | 32% | 15% | 3% | |
| Distribution on 12 Cases | 0.29 | 5.73 | 3.80 | 1.78 | 0.40 | |
| Approx. Dist. | 1 | 5 | 3 | 2 | 1 | 12 |

*Source: Mater Dei Hospital (Malta) Administration / Emergency Department*

**D.2 – EU 27 Hospital Emergency Department Statistics / Hospital Admissions 2018 – 2021 (as at 31 March 2022)**

| Country | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Italia | n/a | n/a | n/a | n/a |
| Belgium | n/a | n/a | n/a | n/a |
| France | n/a | n/a | n/a | n/a |
| Spain | n/a | n/a | n/a | n/a |
| Bulgaria | n/a | n/a | n/a | n/a |
| Czechia | 28,404 | 49,133 | 60,589 | n/a |
| Denmark | n/a | n/a | n/a | n/a |
| Germany | 10,576,365 | 9,727,531 | 8,443,688 | n/a |
| Estonia | 328,515 | 355,189 | 301,329 | n/a |
| Ireland | 1,470,541 | 1,506,343 | 1,278,283 | n/a |
| Greece | n/a | n/a | n/a | n/a |
| Croatia | n/a | n/a | n/a | n/a |
| Cyprus | n/a | n/a | n/a | n/a |
| Latvia | n/a | n/a | n/a | n/a |
| Lithuania | n/a | n/a | n/a | n/a |
| Luxembourg | n/a | n/a | n/a | n/a |
| Hungary | 1,248,781 | 1,231,920 | 1,111,744 | n/a |
| Malta | 93,500 | 93,200 | 69,000 | n/a |
| Netherlands | n/a | n/a | n/a | n/a |
| Austria | n/a | n/a | n/a | n/a |
| Poland | n/a | n/a | n/a | n/a |
| Portugal | n/a | n/a | n/a | n/a |
| Romania | n/a | n/a | n/a | n/a |
| Slovenia | n/a | n/a | n/a | n/a |
| Slovakia | n/a | n/a | n/a | n/a |
| Finland | n/a | n/a | n/a | n/a |
| Sweden | 1,907,055 | 1,877,391 | 1,642,237 | 1,722,618 |
| EC.EUROPA.EU | | | | |
| EUSEM | | | | |

# *E. Case Development*

## E.1 – Interrater agreement exercise - Feedback following disagreement

| CASE # 2 | |
|---|---|
| **ESI LEVEL** | **1** |
| **SCENARIO : Fall** | |
| 20 year old male of African descent brought in by friend due to fall from scaffolding. Patient is a poor historian but says he fell onto rock and is complaining of pain in the upper abdomen and lower ribs on both sides. He also has a deformed wrist on the right which seems to be the main focus of his pain. Patient looks sweaty, clammy and relatively pale. When asked on how bad is the abdominal pain he admits to a 6/10 pain but points to the wrist saying it's a 9/10 pain. He asks to have his wrist fixed. Vital signs: RR 28, Sats 98% on air, Pulse 120, Temp 36 at the door. | |
| **UNDERLYING CONDITION(S)** | |
| Nil | |
| **MEDICAL HISTORY** | |
| No past medical history | |

| **Do you agree with the assigned score for Case # 2 ?** | **No/Maybe** |
|---|---|
| **If no please share your rationale** | **Patient is at high risk of potentially serious intra-abdominal pathology, however not enough information to justify saying he requires immediate life-saving intervention is available (definition of ESI1). Patient may be tachycardic and tachypnoeic due to severe pain, not shock. I feel this may be debatable between an ESI1 or 2, especially without more information. I would not be surprised if in practice this case would be classified as an ESI2.** |

| CASE # 4 | |
|---|---|
| **ESI LEVEL** | **2** |
| **SCENARIO: SOB** | |
| 42-year-old lady, known asthmatic, presents with 2-day history of worsening SOB on exertion and audible wheeze. She has been taking her salbutamol inhaler with minimal effect. On arrival she is audibly wheezy and is unable to complete a sentence in one breath. Her oxygen saturations are 94%, respiratory rate 28, heart rate 115. Ambulance crew have given her 1 salbutamol nebuliser before arrival which she found helpful but now feels her chest is getting a bit tight again. | |
| **UNDERLYING CONDITION(S)** | |
| Asthma<br>Hayfever | |
| **MEDICAL HISTORY** | |
| She had 1 admission to hospital with a severe asthma exacerbation when she was 20 years old but since then has been well controlled. She takes her inhalers daily. | |

| **Do you agree with the assigned score for Case # 4 ?** | **No** |
|---|---|
| **If no please share your rationale** | **Cannot complete sentences and Sats at 94 in otherwise someone with no oxygenation problem which persisted despite use of first line drugs by patient and ambulance crew. Asthma kills rapidly** |

| CASE # 14 | |
|---|---|
| **CASE #** | **DOC_CASE_14** |
| **ESI LEVEL** | **4** |
| **SCENARIO** | |
| A 47 year old presents complaining of a 2 day history of nasal congestion, frontal headache, and a burning sensation in the throat. He denies any fever, shortness of breath or chest pain, however admits to the occasional dry cough. He claims his daughter just started attending playschool and also has had similar symptoms in the past 3 days. His parameters are within normal limits. He has not attempted to take any over the counter medication. | |
| **UNDERLYING CONDITION(S)** | |
| Hypertension, dyslipidaemia | |
| **MEDICAL HISTORY** | |
| Never required hospital admission, co-morbidities managed by his GP | |

| | |
|---|---|
| **Do you agree with the assigned score for Case # 14 ?** | **No** |
| **If no please share your rationale** | **Should be ESI 5 as can be easily discharged with a good history and clinical exam.** |

## *F. Visit Observations*

### F.1 – Emergency Department Visit Evidence of Observations (14 Feb 2022)

L-Università ta' Malta

Luca Bugelli <luca.bugelli.09@um.edu.mt>

**Triage-Based Decisions Study : Doc-Cases - Inter-rater Agreement**

**Luca Bugelli** <luca.bugelli.09@um.edu.mt> 15 February 2022 at 17:34
To: Vincent Cassar <vincent.cassar@um.edu.mt>
Cc: Luca Bugelli <lucabugelli@gmail.com>, Steve Agius <steve.agius@gmail.com>

Hi Steve,

Thanks for making time yesterday.

The visit was a very insightful one as it provided me with an opportunity to get a sense of the intensity of the modus operandi within A&E and the internal dynamics of handling emergencies.

From my end I will be forwarding the case scenarios to IT team now to implement in the simulator - as to experiment date/setup/recruiting participants this is still up for discussion as discussed.

We will be in touch.

Luca

NOTES

ED2?

A&E visit 14. FEB 2022.

Reception Area.
- ↳ Registration, Window 1/2/3/4
- ↳ Noise, Confusion.
- ↳ Constant calls on speaker phone for random people to visit Areas 1/2/... etc.
- ↳ Stretcher in Corridors
- ↳ Noises.

Q. Triage 1 = Area 1 ? No
- ↳ ED2?
- ↳ Emergency Nurses coming from Outside

Door.

| A | B | C |
|---|---|---|

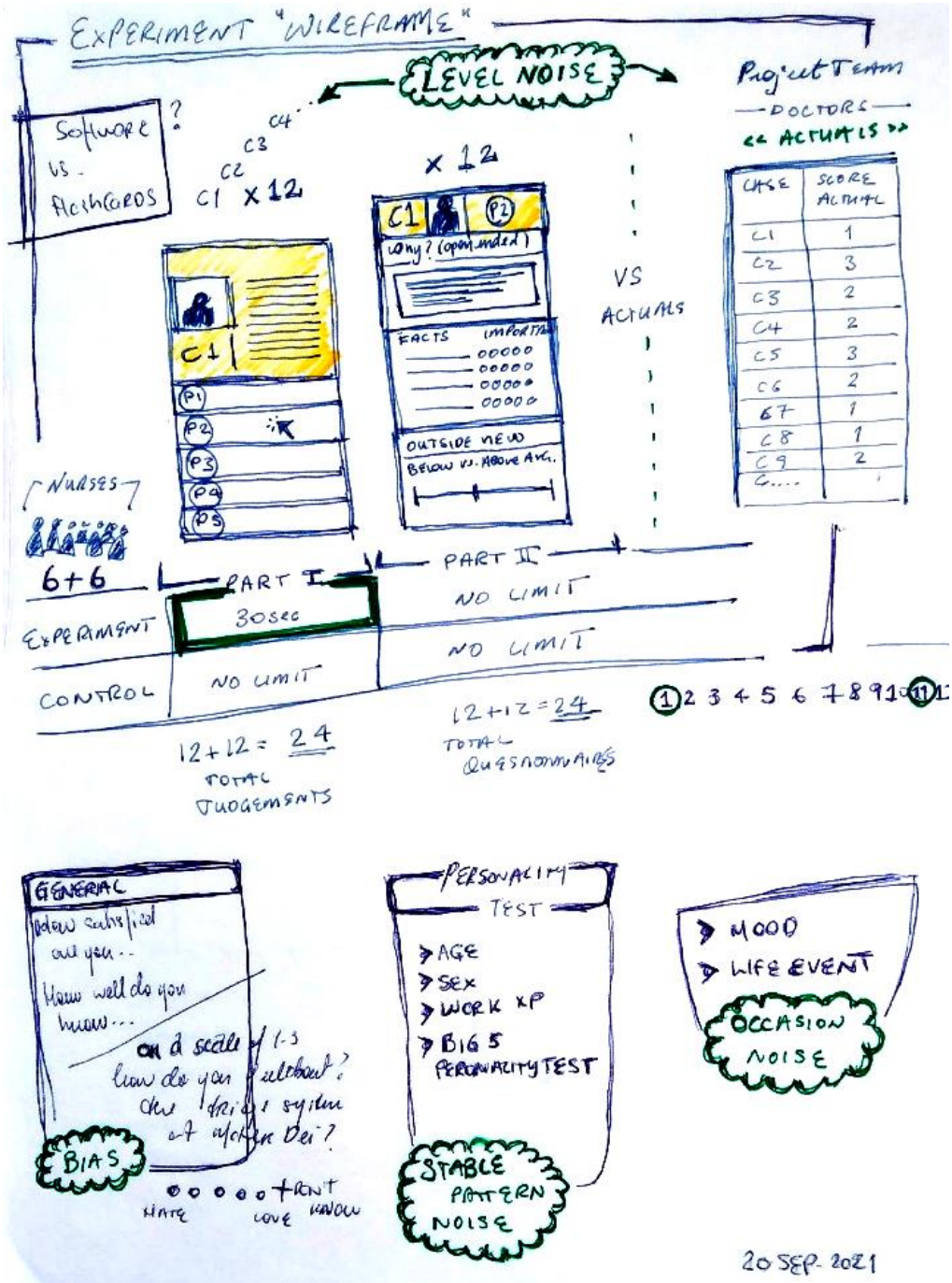
Reception

Covid distractions
Language etc.

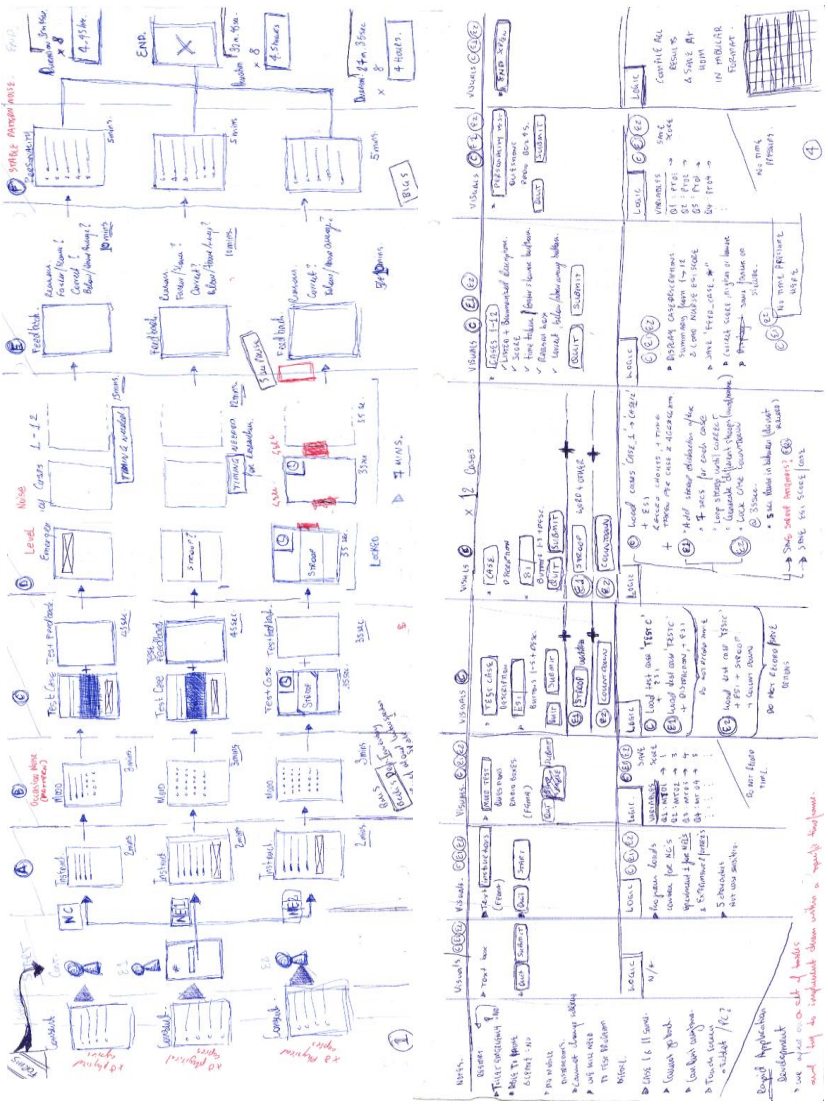
MCC
Minor Care Clinic

## *G. Research Software Simulator (Web application) Development and setup*

### G.1 – Experiment Frontend Wireframe (1), 20 SEP 2021



## G.2 – Experiment Frontend/Backend Wireframe



## G.3 – Requirements Brief (1)

NOISY 0.1

**Requirements**

The application is meant serve as tool for a research project at the Department of Management at the University of Malta whereby the research investigators will observe the variability in judging hospital emergency cases among the participants - emergency nurses. It should be able to :

- Capture and save participant responses throughout the course of the experiment
- Compile datasets into spreadsheets ready to use and analyse post-experiment
- Load and display text, input fields, radio buttons, flash colours, countdown timer, record time, save and reload user responses, allow users to navigate throughout the program at her/his pace (depending on the group).
- Flow seamlessly without any hangs or lags
- Erase participant data if the user chooses to quite the application

The end results should consist of a spreadsheet with all the data linked to the unique username. Each dataset containing the unique code for the researchers to easily manipulate the data and analyse the results

**Architecture, platform and user interface**

It is up to the Faculty of ICT to choose the appropriate platform and programming language and propose a user friendly, clean and friendly interface throughout.

## G.4 – Requirements Brief – Detailed (2)

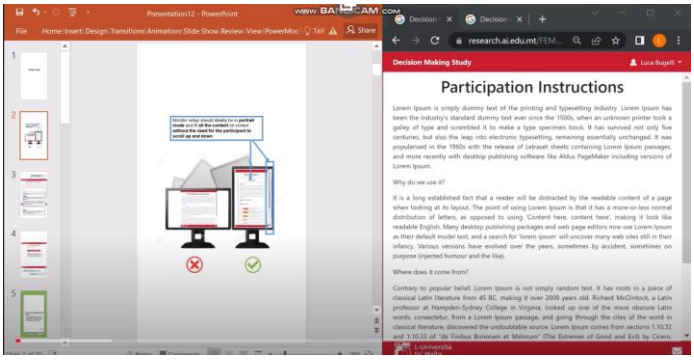
**Application flow**

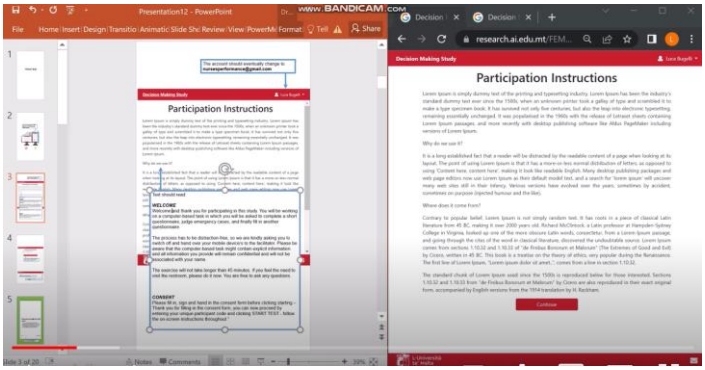
| | |
|---|---|
| **Pre-experiment** | Participants will be invited to participate in this study via an online registration form, word of mouth, nurses' association communications, etc. The researchers will review the list and split the participants into 3 groups of 8 participants - the control group, experimental group 1 and experimental group 2. |
| **Logging-in** | The researchers, will then assign a unique code which will be used to login into the application, protecting their identity throughout the course of the experiment (in line with ethics and GDPR guidelines). The application should be able to load a different flow according to the code entered. The application should load the<br>- control flow for participants with codes commencing 'NC0' e,g, NC0-01<br>- experimental flow #1 for participants with codes commencing 'NE1' e,g, NE1-01<br>- experimental flow #2 for participants with codes commencing 'NE2' e,g, NE2-01<br><br>Error prompt if incorrect input, user should not be allowed to proceed in this case.<br><br>Variables : PART_NUM |
| **A** | Upon logging, the application should first load the protocol and instructions. This part is common to all participants. |
| **B** | The researchers will control for mood will be measured in section A. The researchers will suggest the appropriate rating scale to be implemented (12-15 questions). The result (e.g. positive, etc.) will not be disclosed to participants.<br><br>Variables : PM1, PM2, … |
| **C** | After completing the mood test, the participants will be then asked to test-out the task, that is, assign an ESI (Emergency Severity Index) score to emergency cases. The app should load a test screen displaying a test-case here for the participants to try-out (untimed for the control group, including the Stroop distraction for XP1 and timed (+ Stroop) for XP2, followed by a test-feedback screen, which will be the last part of the actual study.2, …<br><br>Variables : TESTC, TECTC_REV |
| **D** | Once the participants get a good feel of what experiment will require of them, they will then move on to the actual scoring:<br><br>- The control group will be assigned emergency case without any time limit or distractions<br><br>- XP group 1 will get the same screen with a distraction. The Stroop should appear after 7 seconds for each case and looped until the participants chooses the correct entry.<br><br>- XP group 2 will get the same as XP1 including a 35 sec countdown timer for each case and a 5 seconds pause in between cases.<br><br>Variables : CASE_1, CASE_2, CASE_3 … |
| **E** | After scoring the 12 cases, the participants will be then asked to provide reasons for their ratings. Here the application should load the ratings and the title or a brief description for each case. They will also be asked whether they think that their rating is below or above average. No time pressure or distractions here. This section is common for all groups<br><br>Variables : FB_CASE_1, FB_CASE_2, … |
| **F** | Finally in section F, researchers will control for personality. The researchers will suggest the appropriate rating scale to be implemented (12-15 questions). The result (e.g. extrovert, introvert etc.) will not be disclosed to participants.<br><br>Variables : NPT1, NPT2, … |
| **End** : Application should be able to compile all results and save in tabular format for the researchers to analyse further. | |

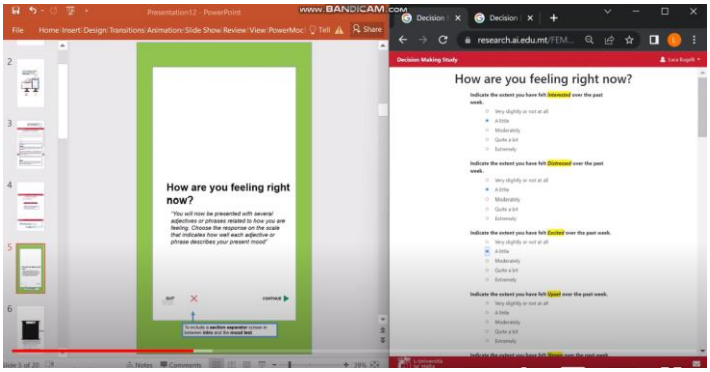
**Prototyping and testing**

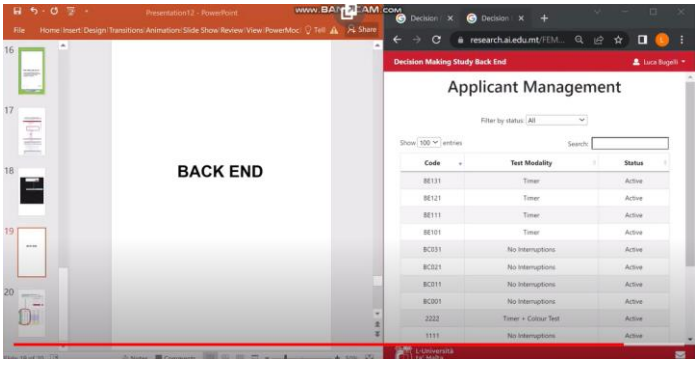
It is critical that the researchers get to test a basic idea, after which it will be left up to F ICT to build on it. The researchers should be allowed the facility to test the application before making it available to participants as it will ensure that each function works correctly and as requested.

## G.5 – Web Application Development (Screenshots)



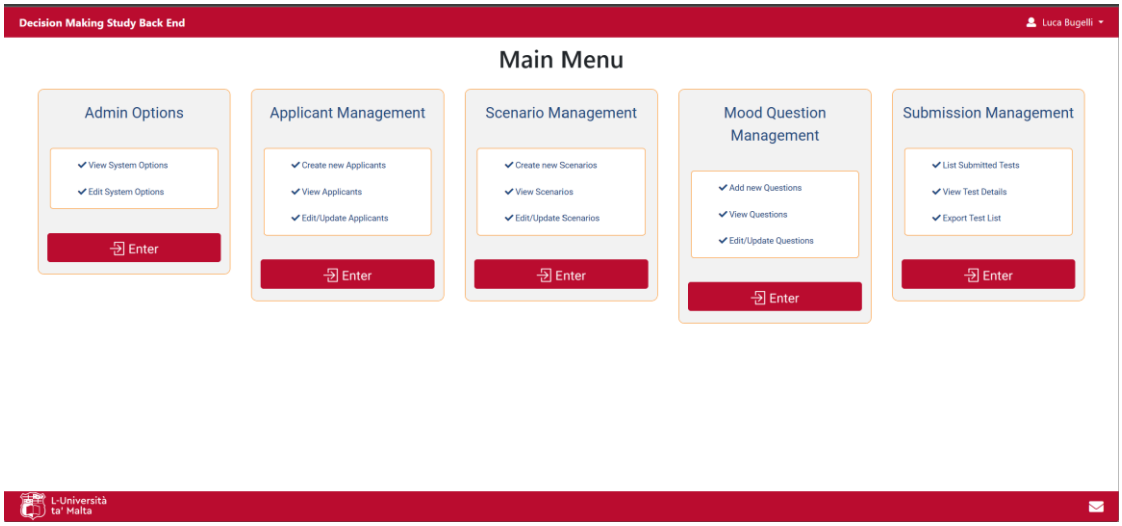



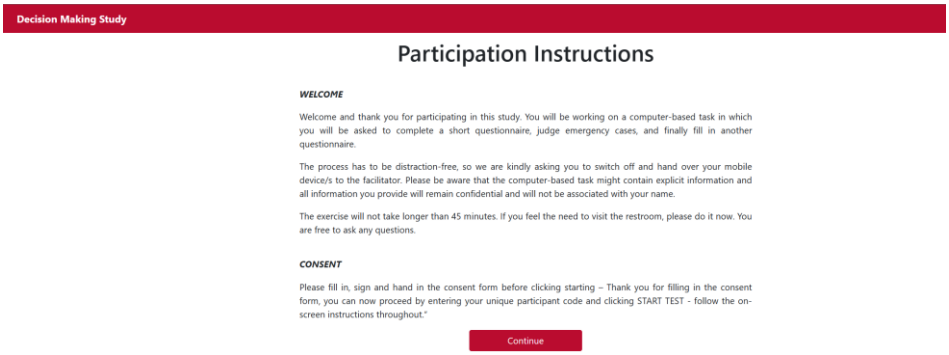
## G.6 – Web Application Final Version

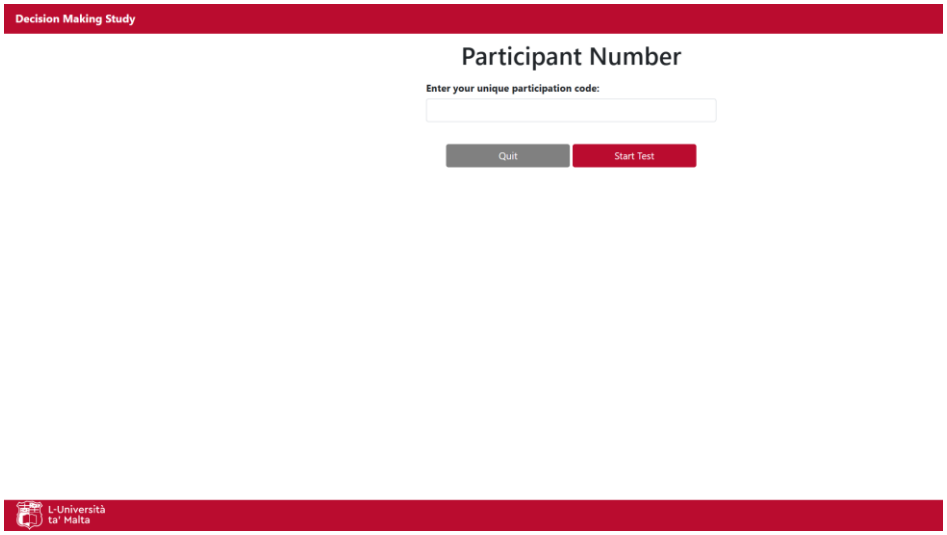
### G.6.1 – Web application Back-end (Researchers' menu)




Link: *https://research.ai.edu.mt/FEMA_DM/backEnd/*

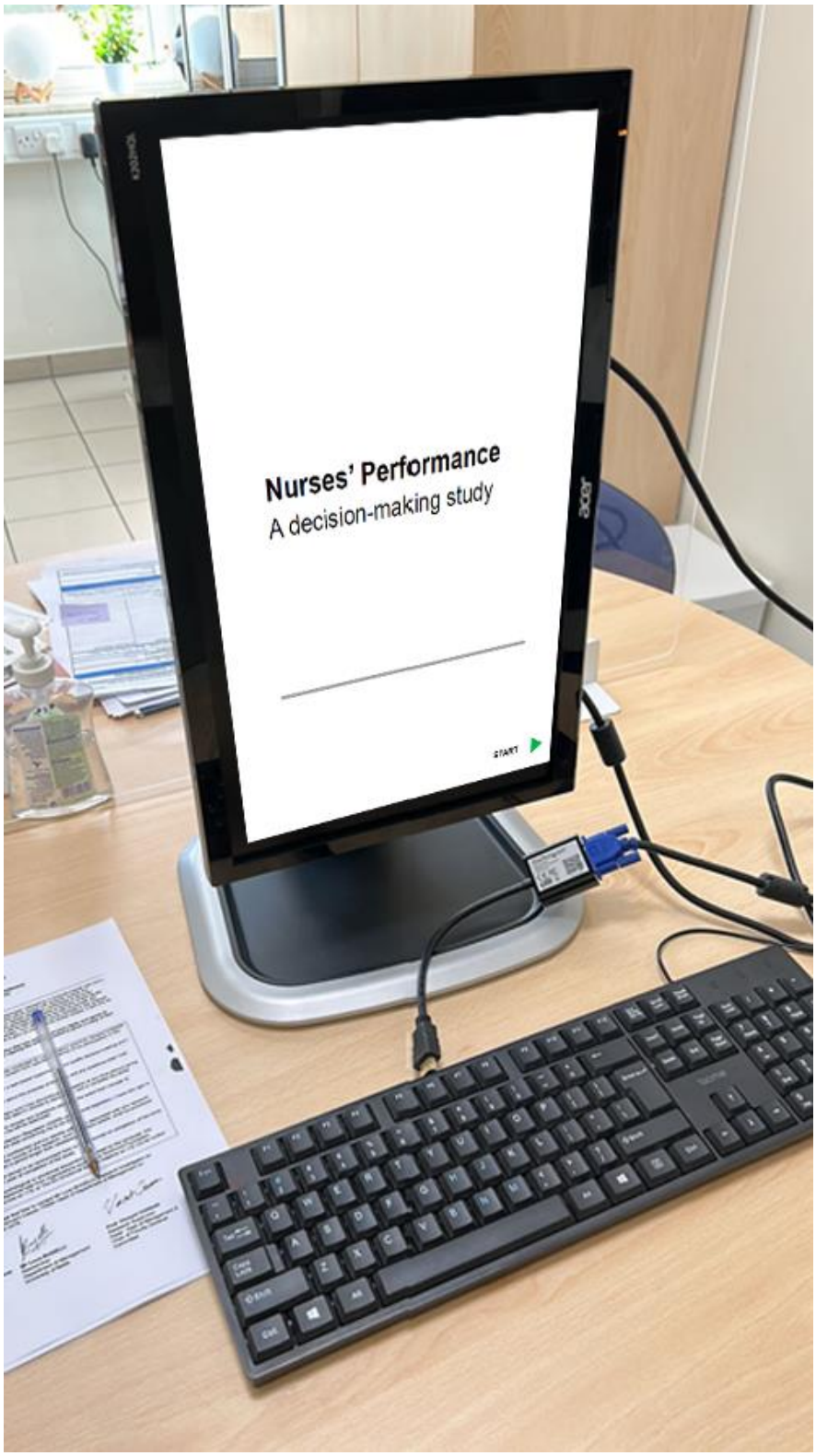
## G.6.2 – Web application Front-end (Participants view)




Link: *https://research.ai.edu.mt/FEMA_DM/frontEnd/*

**G.7 – Setup**



## G.8 – Software Simulator Potential Future Development (Report)

Triage Decision-Making Study
**Results**

Name:
Date:

**Mood (Self-reported)**

| | Score | | % |
|---|---|---|---|
| Positive Effect Level | 27 | = | 54% |
| Negative Effect Level | 23 | = | 46% |

**Tool: PANAS Mood Scale (reference)**
*Positive Affect Score: Scores can range from 10 – 50. Higher scores representing higher levels of positive affect.*
*Negative Affect Score: Scores can range from 10 – 50. Lower scores representing lower levels of negative affect.*

**Case Judgements**

| # | Case Description | Actual ESI Score | Your Score | Variance |
|---|---|---|---|---|
| 1 | Reduced Level of Consciousness | 1 | 1 | 0 |
| 2 | Abdonominal Pain (Ectopic Pregnanc | 2 | 3 | 1 |
| 3 | Chest Pain | 2 | 2 | 0 |
| 4 | Abdonominal Pain | 2 | 2 | 0 |
| 5 | Fever | 2 | 3 | 1 |
| 6 | Food Poisoning | 2 | 2 | 0 |
| 7 | Lower Back Pain | 3 | 2 | 1 |
| 8 | Abdonominal Pain | 3 | 3 | 0 |
| 9 | Shortness of Breath | 3 | 2 | 1 |
| 10 | Twisted Ankle | 4 | 2 | 2 |
| 11 | Ankle Pain | 4 | 4 | 0 |
| 12 | Skin Problems | 5 | 5 | 0 |
| | | | Aggregate Variance | **6** |

**Personality Traits (Self-reported)**

| | Score | Level |
|---|---|---|
| **Extraversion:** [meaning] | 4 | |
| **Neuroticism:** [meaning] | 8 | |
| **Conscientiousness:** [meaning] | 7 | |
| **Agreeableness:** [meaning] | 12 | |
| **Openness:** [meaning] | 9 | |

**Tool: Newcastle Personality Assessor (Reference)**

# *H. Qualitative Data (Results)*

## H.1 Participant Responses

Control Group - Reasons for ESI triage score

| Case 1 - Reduced level of consciousness<br>1 | Case 2 - AbdominalPain - Ectopic Pregnancy<br>2 | Case 3 - Chest pain<br>2 | Case 4 - AbdominalPain<br>2 | Case 5 - Fever<br>2 | Case 6 - Foodpoisining<br>2 |
|---|---|---|---|---|---|
| 25-year-old female brought to the ED with reduced level of consciousness and fever. Her friend reports she had feeling generally unwell for 2 days. Today she had one episode of vomiting and became increasingly confused and drowsy. She is unsure if the patient has been taking her insulin. Ambulance crew report that she has a respiratory rate of 40, heart rate of 140 bpm, blood pressure of 90/50 mmHg and temperature 38.5°C. She is responding to painful stimulus and her blood sugar reading was "extremely high" on the monitor | 33-year-old woman presented to the ED with a 6-hour history of worsening right sided abdominal pain. She states it started as a dull ache which worsened and localised more to the right lower quadrant. She denies fever but has been nauseated. She hasn't had a menstrual period for 2 months but states she has irregular periods. She is tachycardic at 115, blood pressure 125/68 mmHg and is mildly distressed in pain, which she rates 6/10. | 58 year old's male presented with left sided chest pain and left jaw pain after a heated argument with his wife. This lasted about 15 min but has resolved he is currently pain free. Does not want to be in ED but came as both wife and children insisted he comes and gets checked. Current Vitals: Pulse 80, RR 16, Sats 100% on Air, Temp 36 on registration | 59- year old man presents with a 6-day history of worsening left flank pain. He describes a dull ache which is occasionally sharp and radiates to the back. He reports nausea and multiple episodes of vomiting for past 24 hours. He is unable to keep any food or drink down, including a cold. On arrival to the emergency department he is sweating profusely and visibly in pain. He is tachycardic at 130 bpm, BP 105/60 bpm, saturations 98% on air | 48 year old male presented with fever for the past 6 days associated with a dry cough. Patient says he is well otherwise, but fever seems to have persisted. He is vegan and health and stays away from harmful chemicals. Came to get checked as its unusual to have fever for this long. Parameters: Pulse 120, sats 98 on air, RR 20, Temp 39 at door | 38 year old male came per presented with a 2 hour history of nausea and vomiting x1 and lethargy after roasting mackerel bows on oleander branches in open fire. At first he was well but after about 2 hours the nausea started as well as feeling very light headed. Thinks he ate too many mackerel bowllows. Looks clammy. Vitals: Pluse 58, RR 24, Sats 95 on air temp 36 at the door |
| *Possibly "DKA" after "infection"* | *"Pain score"* | *"Age" and "Diabetes".* | *Pain, RR and diabetes.* | *Abnormal parameters. Needs Oxygen supp of* | *Young active male, so HR is justified. Would look into Oleander branches vis-a-vis* |
| *pt is "p on exam" parameter wise "very unstable". It is a time critical situation* | *patient "is in distress" "in severe pain" at time of triage, "tachycardic"* | *"chest pain" which is "radiating after a stressful scenario" "merits a priority 2". "It is urgent case"* | *give the alcoholic, being diabetic and the parameters, patient deserves a priority 2.* | *the parameters especially an SPo2 of 89% on a 40 yr old merits a Priority 2* | *Based only on reading the scenario the priority is 3. I would have checked his CO level, ask* |
| *need assistance within the first few minutes since if the patient is diabetic and not taking her* | *acute pain with long abs period and abdo pain, pain score is high and pain stated abruptly could be a* | *with high pain has a bladder but has multiple co morbidities that can mask the pain* | *4 days increased in urine unable to take cafe fluids already, clammy with low sats,* | *sats are low therefore needs oxygen* | *sudden and branches might have some poisonous substances, with a low pulse rate, slightly raised or* |
| *Deceased GCS with P on AMPU score, unstable parameters,* | *will need investigations for the pain but not a high risk, will require 2 or more resources* | *chest pain on a 60+ year old male with co morbidities stated after stress no exercise with all* | *not tolerating oral intake with unstable parameters which make the patient an automatic 2* | *healthy middle aged patient which is healthy and not in distress showing signs of ill* | *unstable vitals with a possible inhalation/ingestions of toxins* |
| *patient is tachycardic, tachypnoeic, febrile and slightly hypotensive with altered level of* | *patient is tachycardic but afebrile. patient is in pain* | *incompliant to diabetic treatment which might lead to a silent MI. patient has alot of risk factors for* | *abnormal parameters with a history of alcoholism and diabetes. patient is also in pain* | *tachycardia is due to fever. patient has no other complaints. given that fever was there for 4* | *patient is bradycardic and tachypnoeic* |

| Case 7 - Lower back pain<br>3 | Case 8 - AbdominalPain<br>3 | Case 9 - Shortness of breath<br>3 | Case 10 - Twisted Ankle<br>4 | Case 11 - Ankle Pain<br>4 | Case 12 - Skin Problems<br>5 |
|---|---|---|---|---|---|
| 69-year-old lady presents with a 3-month history of worsening lower back pain which suddenly increased in severity this morning whilst she was cleaning the house. Pain is radiating down the left leg and feels a "tingling" feel down to her left big toe occasionally. Pain is worse on movement. She has been taking regular morphine (prescribed by her GP) for the past 2 weeks due to the pain which helps slightly. She has not passed urine for a few hours and has been constipated for the past 4 days. Her vitals/pulse are normal. | A 67 year old man presents complaining of a 2 day history of lower abdominal pain. He claims he is nauseous but is not vomiting, and has been having some loose stool since the pain started. He also had chills and rigors at home, but did not check his temperature. His parameters at triage are normal except for a temperature of 37.9C | An 80 year old male presented complaining worsening shortness of breath on climbing stairs in his home over the past week. Today he is unable to go upstairs at all, and is feeling tightness of breath walking to and from the bathroom, but comfortable sitting down. He also noted he is was waking up at night feeling short of breath last night. His parameters at rest are normal | 38 year old's soccer player twisted ankle due to levers for injury. Has a swollen right ankle with pain over medial and lateral malleoli. Unable to weight bear. Says he is in pain. Vitals: Pulse 130, Sats 100 on air, RR 20, Temp 37.8 at the door | A 25 year old lady is brought in on a wheelchair complaining of pain on her ankle. She claims she was walking on the rocky shore where he lost her balance and twisted her ankle. She was able to put some weight on it and made it back to her car after the fall, however she claims its now too painful to stand on. She is in moderate pain when seated. She denies any other injuries. Her ankle is swollen and has bruising over the lateral malleolus, and is warm and tender to the touch. Her parameters are within normal limits. | A 65 year old male presents complaining of a new mole on his back, which his wife noted whilst he was getting ready to take a shower. He and his wife presented as they were very concerned it may be cancer, as they had watched a television with a dermatologist on television who explained what to look out for. On assessment, the mole is 5mm in diameter, with regular edges, consistent brown colour but with no surrounding erythema or scaling. Parameters are normal. |
| *Unable to pass urine and faeces could indicate another compression injury.* | *Probably needs blood work, IV and IV treatment with probable admission to hospital* | *Exertional dyspnoea for someone at that age accompanied by PMH.* | *No deformity, Needs XRAY+/- Plaster* | *Mild pain and no deformity.* | *Needs dermatology referral. Not a resource. Not acute as a complaint* |
| *pt needs a review by a GP, specially follow up and physiotherapy. pt does not* | *priority 3 because the pt will for sure need a wbc/hb work up, bloods, abdo scan and* | *worsening dyspnoea and orthopnoea give the patient a priority 2,* | *patient only needs a scan of the right ankle* | *may also merit a priority 4 need to examine visually, patient only needs a scan of ankle* | *priority 5 as patient does not need any emergency intervension, rather a* |
| *although the pain has been there for few months there is a new problem of not passing urine can* | *patient is calm with a 2 days history, needs medical assistance but is able to walk* | *patient is comfortable at rest, will be advised not to walk and maybe offer to put the patient of* | *was unable to bear weight, pulse raised in view of pain. pain needs to be treated but he can* | *was able to bear weight after, can be offered to elevate her foot and maybe some cold* | *regular and further testing need to be done that can be done by being referred from a gp or* |
| *requires review of treatment* | *showing signs of possible recurrent episode of diverticulitis, stable but will require* | *elderly who is cardio-path clo worsening dyspnoea which make the patient a high risk* | *young healthy patient with isolated injury to lower limb with intact vascularity.* | *no major injuries except for lower limb injury which no affect on vascularity of the limb, will need* | *just requires a dermatology referral* |
| *long standing problem which improves with morphine. however patient constipated x4* | *If no life symptoms with normal parameters.* | *strong cardiac history with poorly controlled diabetes which might mask pain or other relevant* | *patient is in pain. ? presence of pedal pulses* | *normal parameters with moderate pain. xrays and most likely bloods will be required due* | *normal parameters, patient requires dermatology. could have been seen at GP with the* |

# Experimental Group I - Reasons for ESI triage score

| Case 1 - Reduced level of consciousness<br>1 | Case 2 - Abdonominal Pain - Ectopic Pregnancy<br>2 | Case 3 - Chest pain<br>2 | Case 4 - Abdonominal Pain<br>2 | Case 5 - Fever<br>2 | Case 6 - Food poisining<br>2 |
|---|---|---|---|---|---|
| **21-year-old female brought to the ED with reduced level of consciousness and fever. Her friend reports she had feeling generally unwell for 2 days. Today she had one episode of vomiting and became increasingly confused and drowsy. She is unsure if the patient has been taking her insulin. Ambulance crew report that she has a respiratory rate of 40, heat rate of 140 bpm, blood pressure of 95/50 mmHg and temperature 38.5°C. She is responding to painful stimulus and her blood sugar reading was "extremely high" on the monitor.** | **31-year-old woman presented to the ED with a 6-hour history of worsening right sided abdominal pain. She states it started as a dull ache which worsened and localised more to the right lower quadrant. She denies fever but has been nauseated. She hasn't had a menstrual period for 2 months but states she has irregular periods. She is tachycardic at 115, blood pressure 125/80 mmHg and is mildly distressed in pain, which she rates 8/10.** | **60 year old smoker presented with left sided chest pain and left jaw pain after a heated argument with his wife. This lasted about 15 min but then resolved he is currently pain free. Does not want to be in ED but came as both wife and children insisted he comes and gets checked. Current Vitals: Pulse 80, RR 16, Sats 100% on Air, Temp 36 on registration** | **59-year-old man presents with a 4-day history of worsening left flank pain. He describes a dull ache which is occasionally sharp and radiates to the back. He reports nausea and multiple episodes of vomiting for past 24 hours. He is unable to keep any food or drink down, including alcohol. On arrival to the emergency department his is sweating profusely and visibly in pain. He is tachycardic at 130 bpm, BP 105/60 bpm, saturations 94% on air.** | **40 year old male presented with fever for the past 4 days associated with a dry cough. Patient says he is well otherwise, but fever seems to have persisted. He is vegan and health and stays away from harmful chemicals. Came to get checked as its unusual to have fever for this long. Parameters: Pulse 120, sats 89 on air, RR 20, Temp 39 at door.** | **30 year old male camper presented with a 2 hour history of nausea and vomiting x1 and lethargy after roasting marshmellows on oleander branches in open fire. At first he was well but after about 2 hours the nausea started as well as feeling very light headed. Thinks he ate too many marshmallows. Looks clammy. Vitals: Pluse 50, RR 24, Sats 95 on air temp 36 at the door** |
| *Decreased level of response and " symptoms of DKA " " leading to coma "* | *The "localised pain" "can be appendicitis" or "urinary or gynae related". Yet parameter wise "she is relatively stable and* | *"Needs urgent ECG" to "exclude STEMI" and "bloods" to "exclude other heart attacks". But "not immenently life threatening"* | *Patient is tachycardic, blood pressure is dropping, probably glucose too. A high risk of diabetic complication could be* | *Pt is tachycardic because of fever, if started on oxygen immediately at triage the sats would improve, and given the 4* | *New onset lethargy is a straight forward ESI 2 as per ESI algorithms. Pt is also bradycardia meaning heart rate* |
| *A patient with type 1 diabetes mellitus with an 'extremely high' blood sugar, increased respiratory rate, tachycardia* | *There is a "potential for an ectopic pregnancy" since she "has been having irregular periods" and now "has a P lower* | *The "multiple medical condions" that the patient already suffers from "place him in the high-risk group" for "ischaemic heart* | *The patient is in pain, tachycardic and hypoxic at time of triage which require urgent evaluation and treatment. The* | *The patient is hypoxic and tachycardic and requires oxygen and medical evaluation and treatment urgently.* | *There is a risk of toxin poisoning from oleander branches which could explain the patient's symptoms. Urgent treatment* |
| *The " unstable vital parameters " require immediate medical intervention. Possible " diabetic ketoacidosis " which is life* | *"Severe pain and tachycardia" "reinforcing distress". "Requires immediate analgesia" and "investigation for possible* | *"Requires an ECG" to "exclude damage to cardiac muscle", especially "considering he is a smoker" and "60 years old"* | *Patient requires analgesia within a short period of time. Possible renal calculi* | *Sp02 89% the patient requires oxygen administration* | *The patient is bradycardic and lightheaded and may require fluid resuscitation. Possibly hypotensive, ? poisoning from* |
| *reduced level of conciousness, confusion, abnormal parameters. ? " dka "* | *"pain 8/10". ? "acute appendicitis"* | *"chest pain radiating to jaw" "indicative of ? MI", "multiple co morbidities", "requires ecg" to "check for clomi"* | *not tolerating oral intake, low saturations, sweaty, in pain, compensating tachycardia, low bp* | *low saturations, very high fever which might indicate sepsis.* | *? toxin, ? cause for slight bradycardia, borderline saturations* |
| *P on AVPU is a Priority 1 on its own due to an increased chance of loss of airway. Further more the patient has a* | *Pulse 115 + Pain 8/10* | *"Does not want to be in ED but came as both wife and children insisted he comes and gets checked." - Based on general* | *Not tolerating oral fluids + sweating profusely + 130 Pulse + BP 105/60 and mild hypoxia of 94% are all signs of shock with* | *Tachycardia on its own would not explain a Priority 2 due to concurrent fever, however the patient also has a RM SpO2 of* | *Possible CO poisoning. RR of 24 with SpO2 of 95% despite increase in RR. Priority 2* |

| Case 7 - Lower back pain<br>3 | Case 8 - Abdonominal Pain<br>3 | Case 9 - Shortness of breatch<br>3 | Case 10 - Twisted Ankle<br>4 | Case 11 - Ankle Pain<br>4 | Case 12 - Skin Problems<br>5 |
|---|---|---|---|---|---|
| **49-year-old lady presents with a 3-month history of worsening lower back pain which suddenly increased in severity this morning whilst she was cleaning the house. Pain is radiating down the left leg and feels a 'tingling' feel down to her left big toe occasionally. Pain is worse on movement. She has been taking regular morphine (prescribed by her GP) for the past 2 weeks due to the pain which helps slightly. She has not passed urine for a few hours and has been constipated for the past 4 days. Her vital signs are normal.** | **A 67 year old man presents complaining of a 2 day history of lower abdominal pain. He claims he is nauseous but is not vomiting, and has been having some loose stool since the pain started. He also had chills and rigors at home, but did not check his temperature. His parameters at triage are normal except for a temperature of 37.9C** | **An 80 year old male presented complaining worsening shortness of breath on climbing stairs in his home over the past week. Today he is unable to go upstairs at all, and is feeling slight shortness of breath walking to and from the bathroom, but comfortable sitting down. He also noted he is was waking up at night feeling short of breath last night. His parameters at rest are normal.** | **18 year old soccer player twisted ankle due to inversion injury. Has a swollen right ankle with pain over medial and lateral malleoli. Unable to weight bear. Says he is in pain. Vitals Pulse 120, Sats 100 on air, RR 20. Temp 37.4 at the door** | **A 25 year old lady is brought in on a wheelchair complaining of pain on her ankle. She claims she was walking on the rocky shore when she lost her balance and twisted her ankle. She was able to put some weight on it and made it back to her car after the fall, however she claims its now too painful to stand on. She is in moderate pain when seated. She denies any other injuries. Her ankle is swollen and has bruising over the lateral malleolus, and is warm and tender to the touch. Her parameters are within normal limits.** | **A 65 year old male presents complaining of a new mole on his back, which his wife noted whilst he was getting ready to take a shower. He and his wife presented as they were very concerned it may be cancer, as they had watched an interview with a dermatologist on television who explained what to look out for. On assessment, the mole is 5mm in diameter, with regular edges, consistent brown coloration with no surrounding erythema or scaling. Parameters are normal.** |
| *Sudden worsening of back pain, with tingling, and retention could be cauda equina syndrome requiring urgent treatment* | *Currently patient is stable and it may be a gastroenteritis. However it can also be diverticulitis which requires further* | *Shortness of breath may be related to cardiac complications, the symtpoms are progressing and is a known cardionath not on* | *Tachycardic from pain, probably needs reduction, and thus urgent assessment due to pain.* | *Patient in previously independt, pain is localised to the ankle and requires only one resource* | *Patient requires a doctor assessment without interventions. Not sure of onset of presence of mole. Mole* |
| *The patient has already suffered from disc prolapse and chronic back pain, is already on morphine however is in severe* | *This patient is likely not at high risk because his parameters are within normal range. The patient likely has a flare up of his* | *Exertional dypnoea could be caused by a number of conditions, however, the patient is comfortable at rest and could* | *A young, healthy soccer player usually has a lower heart rate at baseline; therefore a pulse of 120 and a slightly elevated* | *The patient does not have any life-threatening illnesses, and could be seen later as her condition is unlikely to change* | *There is no immediate time-sensitive risk to life or limb from this skin lesion.* |
| *The patient would probably only need analgesia/laxatives as we already know the cause of the pain which was further strained* | *The patient may have another episode of diverticulitis. He wil require blood investigations, imaging and possible analgesia* | *Since his parameters are stable at rest I would only be concerned if I saw he was unable to complete sentences, high* | *The tachycardia indicates severe pain and need for immediate analgesia. The fact he could not walk right after the injury* | *The patient most likely has fractured her malleous, requiring an X-ray and a back slab as well as analgesia* | *The only care needed for the patient would be a referral to a dermatologist, especially considering the mole has regular* |
| *back pain accomopanied by urine retention and tingling in left leg, ? neuro problem* | *fever, for further blood investigations, , normal parameters otherwise* | *dyspnea,* | *? fracture, no deformity reported, for iv analgesia and xrays.* | *moderate pain, probable fracture. will need x ray* | *pt will need a dermatology referral.* |
| *During the first part of the case scenario, sciatica was the most likely differential diagnosis but the history developed into a* | *Subacute pain of 2 days with no increase in acuity since + normal parameters indicating that if dehydration is present, it is not* | *SOB on exertion demands a Priority 2. With the patient's history, this could be clear signs of increase in acuity of CHF or* | *Pain & mechanism of injury (and pulse rate) call for a Priority 2 due to possible complications to neuro, mobility and circulation to* | *No deformity documented + warm to touch implying that calculation is present. She was able to walk implying CSM* | *Round edges + less than 6mm + consistent colour = likely to be a benign mole. Patient needs to go to a GP and get a referral to a* |

# Experimental Group II - Reasons for ESI triage score

| Case 1 - Reduced level of consciousness<br>1 | Case 2 - Abdonominal Pain - Ectopic Pregnancy<br>2 | Case 3 - Chest pain<br>2 | Case 4 - Abdonominal Pain<br>2 | Case 5 - Fever<br>2 | Case 6 - Food poisining<br>2 |
|---|---|---|---|---|---|
| **21-year-old female brought to the ED with reduced level of consciousness and fever. Her friend reports she had feeling generally unwell for 2 days. Today she had one episode of vomiting and became increasingly confused and drowsy. She is unsure if the patient has been taking her insulin. Ambulance crew report that she has a respiratory rate of 40, heat rate of 140 bpm, blood pressure of 95/50 mmHg and temperature 38.5°C. She is responding to painful stimulus and her blood sugar reading was "extremely high" on the monitor.** | **31-year-old woman presented to the ED with a 6-hour history of worsening right sided abdominal pain. She states it started as a dull ache which worsened and localised more to the right lower quadrant. She denies fever but has been nauseated. She hasn't had a menstrual period for 2 months but states she has irregular periods. She is tachycardic at 115, blood pressure 125/80 mmHg and is mildly distressed in pain, which she rates 8/10.** | **60 year old smoker presented with left sided chest pain and left jaw pain after a heated argument with his wife. This lasted about 15 min but then resolved he is currently pain free. Does not want to be in ED but came as both wife and children insisted he comes and gets checked. Current Vitals: Pulse 80, RR 16, Sats 100% on Air, Temp 36 on registration** | **59-year-old man presents with a 4-day history of worsening left flank pain. He describes a dull ache which is occasionally sharp and radiates to the back. He reports nausea and multiple episodes of vomiting for past 24 hours. He is unable to keep any food or drink down, including alcohol. On arrival to the emergency department his is sweating profusely and visibly in pain. He is tachycardic at 130 bpm, BP 105/60 bpm, saturations 94% on air.** | **40 year old male presented with fever for the past 4 days associated with a dry cough. Patient says he is well otherwise, but fever seems to have persisted. He is vegan and health and stays away from harmful chemicals. Came to get checked as its unusual to have fever for this long. Parameters: Pulse 120, sats 89 on air, RR 20, Temp 39 at door.** | **30 year old male camper presented with a 2 hour history of nausea and vomiting x1 and lethargy after roasting marshmellows on oleander branches in open fire. At first he was well but after about 2 hours the nausea started as well as feeling very light headed. Thinks he ate too many marshmallows. Looks clammy. Vitals: Pluse 50, RR 24, Sats 95 on air temp 36 at the door** |
| *Patient has decreased level of consciousness and is a known diabetic with an unrecordable level. Is tachypneoic with* | *Patient "parameters are within normal range", "has h/o irregular menstrual cycle". Patient "will require minimal resources from* | *"Patient is 60 years old" with "increase risks for an MI" as "he is a smoker" and "k/c hypertension and* | *Patient is a known diabetic, has been unable to tolerate food and may be hypoglyceamic as he is diaphoretic and has unstable* | *Patient could have gone to a GP or health centre. If patient is not taking regular paracetamol, fever will not go down. Patient is* | *Patient could be showing signs of smoke inhalation from the oleander leaves. immediate attention is required* |
| *decreased level of consiousness (only responding to painful stimuli) with a background of T1DM, will need " life saving* | *"tachycardiac and possibly pregnany" (also "high-risk for ectopic pregnancy" or "first trimester complications")* | *"high-risk" for "acute coronary syndrome"* | *tachycardia, mild hypotension and clinically diaphoretic. high-risk for intra-abdominal pathology* | *tachycardia, mild tachypnoea and hypoxia on room air* | *high-risk for toxicity due to oleander branches (already presenting with bradycardia)* |
| *Patient is drowsy and confused with very abnormal parameters, which " makes her acute " and " needs " to be seen immediately* | *Patient is "at risk of a ectopic pregnancy", so "needs urgent attention".* | *"Symptoms indicate possible MI", which "makes him high priority". Also "his underlying conditions increase this risk"* | *Patient is showing sigs of possible renal colic or something more acute, pt is showing signs of extreme pain, thus making it of* | *Patient feels well, should be given 02 to check whether sats increase, but since his respiratory rate is 20 and not* | *Patient shows signs of possible carbon monoxide poisoning, which needs urgent attention, vitals are still stable so he can be* |
| *Diabetic ketoacidosis, life threatining situation, needs to be seen now.* | *This could be an ectopic pregnancy and although her parametes are fine excluding a HR of 115, it is an* | *A chest pain is a myocardil infraction unless proven otherwise. ECG first line of tests which I cannot provide at time of* | *Patient is distressed in view of pain, and multiple episodes of vomiting.* | *Pyrexia with unkown origin, decreased oxygen saturations, patient needs to be seen soon.* | *This could be a serious incidence of poisoning due to the plants that the patient was using. "Digitalis, life threatining* |
| *requires life saving interventions* | *Pt has irregular parameters and is in pain* | *high risk situation of an MI* | *incorrect parameters wiht a high risk due to uncontrolled diabetes* | *low saturations requiring oxygen therefore a high risk situation* | *pt has irregular parameters* |

| Case 7 - Lower back pain<br>3 | Case 8 - Abdonominal Pain<br>3 | Case 9 - Shortness of breatch<br>3 | Case 10 - Twisted Ankle<br>4 | Case 11 - Ankle Pain<br>4 | Case 12 - Skin Problems<br>5 |
|---|---|---|---|---|---|
| **49-year-old lady presents with a 3-month history of worsening lower back pain which suddenly increased in severity this morning whilst she was cleaning the house. Pain is radiating down the left leg and feels a 'tingling' feel down to her left big toe occasionally. Pain is worse on movement. She has been taking regular morphine (prescribed by her GP) for the past 2 weeks due to the pain which helps slightly. She has not passed urine for a few hours and has been constipated for the past 4 days. Her vital signs are normal.** | **A 67 year old man presents complaining of a 2 day history of lower abdominal pain. He claims he is nauseous but is not vomiting, and has been having some loose stool since the pain started. He also had chills and rigors at home, but did not check his temperature. His parameters at triage are normal except for a temperature of 37.9C** | **An 80 year old male presented complaining worsening shortness of breath on climbing stairs in his home over the past week. Today he is unable to go upstairs at all, and is feeling slight shortness of breath walking to and from the bathroom, but comfortable sitting down. He also noted he is was waking up at night feeling short of breath last night. His parameters at rest are normal.** | **18 year old soccer player twisted ankle due to inversion injury. Has a swollen right ankle with pain over medial and lateral malleoli. Unable to weight bear. Says he is in pain. Vitals Pulse 120, Sats 100 on air, RR 20. Temp 37.4 at the door** | **A 25 year old lady is brought in on a wheelchair complaining of pain on her ankle. She claims she was walking on the rocky shore when she lost her balance and twisted her ankle. She was able to put some weight on it and made it back to her car after the fall, however she claims its now too painful to stand on. She is in moderate pain when seated. She denies any other injuries. Her ankle is swollen and has bruising over the lateral malleolus, and is warm and tender to the touch. Her parameters are within normal limits.** | **A 65 year old male presents complaining of a new mole on his back, which his wife noted whilst he was getting ready to take a shower. He and his wife presented as they were very concerned it may be cancer, as they had watched an interview with a dermatologist on television who explained what to look out for. On assessment, the mole is 5mm in diameter, with regular edges, consistent brown coloration with no surrounding erythema or scaling. Parameters are normal.** |
| *Patient has back pain history. Has been constipated and the decrease in urine would be a secondary cause to that. Patient* | *2 day history with no worsening of symptoms. parameters are stable. minimal resources required from A&E* | *Patient k/c cardiopath, showing signs related to another cardiac event.* | *Unless any deformity is noted patient will only require an xray as a resource. Patient could have gone to health centre does* | *Patient was able to bare weight, pain and swelling are due to patient not applying ice and elevating feet. Will only require* | *This is not an emergency, the department can only provide a referal ticket to the dermatology department. This could have* |
| *high-risk for developing cauda equina syndrome* | *clinically there is no current high-risk situation. patient is alert and not in distress due to pain. will require two (or more) resources* | *presenting with exertional dysnpoea and orthopnoea - high risk for excecerbation of heart failure* | *tachycardia and in pain. risk for malleolar injury (? requiring reduction)* | *one resource from ED being imaging* | *no resources from ED needed - referral to dermatology as outpatients* |
| *Patient is showing signs of further deterioration of her sciatica, but she will need a CT scan to check her spine and leg* | *Patient shows signs of gastro enteritis, can be seen within 45 mins or later since he is not actively vomiting* | *Patient is comfortable at rest, parameters are normal and has been having symptoms for over a week, which allows patient to be* | *Patient needs an xray and oral anaglesia, so is allowed to wait. If there was a deformity or signs of impaired circulation or in severe* | *Patient needs an x ray of her ankle, 1 resource and some oral analgesia. Since it was a mechanical fall, there are no* | *Patient needs a referral to a dermatologist, he has nothing acute which needs to be seen at ED, mole is regular edges and* |
| *Not an emergency, long standing history of the same pain. Patient can wait.* | *Patient needs to be seen and investigated but not urgently.* | *Patient symptomatic, needs treatment to eliviate the shortness of breath.* | *Pt unable to bear weight, distrissed in view of pain. needs to be seen urgently.* | *Patient needs to be seen in order to exclude a fracture. Unless there is obvious circulatory or nerve impingment on exposure* | *Not an emergency, a familiy doctor could have taken care of it.* |
| *Although the patient is in pain, she does not merit a high risk situation therefore is triaged as an ESI-3* | *not a high risk situation however requires 2 or more investigations* | *High risk situation of CHF* | *Although pt is in pain, oral analgesia will be enough, however pt requires an x-ray therefore 1 resource* | *Requires imaging of her leg therefore 1 resource* | *Pt does not require any investigations from ED perspective, however will benefit from a dermatologist referral* |

# I. Review of the Literature (Process)

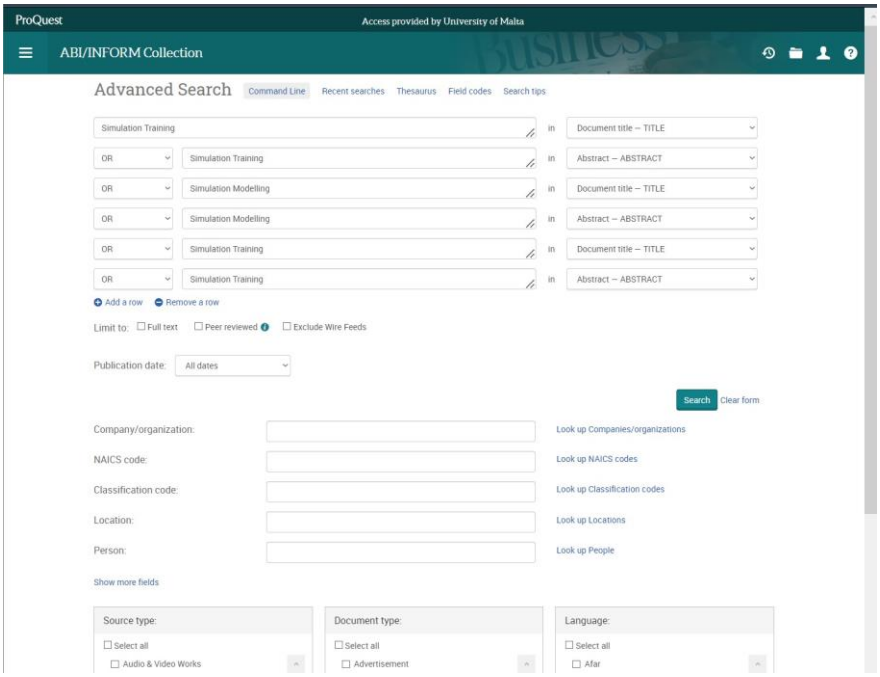
## I.1 - Terminology

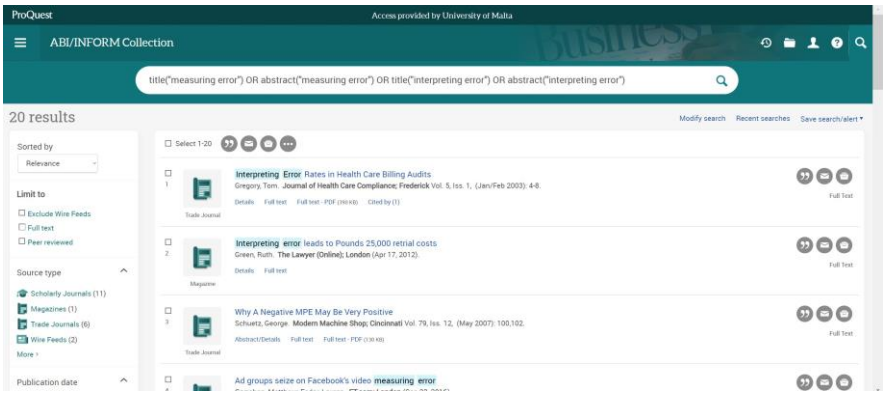
| Construct / Underlying Principle (Round 2 - 09.SEP - 12.SEP) | Terminology (Round 1 - 06.SEP - 09.SEP) | PowerThesaurus.com (Round 3 - 12.SEP -16.OCT onwards) | Wikipedia (Round 4 - 21.SEP - 22.OCT) simple.wikipedia | Google Scholar (Round 5 - 12.OCT - 27.OCT) | LEXICON |
|---|---|---|---|---|---|
| Anatomy | Limb | Stem | Limb | Limb | Limb |
| Anatomy | Electrodermal | Electrodermal | EDA | EDA | EDA |
| Anatomy | Physiology | Cytology | Cytology | Cytology | Cytology |
| Bias / Decision-Making | Bounded Rationality | Bounded Rationality | Rationality | Rationality | Rationality |
| Decision-Making | Imperfect Information | Imperfect Information | Imperfect Information | Imperfect Information | Imperfect Information |
| Decision-Making | Judgement | Sense | Sense | Sense | Sense |
| Decision-Making | Introspection | Self-Awareness | Self-Awareness | Self-Awareness | Self-Awareness |
| Decision-Making | Imperfect Information | Poor Information | Poor Information | Poor Information | Poor Information |
| Decision-Making | Judgement | Perception | Perception | Perception | Perception |
| Decision-Making | Imperfect Information | Partial Information | Partial Information | Partial Information | Partial Information |
| Decision-Making | Imperfect Information | Insufficient Information | Insufficient Information | Insufficient Information | Insufficient Information |
| Decision-Making | Imperfect Information | Inadequate Information | Inadequate Information | Inadequate Information | Inadequate Information |
| Decision-Making / Bias | Fight-or-flight | Fight-flight-or-freeze Respons | Fight-flight-or-freeze Respons | Fight-flight-or-freeze Respons | Fight-flight-or-freeze Response |
| Decision-Making / Bias | Fight-or-flight | Fight or Flight Response | Fight-flight-or-freeze Respons | Fight-flight-or-freeze Respons | Fight-flight-or-freeze Response |
| Decision-Making / Management | Consciousness | Consciousness | Consciousness | Consciousness | Consciousness |
| Decision-Making / Management | Consciousness | Sense | Sense | Sense | Sense |
| Decision-Making / Management | Consciousness | Perception | Perception | Perception | Perception |
| Decision-Making / Management | Consciousness | Feeling | Feeling | Feeling | Feeling |
| Decision-Making / Management | Decision Support System | Decision Aid | Decision Aid | Decision Aid | Decision Aid |
| Decision-Making / Management | Cognition | Consciousness | Consciousness | Consciousness | Decision Aid |
| Decision-Making / Management | Consciousness | Awareness | Awareness | Awareness | Awareness |
| Decision-Making / Other | Burnout | Weariness | Weariness | Weariness | Weariness |
| Decision-Making / Other | Burnout | Fatigue | Lethargy | Lethargy | Lethargy |
| Decision-Making / Other | Burnout | Fatigue | Fatigue | Fatigue | Fatigue |
| Decision-Making / Other | Burnout | Fatigue | Exhaustion | Exhaustion | Exhaustion |
| Decision-Making / Other | Burnout | Depletion | Depletion | Depletion | Depletion |
| Emergency / Triage / Healthcare | Time-sensitive Care | Urgent Care | Urgent Care | Urgent Care | Urgent Care |
| Emergency / Triage / Healthcare | Time-sensitive Care | Critical Care | Critical Care | Critical Care | Critical Care |
| Emergency / Triage / Healthcare | Transfer | Relocate | Relocate | Relocate | Relocate |
| Emergency Department / Nursing | Accident and Emergency | A&E | Emergency Ward | Emergency Ward | Emergency Ward |
| Emergency Department / Nursing | Accident and Emergency | A&E | Casualty Department | Casualty Department | Casualty Department |
| Emergency Department / Nursing | A&E | Accident and Emergency | Accident and Emergency | Accident and Emergency | Accident and Emergency |
| Emergency Department / Nursing / Triage | Triage Acuity Scores (ESI) | Triage acuity Scores | Triage acuity Scores | Triage Acuity Scale | Triage Acuity Scale |
| Emergency Department / Nursing / Triage | Triage Acuity Scores (ESI) | Triage acuity Scores | Triage acuity Scores | Triage Acuity Scale | Triage Acuity Scale |
| Emergency Department / Nursing / Triage | Managerial Nurse | Nurse Manager | Nurse Manager | Nurse Manager | Nurse Manager |
| Emergency Department / Nursing / Triage | Accident and Emergency | Casualty Ward | Medical Treatment Facility | Medical Treatment Facility | Medical Treatment Facility |
| Emergency Department / Nursing / Triage | Emergency Room | Infirmary | Infirmary | Infirmary | Infirmary |
| Emergency Department / Nursing / Triage | Emergency Room | Intensive Care Unit | ICU | ICU | ICU |
| Emergency Department / Nursing / Triage | Emergency Room | Hospice | Hospice | Hospice | Hospice |
| Emergency Department / Nursing / Triage | Accident and Emergency | Emergency Room | Emergency Ward | Emergency Ward | Emergency Ward |
| Emergency Department / Nursing / Triage | Emergency Medicine | Emergency Treatment | Emergency Treatment | Emergency Treatment | Emergency Treatment |
| Emergency Department / Nursing / Triage | Accident and Emergency | Emergency Room | Emergency Room | Emergency Room | Emergency Room |

Lit Rev Sections | Lit Rev | Lexicon | Underlying Principles | Databases | Boolean Search | Steps | Links | Searching for Emp. Studies

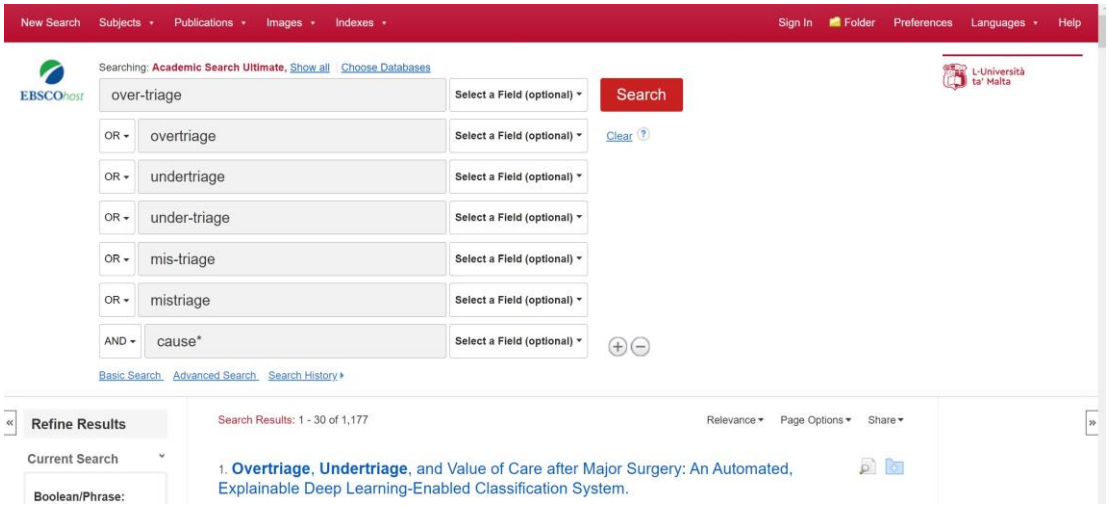
## I.2 - Literature Review Strategy Search Results

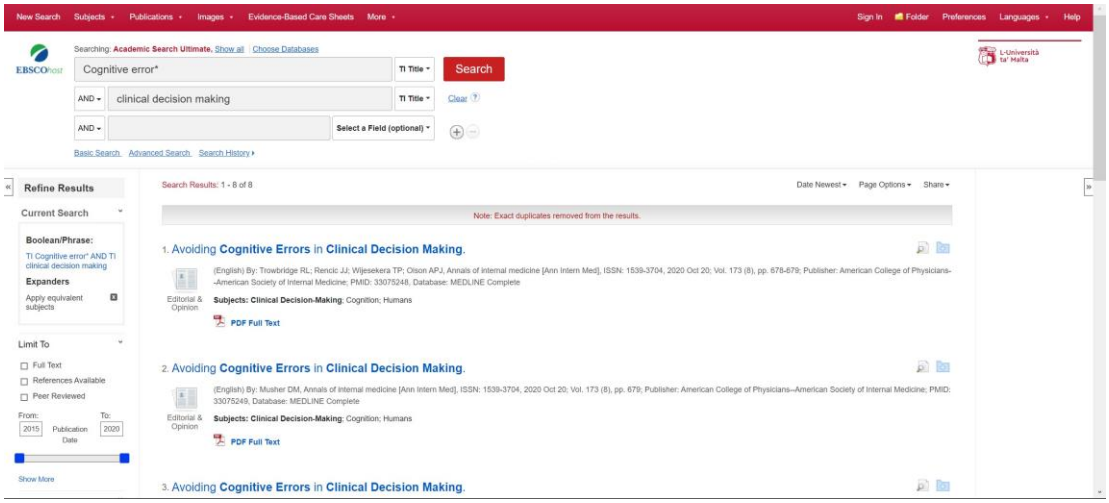
### ABI/INFORM

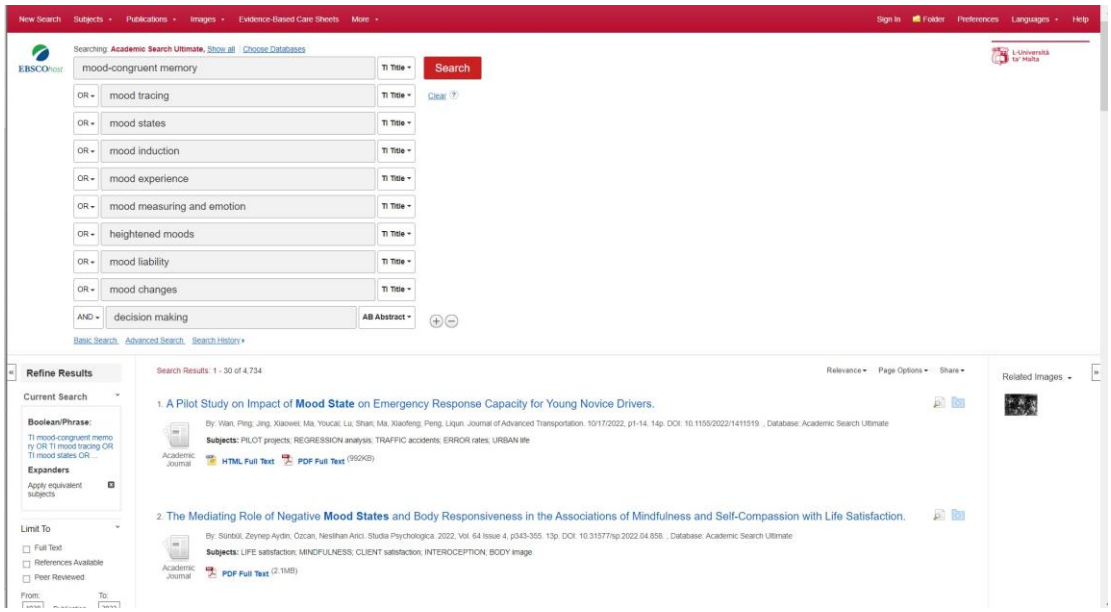


**EBSCO**


New Search
Subjects
Publications
Images
Indexes
Sign In
Folder
Preferences
Languages
Help
Searching: Academic Search Ultimate, Show all | Choose Databases
over-triage
Select a Field (optional)
Search
OR overtriage
OR undertriage
OR under-triage
OR mis-triage
OR mistriage
AND cause*
Clear
Basic Search
Advanced Search
Search History
Refine Results
Current Search
Boolean/Phrase:
Search Results: 1 - 30 of 1,177
Relevance
Page Options
Share
1. Overtriage, Undertriage, and Value of Care after Major Surgery: An Automated, Explainable Deep Learning-Enabled Classification System.


Cognitive error*
clinical decision making
Search
Refine Results
Current Search
Boolean/Phrase:
Expanders
Limit To
Full Text
References Available
Peer Reviewed
Search Results: 1 - 8 of 8
Note: Exact duplicates removed from the results.
1. Avoiding Cognitive Errors in Clinical Decision Making.
2. Avoiding Cognitive Errors in Clinical Decision Making.
3. Avoiding Cognitive Errors in Clinical Decision Making.
PDF Full Text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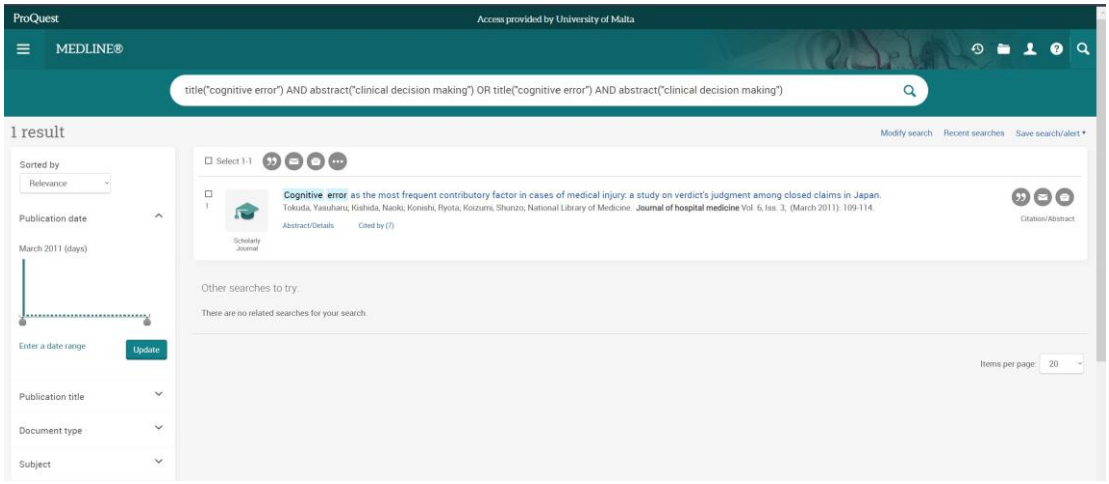
1. A Pilot Study on Impact of Mood State on Emergency Response Capacity for Young Novice Drivers.
2. The Mediating Role of Negative Mood States and Body Responsiveness in the Associations of Mindfulness and Self-Compassion with Life Satisfaction.

## MEDLINE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title("cognitive error") AND abstract("clinical decision making") OR title("cognitive error") AND abstract("clinical decision making")
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Cognitive error as the most frequent contributory factor in cases of medical injury: a study on verdict's judgment among closed claims in Japan.
Tokuda, Yasuharu, Kishida, Naoki, Konishi, Ryota, Koizumi, Shunzo, National Library of Medicine. Journal of hospital medicine Vol. 6, Iss. 3, (March 2011): 109-114.
Abstract/Details
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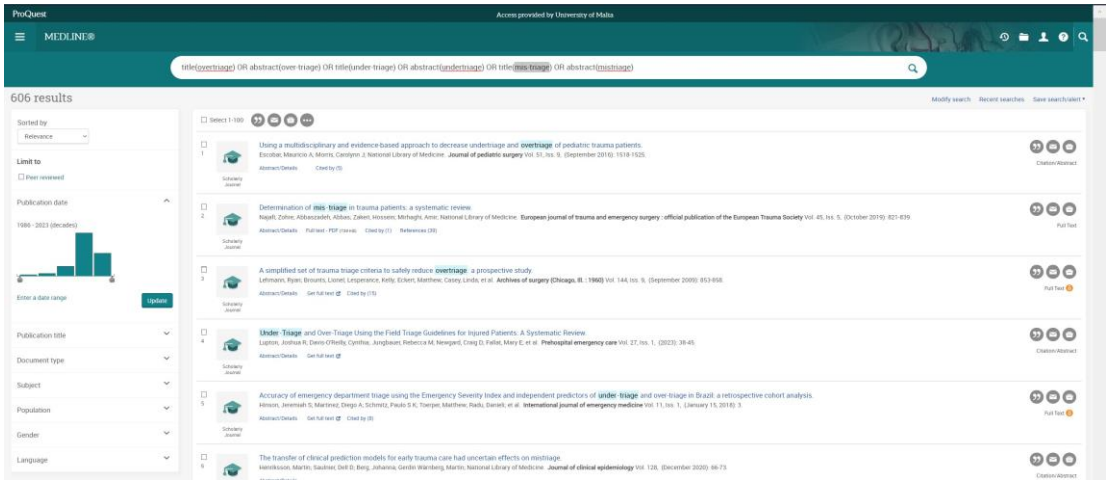
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title(overtriage) OR abstract(over-triage) OR title(under-triage) OR abstract(undertriage) OR title(mis-triage) OR abstract(mistriage)
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Using a multidisciplinary and evidence-based approach to decrease undertriage and overtriage of pediatric trauma patients.
Escobar, Mauricio A, Morris, Carolynn J, National Library of Medicine. Journal of pediatric surgery Vol. 51, Iss. 9, (September 2016): 1518-1525.
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Najafi, Zohre, Abbaszadeh, Abbas, Zakeri, Hossein, Mirhaghi, Amir, National Library of Medicine. European journal of trauma and emergency surgery : official publication of the European Trauma Society Vol. 45, Iss. 5, (October 2019): 821-839.
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Lehmann, Ryan, Brounts, Lionel, Lesperance, Kelly, Eckert, Matthew, Casey, Linda, et al. Archives of surgery (Chicago, Ill. : 1960) Vol. 144, Iss. 9, (September 2009): 853-858.
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Lupton, Joshua R, Davis-O'Reilly, Cynthia, Jungbauer, Rebecca M, Newgard, Craig D, Fallat, Mary E, et al. Prehospital emergency care Vol. 27, Iss. 1, (2023): 38-45.
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Hinson, Jeremiah S, Martinez, Diego A, Schmitz, Paulo S K, Toerper, Matthew, Radu, Daniel, et al. International journal of emergency medicine Vol. 11, Iss. 1, (January 15, 2018): 3.
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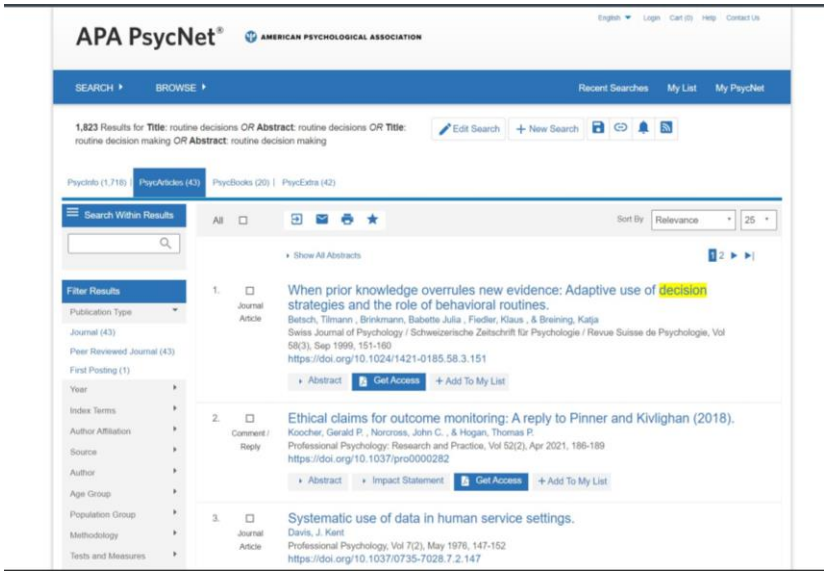
Henriksson, Martin, Saulnier, Dell D, Berg, Johanna, Gerdin Wärnberg, Martin, National Library of Medicine. Journal of clinical epidemiology Vol. 128, (December 2020): 66-73.

**PyscNET**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1. When prior knowledge overrules new evidence: Adaptive use of decision strategies and the role of behavioral routines.
Betsch, Tilmann , Brinkmann, Babette Julia , Fiedler, Klaus , & Breining, Katja
Swiss Journal of Psychology / Schweizerische Zeitschrift für Psychologie / Revue Suisse de Psychologie, Vol 58(3), Sep 1999, 151-160
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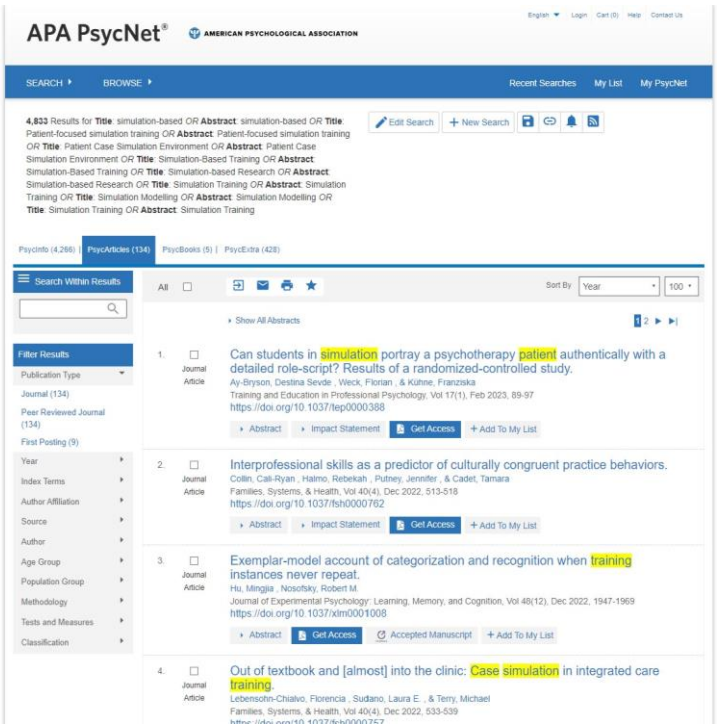
Koocher, Gerald P. , Norcross, John C. , & Hogan, Thomas P.
Professional Psychology: Research and Practice, Vol 52(2), Apr 2021, 186-189
https://doi.org/10.1037/pro0000282
Impact Statement
3. Systematic use of data in human service settings.
Davis, J. Kent
Professional Psychology, Vol 7(2), May 1976, 147-152
https://doi.org/10.1037/0735-7028.7.2.147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1. Can students in simulation portray a psychotherapy patient authentically with a detailed role-script? Results of a randomized-controlled study.
Ay-Bryson, Destina Sevde , Weck, Florian , & Kühne, Franziska
Training and Education in Professional Psychology, Vol 17(1), Feb 2023, 89-97
https://doi.org/10.1037/tep0000388
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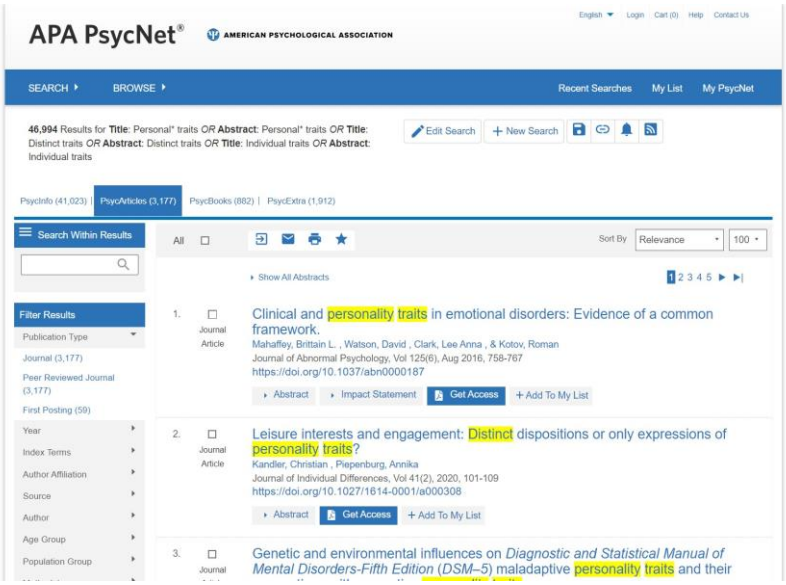
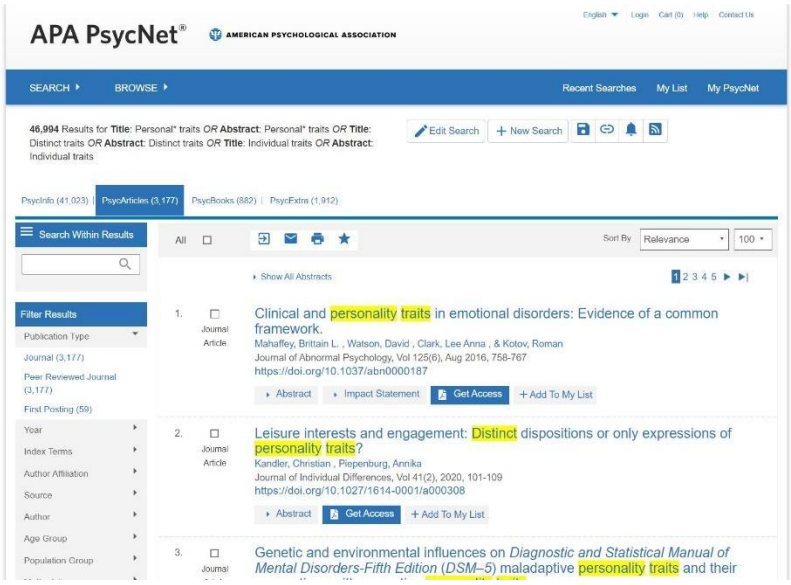
2. Interprofessional skills as a predictor of culturally congruent practice behaviors.
Collin, Cali-Ryan , Halmo, Rebekah , Putney, Jennifer , & Cadet, Tamara
Families, Systems, & Health, Vol 40(4), Dec 2022, 513-518
https://doi.org/10.1037/fsh0000762
3. Exemplar-model account of categorization and recognition when training instances never repeat.
Hu, Mingjia , Nosofsky, Robert M.
Journal of Experimental Psychology: Learning, Memory, and Cognition, Vol 48(12), Dec 2022, 1947-1969
https://doi.org/10.1037/xlm0001008
Accepted Manuscript
4. Out of textbook and [almost] into the clinic: Case simulation in integrated care training.
Lebensohn-Chialvo, Florencia , Sudano, Laura E. , & Terry, Michael
Families, Systems, & Health, Vol 40(4), Dec 2022, 533-539

**PyscNET (contd.)**



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Med J Islam Repub Iran. 2022 Oct 26;36:124. doi: 10.47176/mjiri.36.124. eCollection 2022.
Anchoring Errors in Emergency Medicine Residents and Faculties
Helen Dargahi [1 2], Alireza Monajemi [3], Akbar Soltani [4], Hooman Hossein Nejad Nedaie [5], Ali Labaf [5]
Affiliations + expand
PMID: 36447549 PMCID: PMC9700406 DOI: 10.47176/mjiri.36.124
Free PMC article
Abstract
Background: Clinical reasoning is the basis of all clinical activities in the health team, and diagnostic reasoning is perhaps the most critical of a physician's skills. Despite many advances, medical errors have not been reduced. Studies have shown that most diagnostic errors made in emergency rooms are cognitive errors, and anchoring error was identified as the most common cognitive error in clinical settings. This research intends to determine the frequency and compare the percentage of anchoring bias perceived among faculty members versus residents in the emergency medicine department.
Methods: In this quasi-experimental study, Emergency Medicine's Faculties and Residents are
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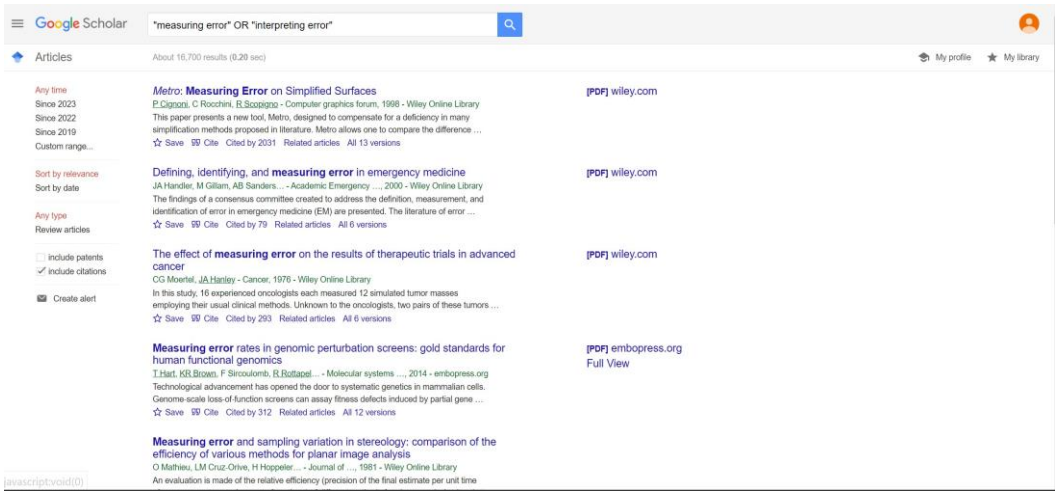
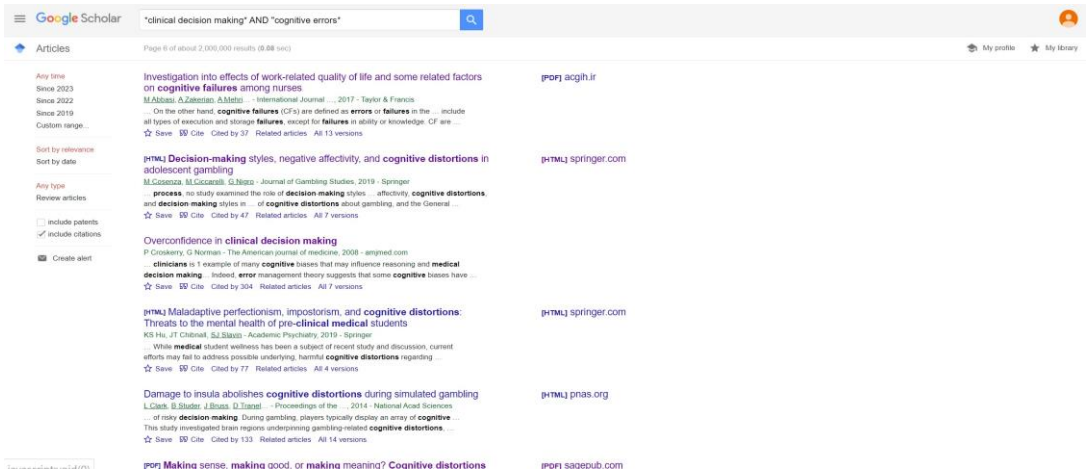
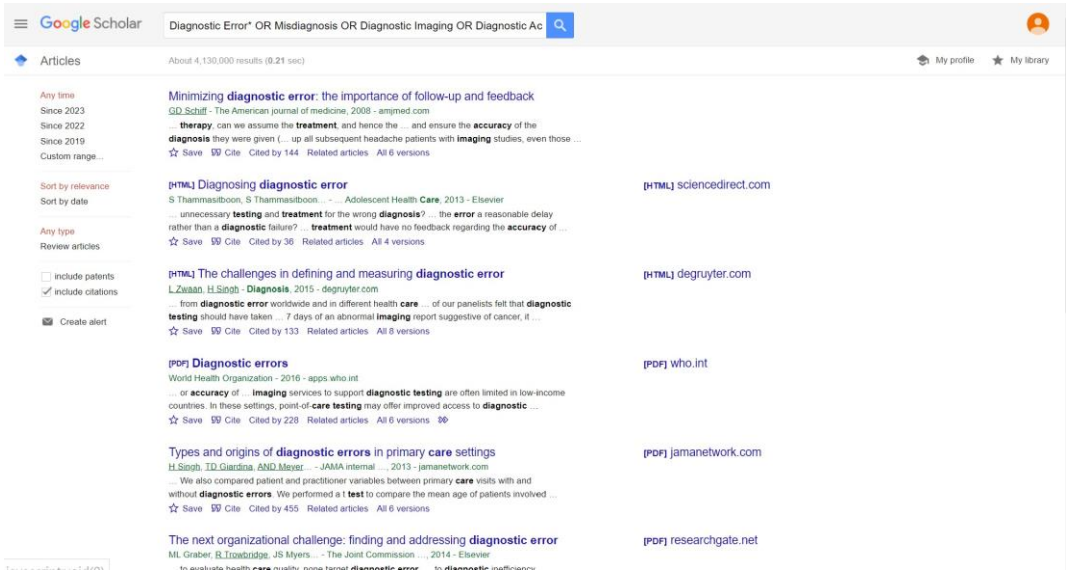
## Google Scholar



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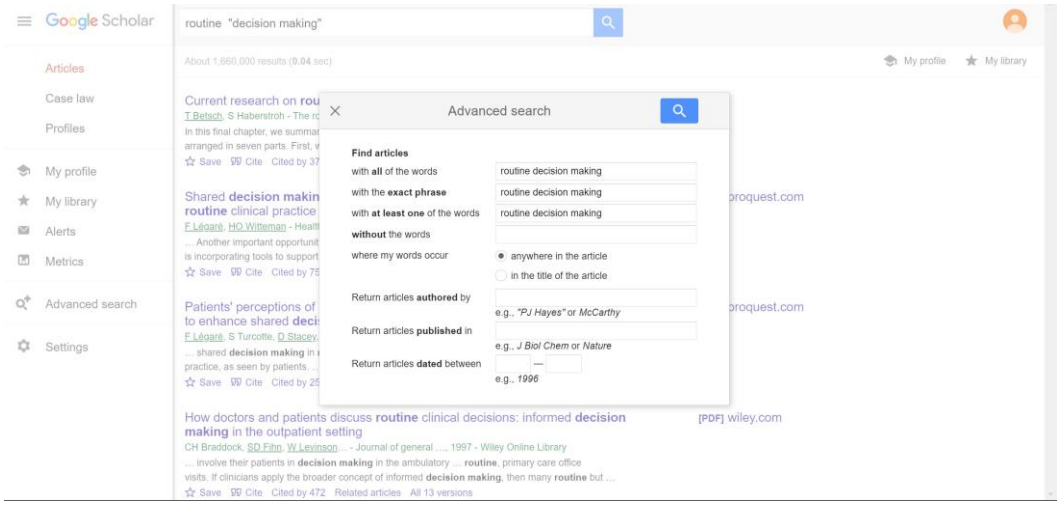
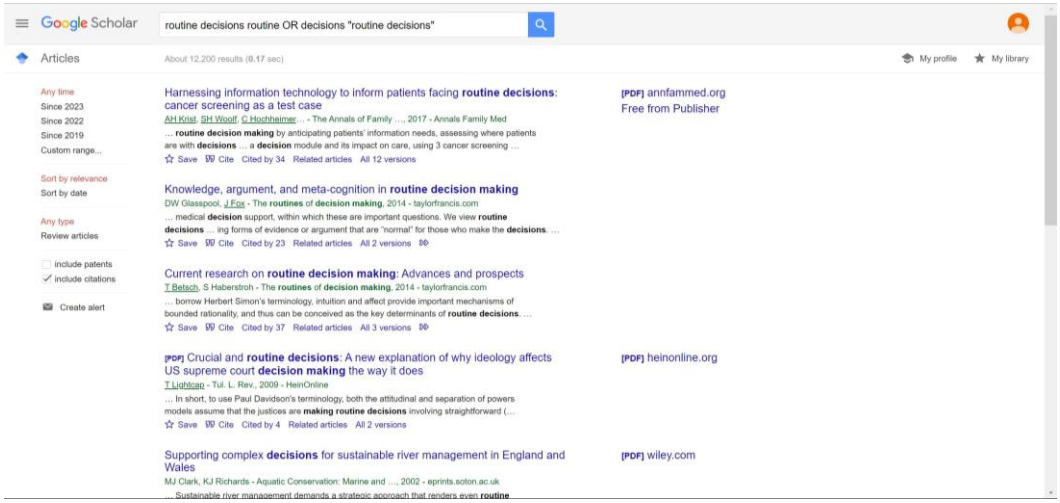
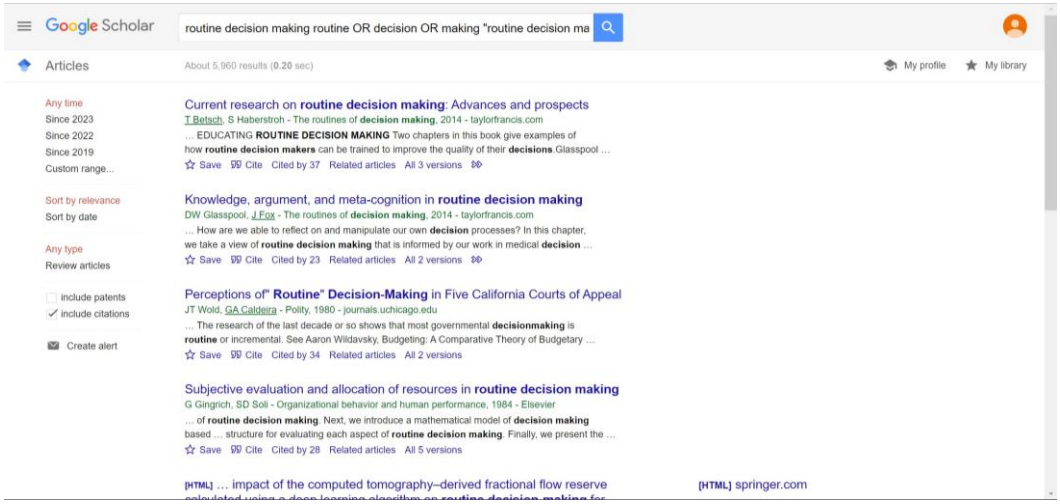


## I.3 – Review of Literature Flow, Stats

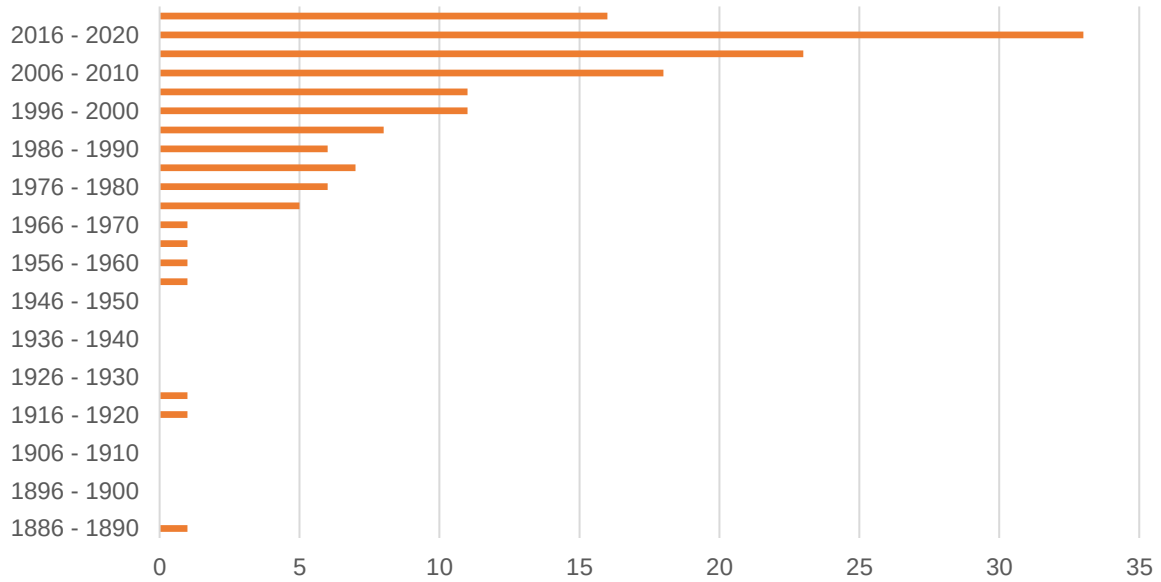
We searched books, publications, the internet, scholarly databases and journals for keyword related to the topics under review. We built a thesaurus of words to help us search journal articles and empirical studies in Scholar.google.com, ABI/INFORM, PsycINFO, PubMed, Medline and Cochrane databases.

Snowballing all the results and adding up the papers having general relevance to the topic totalled to 1510 publications, which were later trimmed down to 755 records after removing the totally irrelevant articles.

A first round of reviewing the relevant titles and abstracts brought the aggregate down to 423 and a second round to 361.

Finally study types, results and relevance to the study were reviewed and 158 were included.

| Identification of Studies via Databases and Registers | | |
|---|---|---|
| Identification | Records identified from Scholar.google.com, ABI/INFORM, PsycINFO, PubMed, Medline and Cochrane: 1510<br>Databases (n = 5)<br>Registers (n = 1) | Records removed before screening: 755<br>Duplicate records removed (n =97)<br>Records removed for other reasons (n = 658) |
| Screening | Records screened (n= 755) | Records excluded (n = 332) |
| | Reports sought for retrieval (n = 361) | Reports not retrieved (n= 13) |
| Retrieved | Retrieved = 348 | |

| | |
|---|---|
| Included | 191 |

### Year of Publication / Number of References Included