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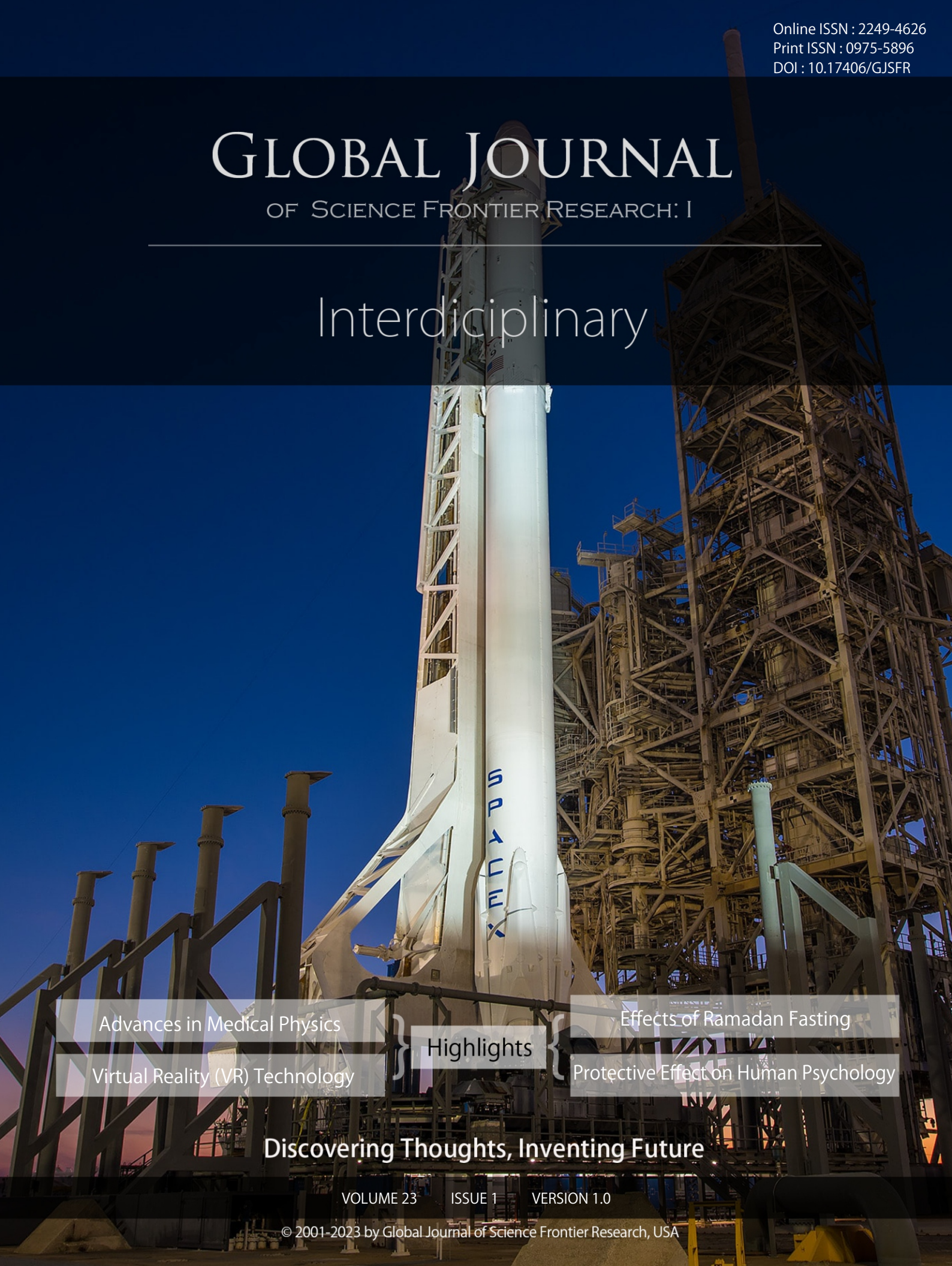

Advances in Medical Physics

Virtual Reality (VR) Technology

Highlights

Effects of Ramadan Fasting

Protective Effect on Human Psychology

Discovering Thoughts, Inventing Future

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Advantages and Dilemmas of the Virtual Reality (VR) Technology: An Overview

By Isha Sood & Varsha Sharma

Abstract- The possibility of experiencing things that may not be attainable in real life, such as going to Mars, swimming with dolphins, or performing with the Rolling Stones, can be realized through the application of Virtual Reality (VR). By utilizing computer graphics and Human-Computer Interaction (HCI), we can create a virtual environment that enables us to interact with almost any conceivable scenario. In short, VR technology enables us to see and experience anything through the power of computer-generated imagery.

Keywords: virtual reality, telepresence, cyberspace, challenges in VR, Security Issues in VR, moral ethical, and social issues in VR.

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Advantages and Dilemmas of the Virtual Reality (VR) Technology: An Overview

Isha Sood [α] & Varsha Sharma [σ]

Abstract- The possibility of experiencing things that may not be attainable in real life, such as going to Mars, swimming with dolphins, or performing with the Rolling Stones, can be realized through the application of Virtual Reality (VR). By utilizing computer graphics and Human-Computer Interaction (HCI), we can create a virtual environment that enables us to interact with almost any conceivable scenario. In short, VR technology enables us to see and experience anything through the power of computer-generated imagery.

Methods/Findings: The development of Virtual Reality (VR) Technology has introduced a new level of creativity. Essentially, VR technology involves using advanced technology to create the illusion of being present in an environment that is not physically present. This is achieved by providing information to the senses, such as sight and sound, that tricks our brains into believing we are experiencing something virtual. The illusion is often augmented by the presence of interactivity, where the virtual world responds to our presence in some way. However, generating such virtual worlds requires advanced computer hardware and software, as well as specialized peripheral devices that perform VR-specific functions. While VR technology presents many advantages and applications, there are also some challenges in fields such as criminology, physical trauma, and emotional relationships. In this article, we aim to present all the advantages and applications of VR technology, while also categorizing and addressing open and solved issues in domains such as security, social dilemmas, and ethical dilemmas.

Application: We have conducted a survey and consolidated the results in one place to assist future researchers in addressing other challenges in the field. Consequently, future VR researchers need not search multiple sources for solutions to related problems, as they can find them in our study if they have been previously solved.

Keywords: virtual reality, telepresence, cyberspace, challenges in VR, Security Issues in VR, moral ethical, and social issues in VR.

I. Introduction

Virtual reality refers to experiencing computer-generated content that doesn't exist in the real world. While it may seem like a simple concept, it involves creating a believable and interactive 3D world that allows users to feel as though they are there, both mentally and physically. To be considered true VR, it must have certain attributes, including Believable, interactivity, Computer-Generated, Explorable, and Immersive. While books, movies, paintings, and music can be immersive and transportive, they do not meet the criteria of true virtual reality.

1. *Believable:* You need to feel like you're in your virtual world (on Mars, or wherever) and to keep believing that, or the illusion of virtual reality will disappear.
2. *Interactive:* As you move around, the VR world needs to move with you. You can watch a 3D movie and be transported up to the Moon or down to the seabed—but it's not interactive in any sense.
3. *Computer-Generated:* Why is that important? Because only powerful machines, with realistic 3D computer graphics, are fast enough to make believable, interactive, alternative worlds that change in real time as we move around them.
4. *Explorable:* A VR world needs to be big and detailed enough for you to explore. However realistic a painting is, it shows only one scene, from one perspective. A book can describe a vast and complex "virtual world," but you can only really explore it linearly, exactly as the author describes it.
5. *Immersive:* To be both believable and interactive, VR needs to engage both your body and your mind. Paintings by war artists can give us glimpses of conflict, but they can never fully convey the sight, sound, smell, taste, and feel of battle. You can play a flight simulator game on your home PC and be lost in a very realistic, interactive experience for hours (the landscape will constantly change as your plane flies through it), but it's not like using a real flight simulator (where you sit in a hydraulically operated mock-up of a real cockpit and feel actual forces as it tips and tilts), and even less like flying *a plane.*

VR is quite different. It makes you think you are actually living inside a completely believable virtual world (one in which, to use the technical jargon, you are partly or fully immersed). It is two-way interactive: as you respond to what you see, what you see responds to you: if you turn your head around, what you see or hear in VR changes to match your new perspective. Page Layout

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II. History of VR Technology and Literature Survey

Although the concept of virtual reality was first introduced in the 1970s, it was not until the 1920s that Edwin Link developed the first flight simulator, which provided pilot training. The first form of interactive theatre experience, called the Sansorma, was developed by Morton Heiling in 1957, and in the late 1960s, the use of User-Mounted Displays (UMD) and Head-Mounted Displays (HMD) began to gain attention in the world of virtual reality. In 1970, researchers at MIT developed Aspen and Colorado, which allowed users to walk through the city of Aspen. The 1980s saw virtual reality being used by NASA and in Human-Computer Interaction (HCI). However, it was not until the 1990s that virtual reality technology really took off, but the hype surrounding this technology also had negative effects. Jaron Lanier helped raise awareness of these issues. Today, researchers are aware of both the advantages and challenges associated with virtual reality and continued understanding and exploration of this technology is ongoing.

In this context, it has been introduced a synchronization scheme to achieve a high-level consistency in peer to peer based virtual environment for shared hepatics with large time delays(Cheong et al., 2005). In another context has been introduced the CVE (Collaborative Virtual Environment) has been. They added the CVE's possibility to the health sciences after that created the Virtual Environment for training to assist the surgical team(Paiva et al., 2013).In 1997, their research team introduced the Driving Simulation. This work has benefited greatly from the experience of developing components for a full-scale operational VE system like IDS. Many other proposed VE technologies would similarly benefit from such real-world testing(Cremer et al., 1996). In (De Moraes & Machado, 2013) have been given the idea to compare the evolutions of Technology for Medical Science. Later on, this idea was used in the neural network. In (Kashiwagi et al., 2012) has been developed a tool by which people can interact with each other by swinging their whole bodies like a rocking chair. This study is purely based on VR Technology. All the above studies reflect the advantages of VR Technology. A book notes by (Burdea, 2002) based on the topic of Virtual Rehabilitation is showing the provision of therapeutic interventions locally or at a distance, using Virtual Reality hardware and simulations. Such therapy has been applied to various patient populations. Also, this book note is discussed the many challenges in integrating this new technology into the medical care system.

In one study discussed (Schultheis & Rizzo, 2001), the potential applications of VR in rehabilitation services were explored, including important considerations for implementing this technology. Another study discussed the concept of Virtual Reality and disabilities, which was initially raised in the 1990s when VR technology was still in its early stages. (Rizzo et al., 2005) compared the challenges and emergence of VR rehabilitation and proposed a method for addressing these issues. These are just a few examples of the research being conducted in the field of VR, with many others exploring the advantages and applications of this technology in various fields. Currently, numerous conferences are being held to discuss the latest advancements in Virtual Reality.

Here we discussed only selected research on VR. Many others have provided advantages in some other fields, while some of them discussed the applications of VR. Currently, many conferences are being held on Virtual Reality.

III. Framework of V.R. Technology

Many reports described the framework of VR Technology based on the concepts, features, and attributes while three tasks are common for each 3D VR Technology system such as Imagery, Interaction, and Behavior (Marsh et al., 1998)(Wann & Mon-Williams, 1996). In (Wann & Mon-Williams, 1996) has been given this idea of the shared framework of VR Technology. The imagination is the virtual and wholly part of the 3D graphics. While the user can manipulate or interact with 3-dimensional computer-generated objects in the 3D (or real-world) environment, and observe these objects and environment from various angles or viewpoints. In (Marsh et al., 1998) described the framework of augmented reality based on the component of VR Technology and virtual reality. They proposed a framework consisting of reusable distributed services for key sub-problems of AR, the middleware to combine them, and extensible software architecture. This framework is to use implemented services for tracking, modeling real and virtual objects, modeling structured navigation or maintenance instructions, and multimodal user interfaces. Here we are showing some different frameworks of Virtual Reality which is very useful for future development. In(Bauer et al., 2001) the authors gave the framework (Figure 1) according to the army training needs. This framework has the following components:

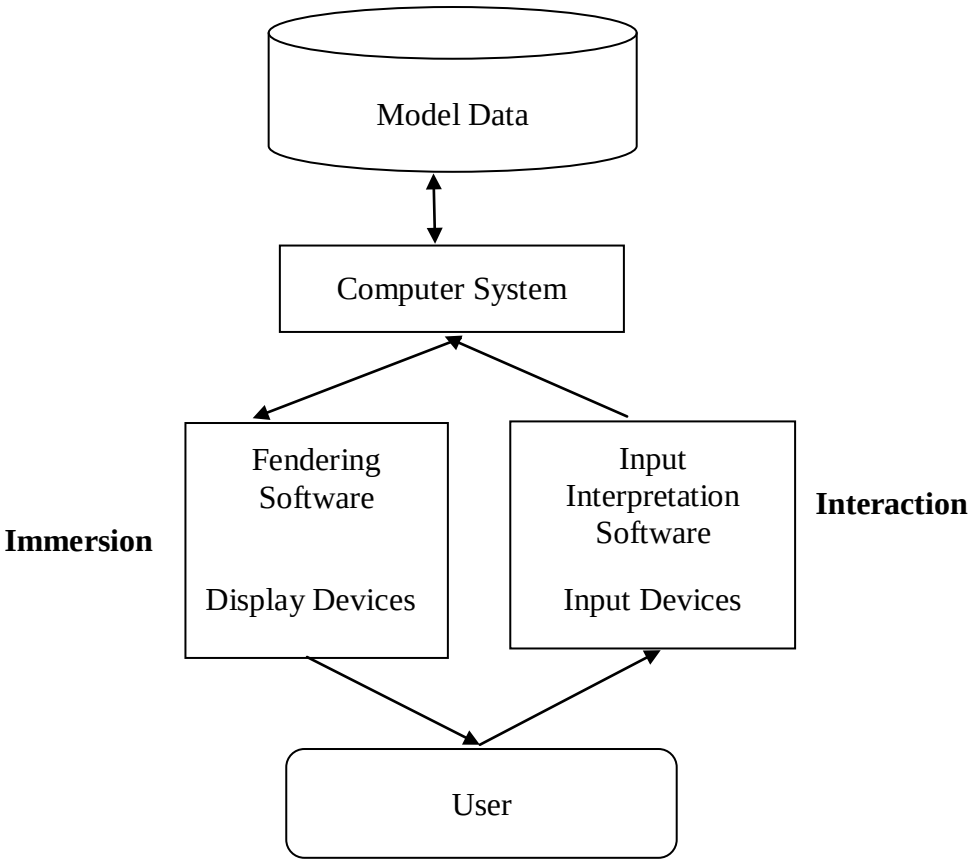

Figure 1: Virtual Reality Framework

Immersion refers to the objective level of sensory fidelity a VR system provides. • Presence refers to a user's subjective psychological response to a VR system. A VR system's level of immersion depends only on the system's rendering software and display technology (including all types of sensory displays). Immersion is objective and measurable—one system can have another. Then immersion of level higher hand is an individual and other on the presence to the related response user context-dependent experience of "being there." Different users can experience the same VR with the presence of different levels Differences might be the experienced user and a single system, different levels of presence with the same system in history, recent mind of state on depending times, and other factors(De Moraes & Machado, 2013).

All the frameworks are based on the flowchart and based on immersion and interaction. These frameworks are helpful for the development of VR Technology. IV. APPLICATIONS OF VR TECHNOLOGY. These days, VR Technology is growing very rapidly. We are watching new types of games, movies, or play station devices, different types of medical equipment, wearable devices, fashion technology, Military Operations, education, etc. Everywhere VR Technology plays a big role in making it efficient. We are describing here some of the important places where VR Technology filled a big gap to enhance that technology. Those places are as follows: Commented [HP1]: Not clear; rewrite Virtual Reality in the Medical Science: In medical sciences, VR helps to develop the best medicine and helps to diagnose the problem of the patient. For many health care professionals, VR is the very first technology since 1986 when used the term for the first time, VR has been usually described as a collection of technological devices: a computer capable of interactive 3D visualization, a head-mounted display, and data gloves equipped with one or more position trackers. These trackers track the position of the user and report that information to the display screen (Riva, 2003). VR has been used in both the medical and dentistry field. This is used for visualization purposes when formulating a diagnosis. Reaching a diagnosis means conducting a series of tests that produce complex sets of data. But virtual reality can be used to create a visual explanation of this data which is easier to read, understand and interpret. On the other hand, virtual reality is used in surgery, especially in the field of robotic surgery where it has proven to be very successful. Robotic surgery is a recent innovation in which surgery is performed using a robotic device, e.g. robotic arm which is controlled by a human surgeon.

This means fewer risks of complications during surgery and a faster procedure. The robotic device is accurate, meaning smaller incisions, reduced blood loss, and faster recovery. VR has shown its importance in the field of nursing, second life, medicine, dentistry, and other health care issues. They do this by using 3D virtual humans or avatars which act as their alter egos. Virtual Reality in Military: Virtual reality has been adopted by the military – this includes all three services (army, navy, and air force) – where it is used for training purposes. This is useful for training soldiers for war situations or other dangerous settings where they have to learn how to react appropriately. A virtual reality simulation enables them to do so but without the risk of death or serious injury. They can re-enact a particular scenario, for example, engagement with an enemy in an environment in which they experience this but without the real-world risks. This has proven to be safer and less costly than traditional training methods.

These include:

- Flight simulation
- Battlefield simulation
- Medical training (battlefield)
- Vehicle simulation
- Virtual boot camp

Virtual reality is also used to treat post-traumatic stress disorder. Soldiers suffering from battlefield trauma and other psychological conditions can learn how to deal with their symptoms in a 'safe' environment. The idea is for them to be exposed to the triggers for their condition which they gradually adjust to. This has the effect of decreasing their symptoms and enabling them to cope with new or unexpected situations. Some of the VR equipment uses in the military are Flight Simulator and Snipper Attack: Which uses in war and combat situations. HMD (Head Mounted Display): Uses in Army operations, to save money and time. Virtual Naval Ship: Uses in the Navy Operations. Virtual Reality in Entertainment: The entertainment industry is one of the most enthusiastic advocates of virtual reality, most noticeably in games and virtual worlds.

But other equally popular areas include:

- Virtual Museums, e.g., interactive exhibitions
- Galleries
- Theatre, e.g., interactive performances
- Virtual theme parks
- Discovery centers Many of these areas fall into the category 'edutainment' in which the aim is to educate as well as entertain.

a) Virtual Reality in Education

Education is another area that has adopted virtual reality for teaching and learning situations. The advantage of this is that it enables large groups of students to interact with each other as well as within a three-dimensional environment. It can present complex data in an accessible way to students which is both fun and easy to learn and these students can interact with the objects in that environment to discover more about them.

b) Virtual Reality Astronomy

Astronomy students can learn about the solar system and how it works by physical engagement with the objects within. They can move planets, see around stars and track the progress of a comet. This also enables them to see how abstract concepts work in a three-dimensional environment which makes them easier to understand and retain. This is useful for students who have a particular learning style, e.g., creative, or those who find it easier to learn using symbols, colors, and textures.

One Ideal Learning Scenario Is Medicine: Virtual reality can be used to develop surgery simulations or three-dimensional images of the human body which the students can explore. This has been used in medical schools both in the KSA and abroad. Virtual Reality and Tech-Savvy Children This is the fact that children today are familiar with all forms of technology and use these at school as well as at home. They have grown up with technology from a very early age and unlike adults, do not have any fear or hesitation in using it.

IV. Open Research Topics in V.R. Technology

A billion-dollar question is always raised in our mind what is the future of V.R. technology, How the peoples can accept this technology without knowing much more about this? This looks exciting for certain with new developments in virtual reality gear and game consoles that play VR games. We are describing here the future scope of VR in some different fields.

a) Future of VR Technology in Medical Science

When people experience virtual reality for the first time, a common reaction is to start imagining all the different uses the technology might hold. Even within one industry, healthcare, the potential is open-ended. The good thing is that scientists and medical professionals have been at the drawing board for years now, developing and implementing virtual reality in ways that can help them train, diagnose, and treat myriad situations.

1. *Exposure Therapy* the VR experiences provide a controlled environment in which patients can face their fears and even practice coping strategies, as well as break patterns of avoidance — all while in a setting that's private, safe, and easily stopped or repeated, depending on the circumstances.
2. *Treatment for PTSD* VR technology can be used to cure PTSD (Post Traumatic Stress Disorder). This will be helpful to treat these diseases. Post Traumatic Stress Disorder is reported to be caused by traumatic events that are outside the range of

usual human experiences including (but not limited to) military combat, violent personal assault, being kidnapped or taken hostage, and terrorist attacks. Virtual Reality (VR) exposure treatment has been used in previous treatments of PTSD patients with reports of positive outcomes(Rizzo et al., 2005)

3. *Treatment for Pain* For burn victims, pain is an ongoing issue. Doctors are hoping distraction therapy via virtual reality could help them get a handle on that pain. A VR video game from the University of Washington called Snow World, which involves throwing snowballs at penguins and listening to Paul Simon, could alleviate pain during tasks that can be excruciating, like wound care or physical therapy, by overwhelming the senses and pain pathways in the brain7.
4. *Treatment for Brain Damage Assessment and Rehabilitation.* In (Rose et al., 2005) Published a roundup of virtual reality experiences in use for not only assessing impairments but also recreating them. Besides these important fields, VR technology can be useful for other types of patients, as it can help the disabled, social cognition, meditation, etc. According to one hypothesis till 2020 VR Technology will take place to cure many lives heartened diseases, like cancer, TB, BP, and heart diseases.

b) Future of VR Technology in Military

As we all know that Military is the strongest element of the defense system of any country. VR technology is playing a big role to enhance the defense system. At present this is working in the combat situation, threats, goal management, decision-making, etc. In the future, the role of games is very important for the progression of the military field. In the future more COTS games are probably being adapted to become military simulators. The realism of these simulators should likewise increase further. Probably there is a shift from real war situations to operations other than war. This means that humanitarian missions and peacekeeping become more important and that developments in the field of virtual reality tend to focus more on these types of situations. In the past simulation was primarily based on controlling the craft. Nowadays and probably in the future interaction is becoming more important. The last section showed that the current developments are based on interactions like communication, leadership, awareness, and emotions [UNK04]. Facial animation shall become more important to be aware of a person's emotional status [DEA04]. It is also in line with expectations that healthcare and virtual reality, like the treatment of PTSD veterans, make further development. Furthermore, it is hard to tell what the future of virtual reality in the military field brings (Haar, 2005).

c) Future of VR Technology in Entertainment

Virtual reality has been predicted as the next big thing in entertainment for some time, but only within the last two or three years has it started to emerge as a real possibility. This is playing a big role in gaming, 3D movies, playing stations, sports, etc.

Gaming options also mean that there is more chance for other types of gaming and game play to become a virtual reality. The regular use of hand-held technology for gaming including Solitaire can be enhanced by the use of virtual reality. It would allow more opportunities for conversations and real-time action, and can also add to the thrill of competitions such as Poker or online Bingo. Some websites in this field are already expressing an interest in this option.

d) Future of VR Technology in Communication

In the field of communication, wearable devices overtake mobile phones in the future. VR technology is helping to enhance wearable devices for making them better. The teams of experts are not thinking only, beyond gaming, they are trying to make such future devices that will be more helpful in the way of information technology and communication. At this time, different types of communication rings, and watches are available; In the future, these devices can probably be enhanced. So, we discuss some open issues on which future work is dependent. Besides these topics, some more challenges are available on which future researchers can give their idea.

V. Challenges of V.R. Technology

Despite VR technology's recent renaissance, this technology still has some problems which need to be improved. So many researchers have pointed out these challenges which we are briefing here. One problem which every author has mentioned is what we see and what we feel, this is a security issue that is still unsolved. What we don't know about VR today can hurt tomorrow.

In the games, there is still a need to enhance the system and this is the chance for future researchers to modify this system. The problem is in this field "Try enough demos, though, and as with any emerging technology, the cracks will start to show. And the biggest crack right now is in user input — the buttons, pads, or sensors that make VR as interactive as traditional video games. The unique challenge of VR technology which is still unsolved is fidelity. The meaning of fidelity is to change the pixels in the pixellated images. The first complaint with the new wave of VR was: "we could see the pixels!" We started at 1,280 x 800 (640 x 800 per eye) with the VR device, then went up to 1,920 x 1,080 with the DK2, and now 2,560 x 1,440 with the Pixellated images are less of a problem already, and even when they are noticeable, the brain learns after a short time to ignore them and we're left

immersed in the virtual world. In the gaming issue, VR is a big option but there are also some the problems like Virtual reality only being a fad is that people worried about. They don't want to invest in an expensive device that will only be relevant for two, maybe three years. Here's where a lot of industry professionals are divided. While some think that VR will be a new and long-standing platform, others think people will just return to traditional games eventually. Besides this, the games or devices of VR technology are too expensive which is beyond people's budget so if anyone wants to make this technology familiar so it should be at a nominal price.

VI. Conclusion

In this study, we discussed the applications and some open research topics related to the safety and security of VR technology. This study is just giving direction to future researchers about virtual reality. Our work is helpful for those people who are new in this field and want more information about Virtual Reality. Where VR Technology has been opened so many opportunities, some of the problems are also there which need to solve. Table 1 lists the advantages and challenges.

Table 1: Advantages, Challenges and Fields

Challenges	Advantages	VR Technology Fields
• Expensive equipment • Clinic and clinical acceptance • Technical expertise	• Engaging/motivating • Economy of scale • Online data gathering • Fine time resolution • Impairment/Function • Malingering detection • Wearable Devices helps to cure problem easily	Medical
• Difference between what we see and what we feel. • Expensive systems • Technical expertise • Hacking problems still their • Fidelity problems	• Development of Many Army devices • Helpful in the Combat situations • Support in the decision making • Helps to detecting the terrorisms activities	Military
• Expensive devices • Memory management • Wrong use can harmful for the child's brain • Fidelity problems for the pixelated images.	• Sports are using this technology for live telecast. • 3D movies. • 3D games • Many games are based on the VR.	Entertainment
• Cannot trace the student's problem. • Work only machine based • Expensive tools • Beyond the limit of poor peoples	• A good tool for the online education • Added cognitive variables in education and training • Helpful to trained the military and army. • Interaction makes this technology more better for the education • Psychologically confirmation. • Some online training wearable tools like • Google watches	Education
• Low data transfer rate • Expensive devices • Security issues • Low bandwidth • Problems of Virtual display	• NTT can be replacing the mobile phones • All the work of internet can be done by the wearable devices which are based on • VR Technology • Very interactive devices • Portable systems, easy to carry	Communication
• Available in developed cities • Peoples are not technically sound for using this system • Sometime wrong information can do a big blast • Language problem	• Help to control the traffic • Working to detect the criminal activities • Helping to control the air traffic • like radar	Traffic Control

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The Investigation of the Effects of Ramadan Fasting on the Mood State of Family Physicians, Does Ramadan Fasting have a Protective Effect on Human Psychology?

By Özgür Erdem, Dudu Izgi Gencel, İzzettin Toktaş, Ahmet Yosunkaya & Ali Erdem

Mardin Artuklu University

Abstract- *Objective:* The present study has been carried out to investigate the effect of Ramadan fasting on human psychology among family physician, working in Diyarbakır, Turkey.

Method: In this cross-sectional study, the universe of the research is composed of family physicians. A questionnaire form included Turkish version of the Depression Anxiety Stress Scale (DASS-42) was prepared. The study was conducted during the summer of 2017, at the final week of Ramadan, 21st - 25th of June. SPSS 21.0 statistical package was used in the data analysis.

Keywords: *depression, anxiety, stress, ramadan fasting, psychology.*

GJSFR-I Classification: *LCC: R, RC435-571*

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The Investigation of the Effects of Ramadan Fasting on the Mood State of Family Physicians, Does Ramadan Fasting have a Protective Effect on Human Psychology?

Özgür Erdem [α], Dudu Izgi Gencel [σ], İzzettin Toktaş [ρ], Ahmet Yosunkaya [Ω] & Ali Erdem [¥]

Abstract- Objective: The present study has been carried out to investigate the effect of Ramadan fasting on human psychology among family physician, working in Diyarbakır, Turkey.

Method: In this cross-sectional study, the universe of the research is composed of family physicians. A questionnaire form included Turkish version of the Depression Anxiety Stress Scale (DASS-42) was prepared. The study was conducted during the summer of 2017, at the final week of Ramadan, 21st - 25th of June. SPSS 21.0 statistical package was used in the data analysis.

Results: 209 healthy subjects with no known health problems and who were not in the risk groups in terms of mental and physical health were included in the statistical evaluation. Of the 209 people included in the evaluation, 163 said they "fasted this month in Ramadan" and 46 said "they did not fast this month in Ramadan". According to the DASS score, when fasting people were compared to those who did not fast in Ramadan; depression ($p < 0,05$), anxiety ($p > 0,05$) and stress ($p < 0,05$) scores were found to be lower in fasting sample. When compared to those who fasted in Ramadan and those who did not fast; depression, anxiety and stress prevalence were found to be lower in fasting sample.

Conclision: The current study results demonstrated that fasting in the holy month of Ramadan has been effective in diminishing stress, anxiety, and depression levels. Therefore, it is concluded that Ramadan fasting has a protective effect on human psychology.

Keywords: depression, anxiety, stress, ramadan fasting, psychology.

I. Introduction

The fast of Ramadan is one of the five pillars of Islam; it is also one of the greatest of the marks and observances of Islam. There are many purposes and instances of wisdom in the fast of Ramadan with aspects to God Almighty's dominicality, man's social and personal life, and the training of his instinctual soul, and his gratitude for divine bounties (1). Healthy and sedentary individuals have been frequently investigated through Ramadan fasting. Although fasting in the holy month of Ramadan is influential on physical and mental health based on religion of Islam (2) and several studies have described the effect of fasting on physical health (3-6), few investigations have addressed to the relationship between fasting and mental health (7-9). Studies examining the association of fasting and mood can be divided into two groups: the first group features experimental studies, while the other group of studies is observational studies on the effects of Ramadan on mood, i.e. a partial fasting for one month per year. Recent clinical observations demonstrated an early (within few days) favourable effect of medically supervised fasting (for 7–20 days) on depressive symptoms, and an improvement in mood, alertness, pain and a sense of tranquility (10,11). However, the results of such experimental fasting cannot be extrapolated to Islamic intermittent fasting during Ramadan because the duration of each fasting episode of experimental fasting is usually more prolonged than the duration of fasting during Ramadan (12).Moreover, Ramadan fasting has unique characteristics. During every day of the month of Ramadan, Muslims abstain from food, drink and smoking between dawn and sunset.

The effect of Ramadan on health has been studied extensively, for example, in relation to diabetes mellitus, electrolyte imbalance, sleep–wake cycle, daytime alertness and other physiological parameters. Unfortunately, the effects of fasting during the month of Ramadan have not been studied adequately in relation to psychiatric disorders. On extensive literature search, we could only find a few studies examining the relationship between fasting and mood changes. Therefore, the effect of Ramadan fasting on mood and depressive symptoms remains to be determined in well-designed studies. In this respect, the month of Ramadan represents an opportunity to study the relationship between mood disorder and Ramadan

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fasting. The overall objective of this study was to explore the psychological effects that occur during the Ramadan month, especially effects on depression, anxiety, and stress. We hypothesized that fasting people would be happier, joyful, peaceful, carefree and more stress-free during this month. In the present study, we aimed to investigate the spiritual status of doctors who study in the primary health care and to compare mood state of faster doctor to non-faster doctors in the holy month of Ramadan.

II. Materials and Methods

In this cross-sectional study, the universe of the research is composed of the doctors, working in family health centres in Diyarbakır. After the literature search, a questionnaire form was prepared. The form included a demographic questionnaire eliciting information regarding age, gender, marital status, educational level, and profession year, and Turkish version of the Depression Anxiety Stress Scale (DASS-42). This questionnaire contained 42 questions, of which there were 14 questions related to stress, 14 questions about anxiety, and 14 ones assessing depression. Each question has a four-part range in which options are graded from 0 to 3. The validity and reliability of the questionnaire in Turkish have been approved by Bilgel and Bayram (13).Ethically, the participants were informed about the aims of the study and they were asked if they would like to volunteer for participation. They were also informed that they could withdraw from the study an any time and that all information would be kept strictly confidential. The online questionnaire technique was used to obtain the data via e-mail and smartphone. The study was conducted during the summer of 2017, at the final week of Ramadan, 21st - 25th of June. There are about 400 family physicians in Diyarbakır and 293 of them voluntarily accepted to participate in our study.

We know that factors such as environment, education, economy, geography, season, occupation play a significant role in the etiology of mental illnesses such as depression, anxiety and stress. Therefore, we have included doctors who have the same profession and education level, who have similar economic income, live in the same geographical area and are interested in similar patient groups in the study. In addition, the criteria for participant exclusion from the study were as follows: “Have you experienced a major event such as accident-death that could seriously affect your psychology in the last year?”, “Do you have any psychiatric treatment in the last 6 months?”, “Do you have a chronic illness?” and “Do you have any drug use continuously?” those who answered "Yes" to the questions (n=84) were excluded from the evaluation. Thus, the confounding factors were intended to be minimized. The remaining 209 healthy subjects with no known health problems and who were not in the risk groups in terms of mental and physical health were included in the statistical evaluation.

a) Statistical Analysis

SPSS (Statistical Package for the Social Sciences) 21.0 statistical package was used in the data analysis. Data were expressed as frequency, percentage and means (SD). The reliability of the questionnaire was tested and the Cronbach's Alpha value was calculated as 0.963. The relations between the dependent and independent variables were examined with the cross tables (Chi-square=$\chi 2$). To compare the two groups in respect to the scores of the scales, Mann-Whitney U was used. The statistical analyses were considered significant if $p<0,05$.

III. Results

Of the 209 people included in the evaluation, 163 said they "fasted this month in Ramadan" and 46 said "they did not fast this month in Ramadan". The mean (SD) age of the participants was 38,0 ± 7,5 (range, 24-64 years). The mean (SD) professional experience of the doctors was 12,4 ± 6,9 years (range, 1-34 years). Among the participants, 17.7% (n = 37) were female and 82.3% (n = 172) were male, 18.7% (n = 39) were single and 81.3% (n= 170 people) were married. Other socio demographic data of participants were summarized in Table 1. According to doctors who fasted and did not fast, it was determined that the number of patients applied in Ramadan decreased and the patients were to be more aggressive ($p>0,05$). According to the DASS score, when fasting people were compared to those who did not fast in Ramadan; depression ($p <0,05$), anxiety ($p> 0,05$) and stress ($p <0,05$) scores were found to be lower in fasting sample (Table 2).

When compared to those who fasted in Ramadan and those who did not fast; depression, anxiety and stress prevalence were found to be lower in fasting sample (Table 3). The prevalence of depression detected in fasting group was 27.0%, in non-fasting group was 45.7% ($p<0,05$). The prevalence of anxiety detected in fasting group was 25.2%, and in non-fasting group was 41.3% ($p<0,05$). Finally, the prevelance of stress detected in fasting group was 21.9%, while the rate was 37.0% in non-fasting group ($p<0,05$).

IV. Discussion

Ramadan fasting is unique because of its intermittent nature and also has many spiritual benefits. It allows deep introspection and an increased awareness of one’s relationship with God and others around them, a greater appreciation of blessings, and it encourages compassion, care, and charity. There are several physical benefits too. Fasting reduces low-density lipoprotein and cholesterol levels, and improves

weight and glycaemic control (14).Although Ramadan fasting imposed no adverse effects on short-term memory and did not negatively impact the cognitive flexibility function (7,15), results in another study show that the effect of fasting on cognition is heterogeneous and domain-specific (16).

Ramadan fasting results in decreased REM sleep with no impact on other sleep stages, the arousal index or daytime sleepiness (12,17). However, eating exclusively at nighttime imposes significant alterations on individuals' life style and sleep-wake cycles; therefore, food and fluid deprivation theory does not appear to be a convincing explanation for all the presumed impacts of Ramadan fasting. The studies described that combination of changes in sleep-wake cycle, food and fluid intakes, and circadian rhythms was likely to affect mental, physical, and social performances (18). Their findings showed that sleep loss might be responsible for excessive fatigue and reduced alertness in the daytime. Ramadan fasting also imposes deep impacts on the natural circadian rhythm through significant shifts in sleep patterns, body clock, and other physiological indices (18,19). Irritability could be increased during Ramadan fasting which was attributed to reduction in sleep time or nicotine withdrawal (20). Similarly, impairments in vigilance, memory, and continuous attention have been suggested in the course of Ramadan (21).

To date, there are only a few studies that have examined the effects of Ramadan fasting on psychological state and mental health, especially on anxiety, depression and stress. In these investigations, there were no differences in tension, depression, anger, vigor, and confusion estimated by the *Profile of mood states* questionnaire. Only fatigue was higher at the end of Ramadan (22). The result of a pilot study indicates that the Ramadan month may disrupt the mood state of bipolar patients. The relapses were not associated with a change of blood level of lithium. Most of the relapses were of a manic type (77.7%) (23). On the contrary, Farooqa et al. did not find evidence of significant deterioration in mood and mental state. None of the patients relapsed requiring admission or change in treatment. They observed a significant reduction in Hamilton Depression Rating Scale scores during Ramadan compared with pre-Ramadan assessment. The scores on Young Mania Rating Scale also showed a significant decrease during Ramadan compared with pre and post-Ramadan assessments (8).

Koushali et al. investigated Effect of Ramadan fasting on emotional reactions in nurses. The level of their emotional reactions was assessed by DASS questionnaire in two stages over 1-2 weeks before and after Ramadan. The findings showed that depression and stress levels were significantly reduced after in comparison with the levels before the holy month ($P<$ 0.05). Despite the reduction of anxiety level in fasting after Ramadan, the difference was not significant (24).

The results of another study reveal that according to the DASS score, depression anxiety and stress levels were significantly reduced at the end of in comparison with the levels before the holy Ramadan ($p <0,05$). Before the Ramadan; according to DASS score, the persons who were evaluated normally in terms of mood state, when the before Ramadan scores were compared to the end of Ramadan there was no statistically significant in depression, anxiety and stress between pre- and post-Ramadan. Therefore, it can be said that Ramadan fasting has not a negative effect on human psychology in healthy individuals. The persons who were evaluated depressive, anxious and stressful, when the before Ramadan scores were compared to the end of Ramadan depression, anxiety and stress scores were found to be lower at the end of Ramadan. Thus, it can be saidthat Ramadan has a positive effect on the psychology of individuals who are experiencing depression, anxiety and stres The results of the present study reveal that according to the DASS score, depression ($p <0,05$) and stress ($p <0,05$) scores were found to be lower in fasting people compared to non-fasting group. Depression, anxiety and stress prevalence were also found to be lower and statistically significant in fasting sample in comparison with those who did not fast in Ramadan (25).

Ourstudy had some limitations, including a small sample size especially in women and who did not fast. Were commend that the study in a larger sample size, should be performed in further investigations.

V. Conclusion

Millions of Muslims observe fasting in a wide variety of climatic conditions every year. However, epidemiological research is sparse especially in relation to psychiatric disorders. Gaining comfort and confidence and staying away from depression and anxiety are the most fundamental innate human needs, and researchers are striving to underlie the provision of relief in different ways. The current study results demonstrated that fasting in the holy month of Ramadan have been effective in diminishing stress, anxiety, and depression levels, as the decrement has been statistically significant for the stress and depression rates. Therefore, it is concluded that Ramadan fasting have a protective effect on human psychology. However, it needs to be more elaborated and confirmed through further investigations in the future.

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Table 1: The socio demographic features of participants

		Did You Fast During Ramadan Month This Year? *			
		NO (n = 46) %	YES (n = 163) %	Total (n = 209) %	P **
Gender	Female	32.6	13.5	17.7	P >0.05
	Male	67.4	86.5	82.3	
Marital status	Single	21.7	17.8	18.7	P >0.05
	Married	78.3	82.2	81.3	
Do you smoke cigarette?	No	78.3	71.8	73.2	P >0.05
	Yes	21.7	28.2	26.8	
Do patients become more aggressive during Ramadan?	No	28.3	42.3	39.2	P >0.05
	Yes	71.7	57.7	60.8	
How did the number of patients who applied during Ramadan change according to the previous times of Ramadan?	Decreased	50.0	62.6	59.8	P >0.05
	It has not changed	43.5	33.1	35.4	
	Increased	6.5	4.3	4.8	
The mean age (min- max year)		37.0 ± 7.6 (25-64 year)	38.3 ± 7.6 (24-63 year)	38.0 ± 7.5 (24-64 year)	P >0.05
The mean year of professional experience		11.5 ± 7.1 (1-34 year)	12.7 ± 6.8 (1-34 year)	12.4 ± 6.9 (1-34 year)	P >0.05

**: Column percentage*

***: Chi square test or Mann whit ney U test was applied.*

Table 2: DASS score of the participants

Did you fast during Ramadan month this year?		DEPRESSION Total Score	ANXIETY Total Score	STRESS Total Score
NO(n=46)	Mean ±SS	9,4±8,4	7,6±7,1	13,4±8,8
	Median (min- max)	7,5(0-36)	6(0-34)	12(0-34)
YES(n=163)	Mean ±SS	6,6±6,1	5,2±4,7	10,3±6,5
	Median (min- max)	4 (0-30)	4 (0-23)	10 (0-34)
	P *	0,044	0,060	0,044

** Mann whit ney U test was applied*

Table 3: The mood of the participants according to DASS score and their fasting status

	DID YOU FAST DURING RAMADAN MONTH THIS YEAR?**							
	NO (n=46)	YES (n=163)		NO (n=46)	YES (n=163)		NO (n=46)	YES (n=163)
DEPRESSION*	%	%	ANXIETY*	%	%	STRESS*	%	%
Normal	54,3	73,0	Normal	58,7	74,8	Normal	63,0	79,1
Light	19,6	11,0	Light	10,9	8,0	Light	13,0	12,9
Middle	19,6	13,6	Middle	13,0	14,2	Middle	13,0	5,6
Forward	2,2	1,8	Forward	10,9	1,8	Forward	8,8	1,8
Very Forward	4,3	0,6	Very Forward	6,5	1,2	Very Forward	2,2	0,6
	OR=0,440 (0,224-0,865) P=0,016			OR=0,478 (0,241-0,948) P=0,032			OR=0,450 (0,222-0,913) P=0,025	

**: The other groups except the normal were combined and the Chi square test was applied.*

*** Column percentage*

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Old Problems in the Face of New Challenges

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Introduction- Humanity is currently facing new challenges in the context of the evolving COVID-19 (SARS-CoV-2) pandemic. The epidemiological situation in connection with COVID-19 causes the greatest tension in society around the world. The situation throughout the world, unfortunately, is getting worse. In this regard, new measures for the prevention of coronovirus infection are actively recommended and are being developed. One of such measures to prevent the spread of the disease, recommended by WHO and Rospotrebnadzor of the Russian Federation, along with the use of masks and gloves, is the use of disinfectants and sanitizers at work places, in transport, educational institutions, and at home. They are liquid (rarely gel) agents that destroy most harmful microorganisms and viruses, as stated by the manufacturer. The composition of most of these products that enter the distribution network includes ethyl or isopropyl alcohol, triclosan, propylene glycol, formic acid, sometimes salicylic acid, all kinds of fragrances and other substances. Moreover, if traditionally, in order to guarantee the effectiveness of an antiseptic, clinical trials are necessarily carried out with the issuance of an opinion on behalf of a certified scientific center, in the case of sanitizers, usually classified as a cosmetic product, manufacturers do not face many difficulties.

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Old Problems in the Face of New Challenges

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I. Introduction

Humanity is currently facing new challenges in the context of the evolving COVID-19 (SARS-CoV-2) pandemic. The epidemiological situation in connection with COVID-19 causes the greatest tension in society around the world. The situation throughout the world, unfortunately, is getting worse. In this regard, new measures for the prevention of coronovirus infection are actively recommended and are being developed. One of such measures to prevent the spread of the disease, recommended by WHO and Rospotrebnadzor of the Russian Federation, along with the use of masks and gloves, is the use of disinfectants and sanitizers at work places, in transport, educational institutions, and at home. They are liquid (rarely gel) agents that destroy most harmful microorganisms and viruses, as stated by the manufacturer. The composition of most of these products that enter the distribution network includes ethyl or isopropyl alcohol, triclosan, propylene glycol, formic acid, sometimes salicylic acid, all kinds of fragrances and other substances. Moreover, if traditionally, in order to guarantee the effectiveness of an antiseptic, clinical trials are necessarily carried out with the issuance of an opinion on behalf of a certified scientific center, in the case of sanitizers, usually classified as a cosmetic product, manufacturers do not face many difficulties.

The use of disinfectants recommended by WHO will increase (Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19), Geneva: World Health Organization; 2020 (https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf). The use of disinfectants and antiseptics increasingly requires consideration of indirect environmental and health impacts. There is only limited information on the effects of the use of disinfectants and antiseptics (including detergents and sanitizers) on health, which makes it timely and necessary to conduct research on animal and human. (https://doi.org/10.1093/occmed/kqaa036, accessed 10 May 2020; Key Messages and Actions for COVID-19 Prevention and Control in Schools. Geneva; World Health Organization; 2020 (https://www.who.int/docs/defaultsource/coronaviruse/key-messages-and-actions-for-covid-19-prevention-and-controlin-schools-march-2020.pdf; List N: Disinfectants for Use Against SARS-CoV-2, US EPA. 2020 (https://www.epa.gov/pesticide-registration/list-ndisinfectants-use-against-sars-cov-2).

However, the massive use of sanitizers can lead to poorly predictable consequences for animal and human health. Most of the populations of countries that actively applying sanitizers notice signs of dry skin, peeling, sometimes redness and flushing of the skin, shortness of breath, etc. after several days of use. Water-washed sanitizers end up in wastewater. Currently, there are no special methods for wastewater treatment from these agents and their metabolites as well as from specific viruses. Thus, the concentrations of sanitizers in wastewater, and then in natural waters (as a result of insufficiently purified waters entering natural water bodies, including those used for fisheries!) will rapidly increase. This undoubtedly causes concern among ecologists, doctors, specialists of environmental departments, and the population. To a greater extent, such accumulation of sanitizers or their metabolic products in the surrounding aquatic environment can damage the condition of aquatic animals and plants.

Disinfectants are often and successfully used in agriculture and aquaculture. The use of disinfectants in these cases increasingly requires consideration of the indirect effects on the environment and human health. Currently, there is only limited information available on the effects of a number of disinfectants, and therefore such information is needed to assess the potential risks of adverse effects, often delayed!, on animal and human health, taking into account the potential for synergistic effects, which include such multi-component aqueous systems like surface water.

In all cases, US EPA (May 15, 2019) recommends the use of detergents of various natures and compositions before disinfection. Surfaces should always be cleaned with soap and water or detergent to remove organic matter first and then disinfect. There are several groups of disinfectants, the most common are chlorine-based and alcohol-containing products. The most widely used cationic detergents are:

degmicide, cerigel, chlorhesidin, ethonium, dimexil, potassium soap, miramistin, containing active chemical elements, for example, nitrogen atoms in cerigel, etc.

Hypochlorite-based products include liquid (sodium hypochlorite), solid or powder (calcium hypochlorite) formulations. These compounds dissolve in water, creating a dilute aqueous chlorine solution in which undissociated hypochlorous acid (HOCl) is active as an antimicrobial compound. Hypochlorite has a

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broad spectrum of antimicrobial activity and is effective against several common pathogens at various concentrations. For example, hypochlorite is effective against rotavirus at a concentration of 0.05% (500 ppm), but for some highly resistant pathogens such as *Candida auris* and *Candida difficile* (Pereira et al., 2015; Kohler et al., 2018), higher concentrations of 0.5% (5000 ppm) are required in medical settings.

The recommendation to use 0.1% (1000 ppm) hypochlorite solution in the context of COVID-19 (SARS-CoV-2) is a conservative concentration that will inactivate the vast majority of other pathogens that may be present in healthcare settings. However, for operational cases with the possibility of blood spills and body fluids (that is, more than 10 ml), a concentration of 0.5% (5000 ppm) is recommended. Hypochlorite is rapidly inactivated in the presence of organic matter; therefore, regardless of the concentration used, it is important to first clean surfaces thoroughly with soap, water or detergent, washing or wiping. High concentrations of chlorine can lead to metal corrosion and skin or mucosal irritation, in addition to the potential chlorine odor side effects for vulnerable individuals such as people with asthma. Thus, the ratio of benefits and harms from the use of disinfectants of different classes (sanitizers) is actively discussed in the scientific literature and in clinical practice.

Commercial sodium hypochlorite products in various concentration levels are readily available for use in a variety of conditions. In Europe and North America, chlorine concentrations in commercially available products range from 4% to 6%. The concentration may also vary according to national regulations and manufacturers' formulas. In non-health care settings, sodium hypochlorite can be used at the recommended concentration of 0.1% (1000 ppm). Alternatively, the use of 70-90% ethyl alcohol is recommended to disinfect surfaces.

In addition, the present reality necessitates the widespread use by the population of household antiseptics for hand skin - sanitizers. Sanitizers may be identical in composition to professional antiseptics or may differ from them due to additives for the purpose of moisturizing and caring for the skin, flavors, food colors and other components.

Summarizing the available information on the composition of sanitizers, the following components can be distinguished:

- ethyl or isopropyl alcohol
- chlorhexidine
- propylene glycol
- panthenol
- glycerin
- triethanolamine
- quaternary salts: benzalkonium chloride
- flavors and skin care products: vitamins, plant extracts, fragrances, etc.

At the same time, manufacturers of sanitizers usually classify these preparations as cosmetics, which eliminate the need for an examination confirming the effectiveness of these preparations and their composition.

Thus, the currently observed mass (both in terms of coverage of the population and in quantity) use of sanitizers may lead in the future to uncontrolled releases into the natural environment of the components that make up these preparations and their metabolites that can cause biological response effects in natural living organisms, incl. - negative.

In addition, some products manufactured by companies do not have the properties stated in their descriptions. For example, there are cases when products manufactured by pharmaceutical companies did not meet the proclaimed requirements and effects on. So, The U.S. Environmental Protection Agency announced a settlement with Clorox Professional Products Company for selling one of the company's disinfectant bleach products used in hospitals was not effective against the bacterium that causes tuberculosis. Clorox has removed the claim from its product, marketed as "Dispatch Hospital Cleaner Disinfectant with Bleach." "Labels that are false or misleading put people at risk," said Jared Blumenfeld, EPA's Regional Administrator for the Pacific Southwest. "Companies must test and correctly label these disinfectant products to protect the health and safety of hospital patients and staff."(US EPA 2005) https://www.epa.gov/archive/epa/newsroom/2015-news-releases-date.html).

The biological effects of the use of such products, as well as the physiological and biochemical mechanisms of adaptation of aquatic organisms to sanitizers and detergents, have not been studied enough (Slye et al., 2011;Gagné et al., 2012; Gilles , 2012; Messina et al., 2014, etc.). Even less studied are the possible synergistic effects of their combined action in the presence of, for example, heavy metals (HMs) in surface waters.

HMs, such as Cu, Zn, Pb, Cd, Hg, As, etc., which are priority environmental pollutants, have bioavailability for living organisms. Understanding the factors that determine the bioavailability and features of the penetration of elements into living organisms, as well as the mechanisms and ways of excretion from living organisms is one of the important fundamental tasks of aquatic ecotoxicology and environmental safety (Moiseenko, 2009). Thus, the relevance of studying the biological effects of the substances indicated above is beyond doubt.

It seems relevant to study the possible biological effects of exposure in various combinations of sanitizers, detergents and salt solutions to the most toxic heavy metals for aquatic organisms (presumably

Cu, Zn, Pb and Cd) in different microconcentrations, with different exposure times of animals in them, on indicators of the state of oxidative stress. At the same time, it is possible to assess the presence in the experimental solution of precisely labile forms of HMs in water, and not just their total content, since the greatest danger to biota is represented by labile forms characterized by high biochemical activity and the ability to accumulate in natural environments and animal tissues (e.g., Ravero, 2001; Levit et al., 2020).

As test objects in future studies, it seems interesting to us to use mollusks of the family Unionidae (Unio spp.), widely distributed throughout freshwater areas, and for marine areas, the Mediterranean mussel *Mytilus galloprovincialis* Lam., or the White Sea mussel *Mytilus edulis* L., as well as representatives of Crustacea - higher crayfish (eg. *Astacus leptodactylus* Esch. and/or *Procambarus clarkii*). The species of mollusks and crayfish listed above are traditionally used as bioindicator species in biomonitoring of pollution of aquatic ecosystems (Elder, Collins, 1991; Salanki et al., 2003; Depledge, Galloway, 2005; Kuklina et al., 2013), as well as in experimental toxicological experiments (Handy, Depledge, 1999; Curtis et al., 2000; Kuznetsova et al., 2010; Hook et al., 2014, etc.).

There are several reasons for choosing these animals as bioindicators. Summing up the opinions of various authors (Widdows, Donkin, 1992; Gruber et al., 1994; Kramer, Foekema, 2001; Nikinmaa 2014, etc.), we obtain:

1. They are widely distributed and can be easily caught.
2. Most of them live in shallow waters, in coastal waters - places most prone to various types of pollution.
3. Inactive animals (low locomotor) or with a sedentary life.
4. These are animals with a rather long life cycle.
5. Large enough to collect and analyze tissue for contaminants.
6. Many species are quite sensitive to various types of pollution, and at the same time have some resistance, which allows them to accumulate pollutants, which, however, does not lead to death.
7. Many substances show dose-dependent effects on many physiological and biochemical processes in animals.

Studies of the bioavailability of many HM substances hazardous to organisms show that the total concentrations of HMs in water and in sediments do not always correlate with their concentrations in animal tissues (due to differences in ecotoxicity, metal interactions in natural environments, and due to protective physiological and biochemical mechanisms in living organisms).

Thus, the question remains whether mollusks and crustaceans can serve as indicators of pollution of coastal waters by domestic wastewater containing sanitizers, detergents, HMs, and their metabolites. Currently, there are few such studies.

At the same time, it is known that Biological Early Warning Systems (BEWs) have long been actively used to monitor water quality, in which living organisms are successfully used as biosensors of natural water pollution. Developed in the 1980s–1990s, automated systems for non-invasive registration of the heart rate in crustaceans and mussels at the Marine Biology Laboratory in Plymouth made it possible to assess the degree of influence of certain heavy metals on the cardiac activity of animals (Depledge and Andersen, 1990; Depledge et al., 1995, US EPA, 2005, etc.).

Heart rate variability (HRV) is one of the fundamental physiological properties of living organisms, and can serve as a basis for early diagnosis of the deterioration of the physiological state (PS) of an organism. Among aquatic invertebrates, the most analogies in the general structure, functioning, and systems of regulation of cardiac activity, in comparison with mammals, are known for mollusks. The main parameters of the heart rate of mollusks, calculated using clinical cardiology algorithms developed for humans, intersect with similar values for human rhythmograms (Bychkov et al., 1997). However, both in the world and in Russia, studies of the cardiac activity of crayfish are quite rare, especially when using automated systems for non-invasive heart rate monitoring (Kholodkevich et al., 2009; Kholodkevich et al., 2021).

In early studies by foreign scientists, it was shown that crayfish can change the rhythm of heart activity in the presence of HMs (Spicer, Weber, 1991; Styrishave et al., 1995), as well as in the presence of chemicals used in the treatment/disinfection of water in aquaculture (Kozak et al., 2009), for example, during its chlorination or chloramination (Kuklina et al., 2014). These works can be the basis for research on the effects of sanitizers on the functional indicators of crustaceans and mollusks.

The effect of chlorine-containing substances on the cardiac activity of crayfish has not been sufficiently studied, despite the fact that organochlorine compounds, being the strongest toxicants, can enter water bodies with wastewater, posing a danger to the flora and fauna of these water bodies. Active chlorine and its compounds are widely used in industry, in water treatment processes at waterworks, in various disinfections, including in aquaculture to combat parasitic infections. Thus, 10 mg/L of biocide as chloramines-T is considered as a commonly used in industry and aquaculture, at the same time in experiments on crayfish *Astacus leptodactylus* (Esch., 1823) the clear exposure effect was shown only after 1 day exposure to 50 mg/L of chloramines-T (Kuklina et al., 2014). According to heart rate changes, the 1-h exposure did not adversely affect crayfish at either

concentration, as well as during daily exposure to 10 mg/L. As assessed by the heart rate, the 24-h exposure to 50 mg/L of chloramine-T was toxic for crayfish and led to substantial loss of energy (Kuklina et al., 2014).

It is known that the biocenosis reacts to a change in the quality of the habitat by changing the intensity of metabolism. The efficiency of aerobic energy exchange in hydrobionts, which can be estimated from the rate of oxygen consumption, can serve as an indicator of the quality of the aquatic environment (see Kolupaev, 1992; Martin et al., 2007). The advantage of using this particular functional indicator, the change of which, as a rule, is associated with the organism's attempt to avoid or compensate for adverse effects, lies in the possibility of detecting the initial effects of pollutants on a living organism and early signs of deterioration in animal health.

The biological effects of the use of sanitizers and detergents, as well as the physiological and biochemical mechanisms of adaptation of aquatic organisms to them, have not been sufficiently studied. Studies on the effects of detergents on living organisms are also rare. It is noted that synthetic detergents (SDs) and surfactants, which are part of them, have a negative impact on the PS of living organisms, water quality for biota, and the self-cleaning capacity of water bodies (Ostroumov, 2001). Pollution of water by them is further complicated by the fact that the products of chemical and biological decomposition in some cases are more toxic than the original substances (Ostroumov, 2001, 2006, etc.). The criterion for changes in the toxicity of SDs in long-term experiments of Ryabuhina et al. (Ryabuhina et al., 2007) was the dynamics of the survival of Ceriodaphnia in water samples compared with the control. In the experiments, an increase in the toxicity of solutions with a SDS concentration of 25 mg/l was revealed on the 15th day of the experiment (Ryabukhina et al., 2007).

There are only a few Russian experimental studies (Gostyukhina et al., 2007; Trusevich et al., 2014; 2017; Kuznetsova, Kholodkevich, 2015) that show the effect of anionic and cationic detergents (TDTMA) and sodium dodecyl sulfate (SDS) at different concentrations on the activity of valve movement and on the heart rate of the Black Sea mussels (*Mytilus galloprovincialis* Lam.). With an increase in the concentration of the active detergent to 1.7 mg/l, the behavior of the mussel is marked by long periods of the presence of the mollusk with closed valves, i.e. lack of filtration. Under these conditions, mussels switch to anaerobic metabolism, in the case of prolonged exposure, this leads to oxygen starvation - hypoxia. The transition of the mollusk to the closed state is a sign of the negative effect of detergent solutions on the functional state of the mussel (Trusevich et al., 2010; 2017; Gaisky et al., 2014; Kuznetsova and Kholodkevich, 2015). However, the same protective reaction prevents the entry of toxic substances into the body cavity of mollusks. In the case of small (smaller) concentrations (0.3-0.5 mg/L) of SDS, mollusks “taste” the water, which manifests itself later in a change in the circadian rhythm of cardiac activity. This indicates the need to take into account the negative effects of low concentrations of detergents, expressed in a significant change in circadian activity, with the loss of the predominance of the active state of mussels at night, which was stressed earlier (Kuznetsova and Kholodkevich, 2015). A higher locomotor (valve opening) during the night, leads to avoidance of vulnerability of mussels to diurnal predators). For the same species of mollusks, changes in biochemical markers of oxidative stress were shown (Messina et al., 2014) under the action of SDS detergent.

In the studies of oxidative stress in hydrobionts in the presence of water pollutants great attention is occupied by the study of detoxification and tissue protection systems, among which the enzymatic antioxidant system (AOS) plays a leading role (Soldatov et al., 2014; Chuiko, 2014). In the presence of the cationic detergent tetradecyl trimethyl ammonium bromide (TDTMA) at a concentration of 0.8 mg/l (a value close to the concentrations of the detergent in the surrounding aquatic environment) for 8 days, the mussels showed a change in AOS indicators, indicating the development of a state of oxidative stress. Significant changes were found in the peripheral tissues of mussels (gills and leg), which were in direct contact with TDTMA. An increased level of TBA-AP was noted by 46 and 11, respectively. Against this background, a significant increase in the activity of SOD, which neutralizes O2-, was noted; in the gills, SOD increased 6 times ($p<0.05$). At the same time, an increase in CAT activity by 1.7 and 3.2 times, respectively, was noted in the gills and leg. The tissue specificity of the AOS response to this detergent was shown, since The AOS system of the hepatopancreas showed the least sensitivity to the action of the detergent, and the gills, on the contrary, showed the maximum sensitivity to such exposure.

In terms of the scale of pollution and the impact on biological objects, HMs compounds occupy a special place among pollutants, and their distribution in the environment is the most serious threat to its environmental safety, which is aggravated over the years. An important feature of metals is that their potential toxicity and bioavailability are largely determined by their form. The forms of elements in natural environments are influenced by the compositional and granulometric composition of the medium, the content and absorbing capacity of mineral and organic sorbents, pH, Eh, the composition of the aqueous phase, and many other factors (Dash et al., 2021). A large amount of scientific literature has been accumulated concerning the distribution and accumulation of HMs in various ecosystems, the

ecotoxicological effects of metals on living organisms (Förstner, 1981; Handy and Depledge, 1999; Kapustka et al., 2004; DeForest et al., 2007; Strode, Balode, 2013; Hook et al., 2014; Moiseenko, 2019; Egorov, 2019), while free HM forms are the most toxic (Linnik and Nabivanets, 1986; Depledge and Rainbow, 1990).

At the same time, one of the topical problems is the disclosure of patterns of behavior of HMs in the bottom sediments of water bodies and the assessment of potential environmental risks of HM accumulation by bottom sediments, which are components of surface waters. The effect of HM ions on the sorption of various organic toxicants by bottom sediments is considered in literature. The effect of Cd^{2+} and Cu^{2+} ions on the sorption of atracine, one of the most common herbicides, by bottom sediments was studied in (Du Laing, 2009; Gadd, 2004). It is shown that Cd exhibits a synergistic (enhancing) effect on the sorption of atracine, while copper has an antagonistic effect. The processes of sorption of HMs and other hazardous substances by natural sorbents are interrelated and little studied; therefore, understanding the patterns of the mutual influence of these toxicants in sorption processes seems necessary and very relevant. Competitive sorption of heavy metals by bottom sediments is practically not studied. The effect of organic pollutants on the transformation of heavy metal compounds has not been studied either. Biochemists have been studying the mechanisms of the toxic effect of HM ions on living organisms for many years. It has been established that HM ions can accumulate in living organisms, interfere with the metabolic cycle, and suppress the synthesis of proteins, including enzymes (Kováčová, Šturdík, 2002; Moiseenko, 2009, 2019; Gadd, 2004). However, it is equally important to study the effect of biota and its metabolites on the behavior of HMs in the environment. Although monitoring of the level of contamination of sediments of water bodies is still carried out by the total (gross) content of toxic elements, however, it should be noted that only labile hydrated ions or unstable complexes most easily penetrate cell membranes and, therefore, are considered biologically active, therefore, bioavailability is determining factor of HM toxicological impact on aquatic organisms. Labile forms of heavy metals such as Cu, Cd, Zn, Pb are priority environmental pollutants. For benthic organisms, the most accessible are dissolved forms of metals present in the pore (silt) waters of bottom sediments. Therefore, the factors affecting the distribution of metals in the "bottom sediments – pore solution" system are simultaneously the factors controlling their bioavailability (Levit et al., 2014).

When evaluating the biological effects of HM environmental pollution, it is customary to determine the bioaccumulation coefficients of heavy metals (BCF) in animal tissues (Mendosa-Carraza, 2016). Tissue specificity in the accumulation of heavy metals (mainly Cu, Zn, Pb, and Cd) and metal specificity of the effects of such accumulation by mussel's tissues were shown (e.g., Brown et al., 1998; Brown et al., 2004; Levit et al., 2017; Zarykhta et al., 2019). However, in most ecotoxicological studies, the gross values of HM concentrations in experimental solutions are taken into account, without taking into account the concentration of labile forms of these metals and possible HM transformations in natural waters of various compositions.

A lot of works are devoted to the biological effects of HM action on the physiological and biochemical indicators of the state of aquatic organisms (Gundacker, 2010; Fokina, Nefedova, Nemova, 2010; Moiseenko, 2019). Most of these studies were carried out on bivalves, both marine and freshwater species (Curtis et al., 2000; Chuiko et al., 2014; Kholodkevich et al., 2019). Curtis et al. (2000) evaluated the responses of the mussel's cardiac system and changes in locomotor behavior (valve movements) to exposure to various concentrations of copper ions in water. The responses of these two functional systems to copper differed significantly and were not always dose-dependent. In the literature, we also find evidence of species specificity in the sensitivity of aquatic animals to HMs and in their accumulation (Levit et al., 2017).

In general, the ability of macrobenthic invertebrates (mollusks and crustaceans) to accumulate heavy metals depends on the form of the metal and the characteristics of the organism; therefore, bioaccumulation should be considered in combination with data on metal concentrations in the abiotic components of the ecosystem (Kudryavtseva et al., 2021). Using stripping voltammetry (IVA), it was found that the amount of IVA-labile forms of heavy metals, such as Cu, Cd, Zn, Pb, depends, among other things, on the pH of the experimental solution, which can be affected by the components of sanitizers and detergents.

A batch of different test species each for a different trophic level is highly recommended in order to study the toxicity of a substance or synergistic effects of its mixture on benthic invertebrates (HELCOM 2014).

It should be noted that a comprehensive study of natural objects using various methodological approaches and algorithms for their implementation will make it possible to predict the state of ecosystems under anthropogenic impacts in the face of new challenges associated with the emergence and spread of a new coronovirus pandemic.

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Advances in Medical Physics for Regenerative Medicine

By Dr. Alla Srivani, Gurram Vasanth & M. Srinivasa Rao

Annamali University

Abstract- Globally, the cost of hard tissue repair and regeneration is in the hundreds of billions of dollars every year, and as the population ages, this demand has grown significantly. Structures made of calcium phosphate minerals, such as bone and teeth, are considered to be hard tissues. Techniques for regenerative medicine and smart biomaterial-based tissue engineering have the exciting potential to fill this critical need. By engineering the material's responsiveness to internal or external stimuli, smart biomaterials and constructs can have instructive/inductive, triggering/stimulating, or stimulating effects on cells and tissues. They can also have intelligently tailored properties and functions that can encourage tissue repair and regeneration. Smart scaffolds and stem cell constructs for bone tissue engineering, intelligent medication delivery systems to improve bone regeneration and intelligent dental resins.

Keywords: *advanced bio materials, medical physics, regenerative medicine.*

GJSFR-I Classification: *DDC Code: 571.835 LCC Code: QH587*

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Advances in Medical Physics for Regenerative Medicine

Dr. Alla Srivani [α], Gurram Vasanth [σ] & M. Srinivasa Rao [ρ]

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Keywords: advanced bio materials, medical physics, regenerative medicine.

I. Introduction

This research study, which focuses on recent developments in the fields of tissue engineering and regenerative medicine, offers a useful overview of biomaterial approaches to regenerating tissues and organs by using various bio-fabrication strategies and materials. The design of in vivo and in vitro biomaterials and devices, as well as a variety of subjects relating to stem cell biology, biomaterials, and technical techniques, are all covered in the papers. The development of innovative functional liver substitutes, advancements in bone regeneration, the synthesis of neural tissue, a ground-breaking model of cardiac fibrosis and the development.

II. Methodology

In order to better human health and wellbeing, medical physics[1] focuses on using physics principles and techniques in the detection, diagnosis, and treatment of human disorders. [2] According to the International Labour Organization's International Standard Classification of Occupations, medical physics has been classified as a health profession since 2008. [3] "Medical physicist" is specifically a health professional [4] with specialised education and training in the concepts and techniques of applying physics in medicine and competent to practise independently in one or more of the subfields of medical physics. Medical physics may also occasionally be referred to as biomedical physics, medical biophysics, applied physics in medicine, physics applications in medical science, radiological physics, or hospital radio-physics.

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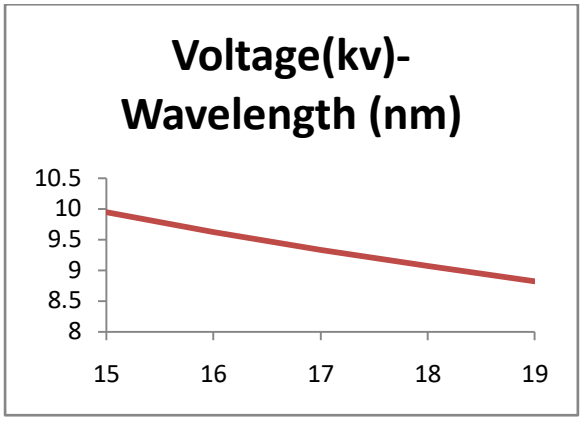
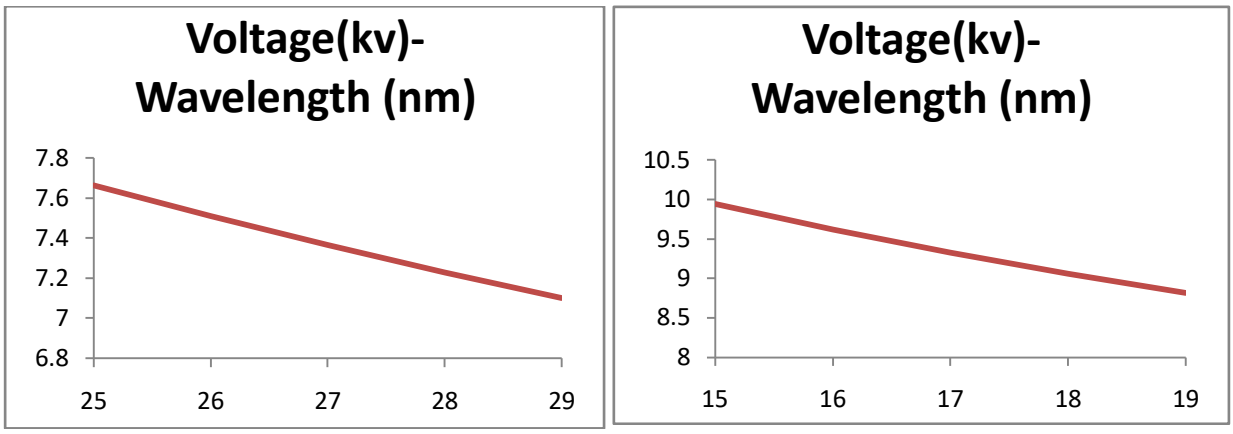
III. Results & Discussion

Sl. No	Acceleration Voltage (KV)	Wavelength (nm) 10^{-3}
1	20	8.588
2	21	8.377
3	22	8.180
4	23	7.997
5	24	7.825



Sl. No	Acceleration Voltage (KV)	Wavelength (nm) 10^{-3}
1	15	9.941
2	16	9.620
3	17	9.328
4	18	9.061
5	19	8.815

Sl. No	Acceleration Voltage (KV)	Wavelength (nm) 10^{-3}
1	25	7.663
2	26	7.511
3	27	7.367
4	28	7.230
5	29	7.101



Figure

The very large Voltage-wavelength variations in the dielectric constant and loss factor, the requirement to measure these properties as a function of temperature, and the requirement to measure tissue properties in vivo all pose challenges for electrical property measurements of biological materials. The authors discuss the equipment and measuring techniques they created and employed at frequencies ranging from 10 kHz to 10 GHz for in-vivo and in-vitro biological materials. Both the sensors and the equipment for time-domain and frequency-domain measurements are discussed. Included is a general summary of the work done at different laboratories.

Using the principles of biomimetics, nano-assembly technology, and additive manufacturing techniques, smart artificial bone scaffolds have recently been created to match the composition and structural features of genuine bone. 25 On the scaffold, particular molecular recognition signals including peptides, growth factors, and genes were immobilised. To create biomimetic settings for tissue engineering, peptides were combined with porous poly(lactide-co-glycolide, or PLGA) microspheres. 26 The surface morphology and pore size distribution of the bone microstructure might be described using computer-aided porous scaffold design for tissue engineering based on the examination of the porous structures of trabecular bone. 27 The smart scaffold.

Materials that can react to pH are one significant smart stimulus-responsive strategy used in dentistry to safeguard tooth structures. Dental caries is a widespread condition that costs a lot of money and is one of the most prevalent bacterial diseases in people. 122,123.

IV. Conclusion

Demineralization caused by bacterial acid assault is the fundamental cause of caries. 123,124,125 Organic acids like lactic, formic, acetic, and propionic acids are produced by oral acidogenic bacteria.

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Design and Implementation of a Quantitative Risk Assessment Model for UK Road Tunnels

By Razieh Khaksari & Zambri Harun

University of Malaysia

Abstract- One of the critical transportation infrastructures is road tunnels and fire safety is one of the important aspects of their operation. Interaction between the fire, tunnel users, traffic, and fire safety measures influences fires in road tunnels. Therefore, a complex model is required to analyse the risk and quantify the consequences. In this paper, a novel quantitative risk analysis model developed for UK road tunnels is presented consisting of a quantitative consequence analysis model and a quantitative frequency frequency analysis model. The proposed quantitative consequence analysis model is provided through three sub-models; queue model, distribution model, and egress model. The frequency analysis is via an event tree that takes into account the tunnel fire rate in UK road tunnels. After a brief description of this model, the proposed method is illustrated through a case study of an urban road tunnel. The effect of different emergency ventilation systems on societal risk and sensitivity of the model to pre-movement time, accident frequencies involving Heavy Good Vehicles (HGVs), tenability threshold temperature, and different burning vehicles were studied in this case study.

Keywords: *fire safety, quantitative risk analysis, consequence analysis, frequency analysis.*

GJSFR-I Classification: *LCC: TE228.3*

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Design and Implementation of a Quantitative Risk Assessment Model for UK Road Tunnels

Razieh Khaksari [α] & Zambri Harun [σ]

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I. Introduction

The number of road and rail tunnels constructed worldwide within the last 15 years has increased. This increase is due to the considerable rise in traffic volume. Not only has the number of tunnels increased, but the type and complexity of fire safety systems used in them have also changed. Tunnels can relieve congestion in developed urban areas and reduce travel times in urban areas.

However, the growth of using tunnels results in an endogenous problem, the severity of accidents that may occur [1]. Although the accident rate in tunnels is lower than on open roads as shown in [2], accidents can lead to severe consequences due to tunnel nature. Fire is one of these disastrous consequences, which can cause human losses and structural damage [3]. Much research about tunnel fire dynamics and influencing parameters has been performed within the last 20 years. [4] summarized the main research in that field. Fire in Mont Blanc in France (1999; 39 fatalities), fire in Frejus in France (2005; 2 fatalities and 21 injuries), and fire in Yanhou in China (2014; 40 fatalities) have raised awareness of the safety issues of the tunnels, and that of the road tunnel users. Therefore, risk analysis has become one of the essential tools to improve and optimize the safety level of road tunnels. There are several methods of risk analysis to determine risks and evaluate the effectiveness of safety measures. One of these methods is quantitative risk analysis (QRA), which has been one of the explicit requirements under the European Union (EU) Directive (2004/54/EC) [5]. QRA includes event tree analysis and consequence analysis models. Various QRA models for fire in road tunnels have been developed by different countries, such as the TuRisMo model of Austria, the TUNPRIM model of the Netherlands, the Italian risk analysis model, and the OECD/PIARC model [6]. Societal risk represented graphically in the form of a frequency/ number of fatalities (FN) curve, is the main output of these models. The calculated societal risk must be evaluated by comparison with the risk acceptance criteria, i.e. must be less than a specified minimum and acceptable value (threshold) as presented in the case studies, for instance, Diamantidis, 2005 [7]; Botschek et al., 2007 [8]; Kohl and Zibert, 2010 [9].

In the UK, many of the 48 road tunnels have been constructed when transport conditions, knowledge, and technical possibilities were in their infancy and very different from the present. For instance, current traffic volume and its composition are not the same as decades ago. There are still tunnels under construction and also innovations today that permit the use of safety systems and devices that were improbable before.

Although the UK's design manual BD78/99, which was published in August 1999 and then superseded by CD 352 in March 2020, identifies risk analysis as a practical method for determining the risk level of all road tunnels in the United Kingdom, it must be improved and the lack of a quantitative risk model, a comprehensive system-based risk assessment tool to cover fires in road tunnels, is felt.

In other industries, the risk assessment system or software is widely used to be as a decision-support tool [10,11]. Therefore, it is important to develop a robust and flexible QRA software tool that is suitable for road tunnels.

As far as research work and further development of methods are concerned, efforts should

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focus on developing a systematic approach to performing a quantitative risk analysis (QRA) model for the UK road tunnels. Along with both legal regulations and requirements defined in the UK, the risk analysis model can be an additional tool to estimate the level of safety that meets the respective requirements. Consequently, a model of quantitative risk analysis concerning safety in road tunnels called LBAQRA has been developed to perform a risk analysis as required by UK regulations.

The LBAQRA performs a quantitative risk assessment and includes quantitative frequency analysis and quantitative consequence analysis.

This paper first presents a brief description of the sections of this model and how it derives the societal risk. In the second part, an illustrative case study was carried out to study the sensitivity of this model to various risk indicators, and the risk reduction potential of different ventilation strategies.

Risk assessment of fire incidents in road tunnels includes complicated scenarios as they constitute interactions among the fire, tunnel users, and safety measures such as fire detection, tunnel alarm, or emergency ventilation. Thus, many risk indicators, which affect risks for tunnel users, describe the scenario. In order to evaluate the LBAQRA and included risk indicators, Southwick Tunnel with 490 m length is investigated. The tunnel is an urban tunnel with approximately 46900 vehicle/day traffic density in the Eastbound bore. A total of 94 fire scenarios is included in this project. Under-study scenarios have different heat release rates (HRR), fire source locations, and traffic conditions. The influences of different emergency ventilation strategies including various activation times, ventilation velocities and operational strategies, and detection times on societal risk are studied. In each scenario, the possibility for safe egress is estimated by 3D fluid dynamics simulation via measuring tenability thresholds through the evacuation path. The sensitivity of the model to pre-movement time, accident frequencies involving HGVs, tenability threshold temperature, and different burning vehicles were studied as well.

II. Methodology

The specific consequences of tunnel fires such as oxygen concentration decrease, and toxic gases' concentration increase make them one of the catastrophic hazards in road tunnels. Consequently, assessment of risk either quantitatively or qualitatively should be considered an influential tool to reduce such hazards. Although quantitative risk analysis models have been developed in countries such as Austria, Italy, and Singapore to improve the validity of qualitative risk analysis, there is a lack of a quantitative risk model, a comprehensive system-based risk assessment tool to cover fires for road tunnels in the UK. Therefore, it was decided to develop the most appropriate quantitative risk analysis model for safety in UK road tunnels, leading to improved and consistent decisions on the grounds of safety in the design and operation of road tunnels, LBA Quantitative risk analysis model (LBAQRA).

Due to the specific features of each tunnel, risks must be evaluated considering the tunnel geometry and its infrastructures, fire safety measures, as well as equipment and management procedures. In addition, it requires the analysis of many complex factors and processes related to human behaviour, such as pre-evacuation times, interactions between occupants, interactions between occupants and smoke, etc. These aforementioned parameters are taken into account in this model.

This model consists of two main sections: quantitative consequence analysis and quantitative frequency analysis.

a) Quantitative Consequence Analysis

The number of fatalities is calculated via quantitative consequence analysis which comprises three parts: queue model, distribution model, and egress model.

The queue model calculates the length of the vehicle queue behind the fire by considering traffic density, percentage, and type of vehicles in each lane, and a comparison between tunnel closure time and saturation time. Then the number of vehicles queueing in each lane and consequently the number of exposed tunnel users is estimated by queue length and traffic density.

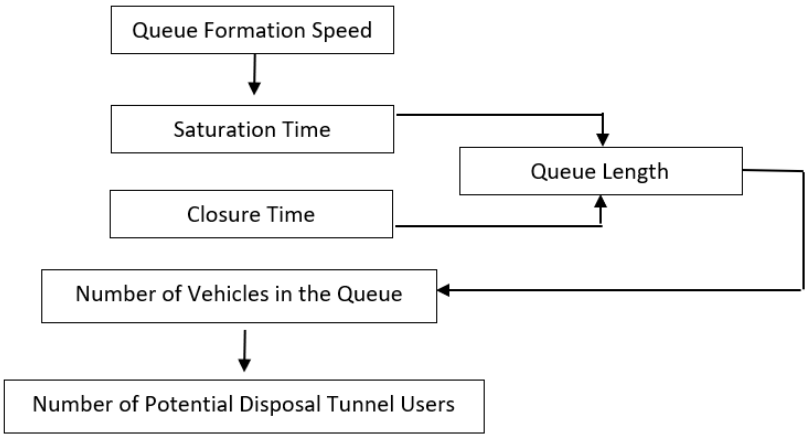

Figure 1: The Process Sequence of Calculating the Number of People in the Queue.

After calculating the number of potentially exposed people, the distribution model is used to divide the queue into cells of the same size and then distribute tunnel users homogeneously. The total distance of the evacuation path is calculated by the distribution model taking into account both the longitudinal and lateral shares in the evacuation route. Exposed tunnel users distributed in each cell start the evacuation path from their initial position and they travel cell by cell towards a place of safety i.e., an emergency exit or the tunnel portal.

It should be mentioned that the structure of the queue formation model and the distribution model has been inspired by [12].

The egress model is a four-section timeline model. The first stage is detection which depends on the safety equipment in the tunnel (t_{det}). The second stage is the alarm stage which is the time between detection and the time when the alarm system is activated (t_{alarm}). The third stage is the pre-movement stage including recognition time, response time, and the time to exit the vehicle (t_{pre}). The distance users have from the accident and the severity of the fire influence the recognition time. The variation of response time is opposite to that of the recognition time as those who are actively evacuating influence those still in their car. The last stage is traveling, which depends on the movement speed and the distance to the emergency exit (t_{travel}). In this model, the relationship between walking speed and people density is used to estimate walking speed. The presence of other people can influence walking speed during evacuation.

The total time of these stages defines RSET (required safe escape time). According to this description, RSET was calculated through Eq.(1) as below:

$$RSET = t_{det} + t_{alarm} + t_{pre} + t_{travel} \quad (1)$$

The next step is the verification of users' egress process to find out if evacuees can start and then continue the evacuation process based on the considered tenability thresholds. In this section, the evacuation time is compared with the time when the tenability thresholds exceed their limits, ASET.

Three indicators are measured at humans' height at the centre of each cell to assess whether occupants can travel the evacuation path and reach a place of safety.

The Tenability Criteria used for this Model are:

- Fractional Irritant Concentration (FIC)<1.
- Fractional Effective Dose (FED) < 1.
- Gas temperature<80 °C.

The total number of casualties is defined as the sum of fatalities in each cell where the tenability thresholds are exceeded (RSET>ASET). The total number of causalities in the whole tunnel is determined by the sum of fatalities in each lane.

b) Quantitative Frequency Analysis

The quantitative frequency analysis is an event tree. The first column of the frequency event tree is initial fire frequency which has been obtained from the historical statics of fire incidents in England road tunnels. Then this initial fire rate is updated by considering the length, traffic volume, and gradient of the under-studied tunnel. Then the updated fire rate is distributed across event tree branches including "time of the incidents", "traffic condition", "type of fire incidents", "vehicle type", and "fire source location".

The results of quantitative consequence analysis and quantitative frequency analysis are presented in terms of social risk, as an FN curve. Risk acceptance is obtained using the ALARP (As Low as Reasonably Practicable) criterion in the UK.

III. Case Study

In order to achieve the purpose of this study mentioned in the introduction section, a specific tunnel was investigated. This tunnel, Southwick Tunnel, is

located on the A27 between the junction of the Holmbush interchange (A27), portal A and the Hangleton interchange (A293), portal B, UK.

The structure is a twin-bore curved uni-directional road tunnel. Each bore is approximately 490 meters long and carries two lanes of traffic. The bores are connected by 3 cross passages, approximately 100m apart and 100m from either portal.This tunnel has a positive longitudinal slope of 3% from portal A to B.

The tunnel equipped with a longitudinal ventilation system consists of 14 jet fans (7 pairs) installed at the ceiling of each bore. The system operates automatically to remove pollution from vehicle exhausts and also to help manage smoke in the event of a fire. Monitoring systems are considered to consist of the Tunnel Control Centre (TCC) with CCTV video surveillance, air quality monitoring, and automatic fire detection systems.

This tunnel has an annual average daily traffic of about 46900 vehicles/day traffic density in the Eastbound bore with an average percentage of 77% passenger car, 0.2% bus, 19% truck, and 3.8% HGV.

Three different traffic conditions, free fluid, congested, and stoppage, were considered. 158 MW, 47 MW, and 30 MW fire scenarios at three locations including 0.3L, 0.5L, and 0.8L (L is tunnel length) are studied. Overall, 94 scenarios were simulated via Fire Dynamic Simulator (FDS) to analyse different emergency ventilation systems for the aforementioned fire loads.

FN curves as the output of quantitative risk analysis and sensitivity analysis of this model taking into account pre-movement time, accident frequency involving HGVs, tenability threshold temperature, and different types of vehicles were carried out for the scenarios understudied.

IV. Results

a) FN Curve

Five different ventilation conditions listed in Table 1 in the case of 158 MW, 47 MW, and 30 MW fire scenarios were studied to investigate the effect of ventilation system strategy on the FN curve. According to the Regulatory Reform (Fire Safety) Order 2005, all tunnel operators in the UK are obliged to take precautions to ensure that the safety risk in the tunnel is as low as reasonably practicable (ALARP). The ALARP limit, acceptable and unacceptable limits, was adopted by Moonis et al. (2008) [13]. In this study, three different traffic conditions including free flow, congested, and stoppage were considered. FN curve of scenarios without ventilation was located at the unacceptable region which means it could not meet the safety target (Figure 2 (a)). The comparison between scenarios without ventilation (V= 0m/s) and other ventilation conditions in Table 1 was presented in Figure 2 (b, c, and d). According to FN curves, when the ventilation system was activated at 4 min after ignition, there was no obvious difference between FN curves of V=0m/s and V=3.2 m/s with 4 min activation time (Figure 2 (b, c)). It means as the ventilation system was activated very late, it could not cope with the influences of fire and smoke. On the other hand, when the ventilation system was activated 2 min after ignition (Figure 2 (d)), the FN curve was lower than in scenarios without ventilation which showed the positive effect of the activation time of the ventilation system. Although it was still in the unacceptable region.

For scenarios with a 3.5 m/s ventilation velocity, jet fans were activated by the detection system when the temperature was above 68˚C. The activation time was between 2.67 and 3.17 min for HGV fires and between 6 and 7.17 for bus fires. As the detection time of these scenarios depended on the linear heat detection system, same as ventilation system activation, and this time was the first stage of the evacuation timeline, people started to evacuate later than scenarios with 1 min detection time (Scenario 1-4 – Table 1). Although for 30 MW fire scenarios, the activation time was between 2 and 3 min, the positive effect of higher ventilation velocity, 3.5 m/s, could make a more tenable situation during evacuation and alleviate the negative effect of late activation of jet fans (Figure 2 (e)).

Table 1: Under Study Ventilation Systems

Scenario No.	Ventilation velocity (m/s)	No. Fans	Ventilation activation time after ignition
1	0	_	–
2	3.2	80%	4 min
3	3.2	100%	4 min
4	3.2	80%	2 min
5	3.5	80%	Activation by detector at 68˚C

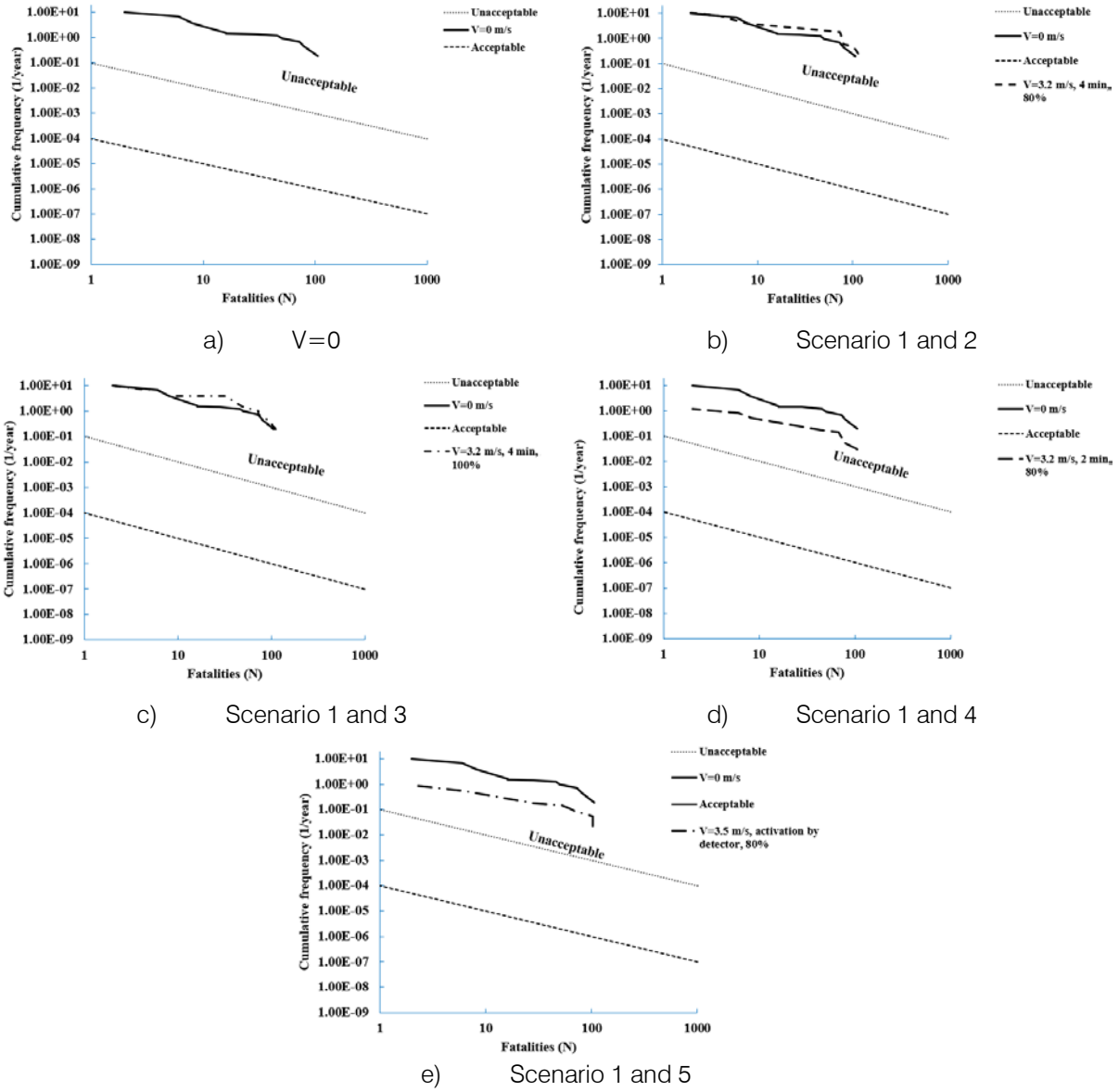

Figure 2: FN Curve of Different Emergency Ventilation Systems

b) Sensitivity Analysis

Basic recognition and response times, and time taken to leave the vehicle Sensitivity analysis was carried out for 30 MW, 47 MW, and 158 MW fire scenarios where 80% of jet fans were activated 2 min after ignition with a 3.2 m/s velocity. Recognition time, response time, and time to leave the vehicle are determined as pre-movement times of tunnel users 'evacuation, a time before the evacuation process toward the emergency exits begins. In this model, these pre-movement times have basic values, $t_{rec,base}$,$t_{res,base}$,and t_{veh} (each type of vehicle). The higher these values, the more likely that the harmful effects of the fire incident reach the users before they start the evacuation. Three modes, basic values of basic pre-movement parameters, half of the basic pre-movement parameters, and double the basic pre-movement parameters, were considered to study the sensitivity of this model to pre-movement times. The expected damage value, EDV, which is calculated via Eq.(2), was calculated for each mode.

$$EDV = \sum N_{si} \times F_{Si}, \quad (2)$$

Where N_{si} is the number of fatalities for each fire scenario and F_{Si} is the cumulated frequency of each fire scenario.

Table 2 illustrates the variation of EDV for half and double pre-movement parameters in comparison with its value in the standard configuration.

Table 2: The Variation of EDV for Half and Double Pre-Movement Parameters in Comparison with its Value in the Standard Configuration

	Half Parameters Zone 1, Zone 2, Zone 3	Reference Parameters Zone 1, Zone 2, Zone 3	Double Parameters Zone 1, Zone 2, Zone 3
$t_{rec,ini}$ (min)	1,1.5,2	2,3,4	4,6,8
$t_{res,ini}$ (min)	2,1.5,1	4,3,2	8,6,4
t_{veh} (s)	4 for PC, 8 for van, 30 for bus, and 2 for truck and HGV	8 for PC, 16 for van, 60 for bus, and 4 for truck and HGV	16 for PC, 32 for van, 120 for bus, and 8 for truck and HGV
EDV	3.54E-01	5.89E-01	9.04E-01
Variation %	-40.00%	–	53.35%

By halving these parameters, the EDV decreased by 40%. On the other hand, by doubling these parameters, the EDV increased by 53.3% which indicated greater pre-movement time and consequently, a higher number of tunnel users implemented evacuation process later and were in the damage intolerable condition for too long. Borghetti et al. [12] also carried out the same analysis and showed the same variation.

c) *The Accidents Frequency Involving HGVs*

To study the influence of incident frequency involving HGV, the frequency of HGV fire scenarios without ventilation decreased by a factor of 10. That leads to lower cumulative frequencies and a lower FN curve compared to the initial FN curve of the same scenarios (without ventilation) (Figure 3). These results were explained when considering that the frequency of occurrence of each scenario depended directly on the value of the incidental frequencies.

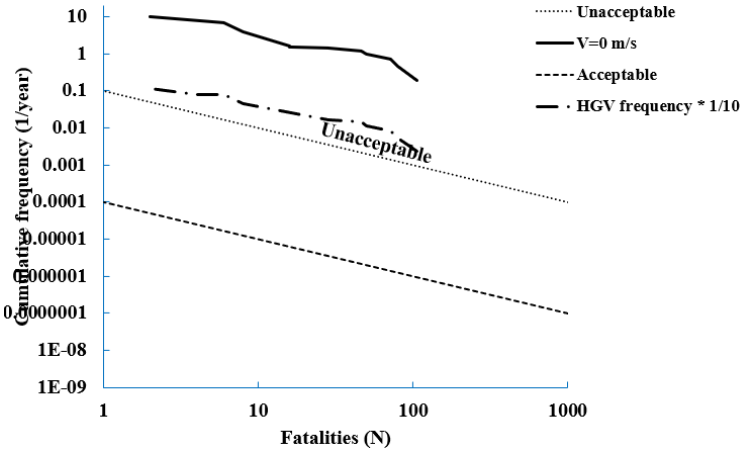

Figure 3: Sensitivity Analysis of the Model to the Influence of Incident Frequency Involving HGV, HGV FN Curves of Scenarios Without Ventilation

d) *Tenability Threshold Temperature*

The tenability threshold temperature defines to what temperature exposed tunnel users can resist the extended damage of fire and smoke before considered as being dead. The initial tenability threshold temperature in this model is 80˚C, the tolerable maximum temperature for 15 min exposure during a tunnel fire according to PIARC (1999). To study the sensitivity of results to this temperature, three cases were considered, initial temperature, halved temperature, and double temperature. It is reasonable to expect that increasing the threshold temperature results in a lower EDV or fewer fatalities, and vice versa. Table 3 shows the EDV variation in relation to the standard configuration, halving, and double values. Doubling this temperature made the EDV decrease by about 35% while halving it caused the EDV to increase by 17.8%.

Table 3: The EDV Variation in Relation to Tenability Threshold Temperature of the Standard Configuration, Halving, and Double Values

	Halved paramer (˚C)	Reference parameter (˚C)	Doubled parameter (˚C)
T_{ten}	*40*	*80*	*160*
EDV	5.44E-01	4.62E-01	3.00E-01
Variation %	17.80%	–	-35.04%

e) Different Types of Burning Vehicles on the Evacuation Time

A comparison between the HGV and bus fire scenario located in the middle of the tunnel length and 80% of the tunnel length for three traffic conditions was carried out. In this model, the exposed tunnel users are distributed homogeneously into cells. The time required for each cell evacuation via emergency exits was between 192 and 695 s for the HGV fire and between 590 and 705 s for bus scenarios. Lower evacuation time for HGV scenarios was probably due to more effect of HGV fire scenarios on pre-movement time. The basic recognition time decreased for more severe accidents and consequently, people became aware of the threatening situation within a shorter time. The percentage of dead people and ASET are reported in Table 4 for the various scenarios. Results clearly show that in the case of a bus fire, all people might safely evacuate the tunnel except in one scenario. In the event of HGV fires, most or all people might be at risk.

Table 4: The percentage of Dead People and ASET

	Traffic	Fire Location (%L)	Ventilation Velocity	People at Risk (%)	ASET Range (S)
Bus	Free fluid	0.5	0	0%	616-681
Bus	Congested	0.5	0	0%	603-698
Bus	Stoppage	0.5	0	3.15%	625-705
Bus	Free fluid	0.8	0	0%	638-684
Bus	Congested	0.8	0	0%	600-690
Bus	Stoppage	0.8	0	0%	590-700
HGV	Free fluid	0.5	0	100.00%	633-703
HGV	Congested	0.5	0	90.91%	192-690
HGV	Stoppage	0.5	0	72.00%	599-651
HGV	Free fluid	0.8	0	57.00%	623-693
HGV	Congested	0.8	0	45.00%	600-698
HGV	Stoppage	0.8	0	81.54%	598-692

V. Conclusion

Fire is the most important critical event for road tunnel users' safety. Although the UK's road tunnels design manual identifies risk analysis as a practical method for determining the risk level of all road tunnels in the United Kingdom, it must be confessed that there is a need for a comprehensive system-based quantitative risk assessment tool to cover fires in road tunnels.

Risk assessment techniques play a very valuable part in tunnel safety decision-making. Consequently, a model of quantitative risk analysis concerning safety in road tunnels called LBAQRA has been developed to perform a risk analysis as required by UK regulations for complex fire scenarios.

The proposed model performs a quantitative risk assessment to effectively and efficiently evaluate the risks for UK road tunnels and includes quantitative frequency analysis and quantitative consequence analysis. The frequency of each fire scenario has been determined based on the basic fire rate of UK road tunnels per 100 million veh-km. This basic fire rate is updated by taking into account the length, traffic, and gradient of the tunnel under study. Then the effect of time of fire incident, traffic condition, accident type, vehicle type, and the fire source location on the updated fire rate is considered through branches of the frequency event tree.

The quantitative consequence model comprises three parts, the queue formation model that estimates the number of potential tunnel users for each lane of a multi-lane tunnel separately, the distribution model that calculates the evacuation distance in two dimensions, and the egress model that calculates the required egress time.

This paper first presents a brief description of the sections of this model and how it derives the societal risk. In the second part, an illustrative case study was carried out for the Southwick Tunnel to study the robustness of this model, and the risk reduction potential of different ventilation strategies was assessed. A study of various emergency ventilation strategies shows that when the ventilation system is activated very late, it cannot cope with the influences of fire and smoke. For scenarios with a 3.5 m/s ventilation velocity when jet fans are activated by the detection system, a higher ventilation velocity can make a more tenable situation during evacuation and alleviates the negative effect of late activation of jet fans, although the activation time is between 2 and 3 min.

The Sensitivity Analysis Shows that:

- By halving pre-movement time parameters, the EDV decreases. By doubling these parameters, the EDV increases, which indicated higher pre-movement time and consequently, a higher number of tunnel users who implemented the evacuation process later and were in the intolerable environment for too long and became incapacitated.
- When the frequency of HGV fire scenarios decreases by a factor of 10, that leads to lower cumulative frequencies and a lower FN curve.This indicates that the frequency of occurrence of each scenario depended directly on the value of the incidental frequencies.
- An increase in the threshold temperature results in a lower EDV or fewer fatalities, and vice versa because the threshold temperature is the main tenability criterion that determines intolerability conditions.
- Different types of burning vehicles result in different evacuation times.because the basic recognition time decreased for more severe accidents such as HGV fire and consequently, people became aware of the threatening situation within a shorter time.

Acknowledgment

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The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

a) A title which should be relevant to the theme of the paper.
b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
d) An introduction, giving fundamental background objectives.
e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
f) Results which should be presented concisely by well-designed tables and figures.
g) Suitable statistical data should also be given.
h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
j) There should be brief acknowledgments.
k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.

Format Structure

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, “What words would a source have to include to be truly valuable in a research paper?” Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

Tips for Writing a Good Quality Science Frontier Research Paper

Techniques for writing a good quality Science Frontier Research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of science frontier then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.

6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.

Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

Criterion for Grading a Research Paper (Compilation) by Global Journals

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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