PACTS
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32ND WESTMINSTER LECTURE
ON TRANSPORT SAFETY

FEATURING

THE DOGMA ATE MY HOMEWORK: RETHINKING ROAD SAFETY

PROF. TIM NUTBEAM

PROFESSOR OF EMERGENCY MEDICINE AND POST-COLLISION CARE AT THE UNIVERSITY OF PLYMOUTH
CRITICAL CARE DOCTOR AT THE DEVON AIR AMBULANCE
DIRECTOR AT IMPACT: THE CENTRE FOR POST-COLLISION RESEARCH INNOVATION AND TRANSLATION (WWW.POST-COLLISION.COM)

Delivered on Wednesday 4th December 2024 at the Wellcome Collection

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The Westminster Lecture Series

PACTS held the first Westminster Lecture on Transport Safety in 1990. PACTS is proud to have sustained this tradition over many years. Leading figures in transport safety from around the world have kindly accepted the invitation to speak. The full list of Lectures is provided in the Appendix.

About PACTS

The Parliamentary Advisory Council for Transport Safety (PACTS) is a UK-based registered charity, and company limited by guarantee, dedicated to improving transport safety. Formed in 1982, PACTS plays a unique role by bridging the gap between safety professionals and lawmakers. Its aim is to advise and inform members of the House of Commons and the House of Lords on air, rail and road safety issues, bringing together safety professionals and legislators to identify research-based solutions to transport safety problems with regard to cost, effectiveness, achievability and acceptability.

The organisation draws its income from member subscriptions, sponsorships, research grants, and events. PACTS is independent of political or commercial interests and collaborates with various stakeholders across the public, private, and third sectors.

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Presenter's Profile

PROF. TIM NUTBEAM

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Professor Tim Nutbeam is a consultant in Emergency Medicine and Prehospital Emergency Medicine working in the South West of the UK. Tim has a particular interest in the immediate phases of care following a motor vehicle collision and how outcomes for patients can be optimised.
He is the lead researcher for the EXIT (EXtrication In Trauma) project, which challenged traditional approaches to the management of trapped and injured patients, resulting in significant changes to national guidance and improving outcomes for trauma victims. The EXIT project considers how to optimise care and extrication for patients who are trapped following a motor vehicle collision. This work has been adopted into national guidelines, has influenced care internationally and has been awarded first place in the prestigious International Road Safety Awards (2022).

He has also recently formed IMPACT; the Centre for Post-Collision Research, Innovation, and Translation. IMPACT is dedicated to delivering world-class research and creating a collaborative forum for researchers, emergency services, and industry partners. The Centre's mission is to facilitate translation and innovation in post-collision care to reduce death and injury from road trauma, both nationally and globally. IMPACT focuses on improving post-collision outcomes through research, cross-disciplinary collaboration, and practical innovations, driving improvements in care for trauma patients at every stage of their journey. Through partnerships with leading academic institutions, healthcare providers, and policy-makers, IMPACT's research aims to bridge the gap between theoretical knowledge and practical application, to ensure that deliver patient centred care and that their patients have optimal outcomes.

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The Dogma ate my homework: Rethinking Road Safety

Road Injury

Road injury can be conceptualised through a straightforward framework that simplifies the complexities of collisions. This approach focuses on three key factors: kinematics, safety systems, and tissue tolerance.

Kinematics refers to the force involved in a collision – whether it is a significant or minor force, and the direction of that force. Safety systems encompass the protective mechanisms within vehicles, their functionality, and whether they were used correctly. Perhaps most critically, tissue tolerance plays a central role. Tissue tolerance refers to the amount of energy the human body can absorb before sustaining an injury. This explains why younger individuals may emerge relatively unscathed from severe rollovers, while older adults can sustain critical injuries even in low-impact collisions.

The extent of injury is determined by the relationship between the force involved, the mitigating effects of safety systems, and the body's tissue tolerance. When the remaining energy exceeds tissue tolerance, the severity of injuries increases. This framework highlights the interplay between these factors in understanding road injury outcomes.

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Sophie's Story

This section recounts the story of Sophie, who was involved in a catastrophic collision that illustrates the devastating effects of road trauma. The vehicle Sophie was in was severely damaged, with the engine block found 200 metres from the crash site—an indication of the immense forces at play. Despite the presence of advanced safety systems, the severity of the crash resulted in significant injuries. Sophie received immediate care, including a careful extrication process by the critical care team to minimise movement and protect her injuries, particularly her spinal cord. However, despite being transported to a major trauma centre just 12 minutes away, Sophie suffered a cardiac arrest en route and sadly passed away.

The cause of Sophie's death was a pelvic injury, a condition that underscores the lethal nature of non-compressible haemorrhage. The pelvis contains major blood vessels that, when ruptured during a front or side impact, can lead to severe internal bleeding. This type of haemorrhaging is particularly challenging to address in a pre-hospital environment and often requires surgical intervention, interventional radiology, or advanced treatments such as blood transfusions. Non-compressible haemorrhage is the leading reversible cause of road deaths in the UK and beyond, representing an area where improved interventions could save lives.

Despite the swift response from critical care consultants, paramedics, and fire and rescue services, as well as proximity to a trauma centre, Sophie's injuries proved unsurvivable. Her story highlights the critical importance of addressing non-compressible haemorrhage in road collisions and sets the stage for the focus of this lecture, which is divided into three key themes: Finding Dogma, Dogmalysis, and Collaboration. While this narrative is a sobering reminder of the challenges in road safety and trauma care, the talk promises to conclude with a hopeful outlook.

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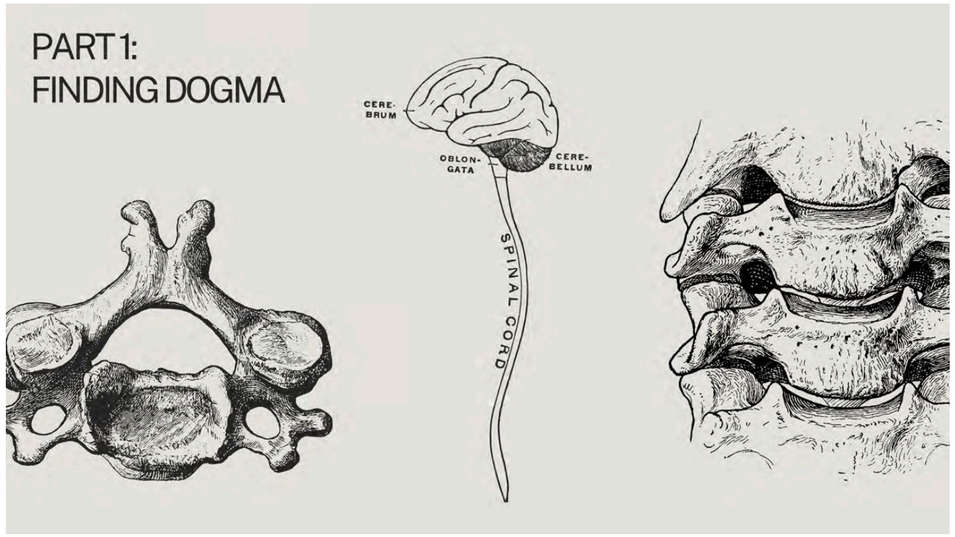
Part 1: Finding Dogma

The vertebrae, shown here, are structured with a central space designed to house and protect the spinal cord. These bones provide both stability and critical safeguarding for the spinal cord, which extends from the base of the brain. Any severe damage, such as bruising or severing of the spinal cord, can result in significant consequences, including paralysis. Such injuries profoundly impact quality of life and present considerable challenges for those affected.



Dogma refers to a principle or set of principles that are established by authority and regarded as incontrovertibly true, or beliefs and protocols that remain unchallenged despite evolving evidence. To explore examples of dogma in this context, it is essential to first understand some foundational information about the spinal cord and spinal anatomy.

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Part 1: Finding Dogma

Concerns about potential spinal cord damage, particularly movement-related injuries, have significantly shaped the approach to assisting individuals injured in motor vehicle collisions who remain in their vehicles. Complex extrication methods have been developed to minimize movement and protect the spinal cord, even though these processes are time-consuming. Fire and rescue teams, for example, are trained to hold a patient's head still and avoid any neck movement during extrication. Training exercises often include a glass of water placed on the dashboard to ensure minimal car movement; spilling even a drop prompts a restart of the exercise. This meticulous approach became deeply ingrained in fire and rescue protocols.

An old overhead projection slide that surfaced during research highlighted the sentiment that "Fire Service have killed more people than they've saved through the mishandling of the spine." While this statement is not accurate, it reflects the extent to which spinal cord protection has influenced rescue practices. Over time, new and more advanced tools have been developed to aid extrication, and the proportion of patients removed from vehicles through these methods has steadily increased.

Research into extrication times revealed that, on average, it took 32 minutes to safely remove individuals from vehicles. While this might seem reasonable at first glance, it becomes problematic in cases of ongoing haemorrhaging. In such situations, every minute counts, and delays of this magnitude could have critical consequences, underscoring the need for a balance between caution and urgency.

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Dogma 1

The principle of "slow and steady" has long been associated with improving patient outcomes during extrication, as it minimizes spinal movement. The assumption has been that a cautious and deliberate approach to extrication inherently benefits patients. This foundational belief underpinned much of the research conducted in this area.
The research discussed here was generously funded by the Road Safety Trust, with sponsorship from the National Fire Chiefs Council, whose support was instrumental in facilitating these studies. A series of scientific investigations were conducted, culminating in three key papers. These publications, which are openly accessible to the public, provide detailed insights into the findings and are available for further exploration.

The research conducted revealed important findings regarding extrication and its impact on patient outcomes. The rate of spinal cord injury among individuals injured in motor vehicle collisions who underwent extrication was determined to be 0.7%. However, entrapment was found to be independently associated with mortality, regardless of factors such as injuries, blood pressure, heart rate, pre-existing conditions, or hospital arrival time. Entrapment itself emerged as a critical factor contributing to fatalities. Biomechanical studies were also carried out, employing motion capture techniques commonly used in game development. These studies involved recruiting individuals of varying heights, weights, ages, and genders to represent a diverse population. Participants were equipped with devices to measure movements, and they were extricated repeatedly using a variety of common extrication techniques. This allowed researchers to build biomechanical models and quantify the movements associated with each method.

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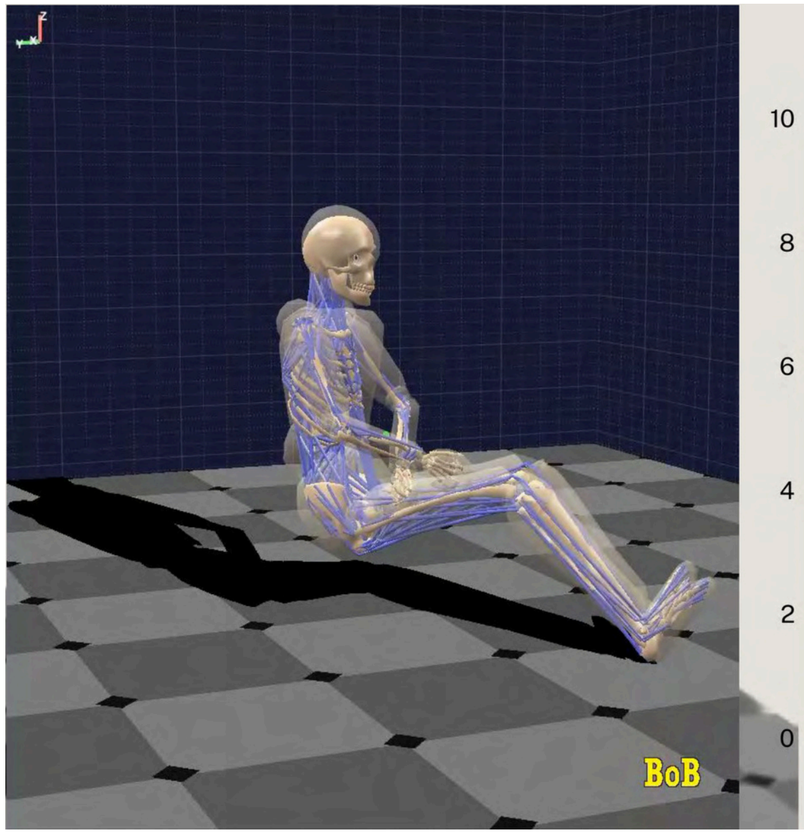
Dogma 1



The research identified three primary extrication techniques:

- Roof-off extrication: This method, designed to minimize movement, takes approximately 32 minutes.
- Side extrication: In this approach, the patient is removed laterally, taking around 20-25 minutes.
- Rapid extrication: A quicker method with no cutting, where the patient is gently lifted from the vehicle by fire and ambulance services.

Dogma 1

Surprisingly, the findings indicated that all three techniques caused similar levels of spinal movement. Despite the roof-off technique being designed to reduce movement, it did not perform better than the rapid method. Given the critical importance of time during hemorrhaging, the results suggest that minimizing extrication time, such as opting for the rapid method, may offer significant advantages for patient outcomes.

One of the most transformative findings from the research was the discovery that minimal spinal movement occurred when individuals were simply assisted in stepping out of their vehicles, provided they were capable of initiating their own movements. This result challenges long-held assumptions about extrication methods. Techniques that were traditionally believed to minimize movement, such as holding the patient's head firmly and carefully removing them using controlled methods, were found to actually cause more movement than anticipated.
The research revealed that rapid extrication—where the patient is lifted out of the vehicle quickly—results in comparable spinal movement to the more time-intensive roof-off method. However, when patients are capable of stepping out themselves, this approach consistently results in the least amount of spinal movement. These findings fundamentally upend previous beliefs and highlight the importance of empowering patients to self-mobilize where it is safe and appropriate to do so.

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Dogma 1

The research challenged two longstanding assumptions—or dogmas—about extrication techniques:

- Slow and steady improves patient outcomes. This belief is contradicted by the finding that entrapment is independently associated with death. The prolonged process of slow extrication does not enhance outcomes and may, in fact, contribute to worse results.
- Slow and steady reduces spinal movement. The data showed that slow and steady methods cause the same amount of spinal cord movement as rapid techniques. In some cases, the extended duration of these methods could exacerbate injuries due to delayed medical intervention.

These findings bring us back to the central question: did adherence to these dogmas contribute to Sophie's outcome. Would a two-minute extrication, rather than 32 minutes, have made a life-saving difference by getting her to a surgeon, interventional radiology, or a blood transfusion sooner? The evidence suggests that it might have.

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Example 2

The discussion turned to non-compressible haemorrhages, many of which occur in the pelvis and abdomen, posing significant challenges in trauma care. One effective treatment is tranexamic acid, a medication with a robust evidence base supported by multiple randomized controlled trials. Now available for intramuscular administration, tranexamic acid is a promising solution for addressing some of these critical issues.

However, this leads to a broader question: are we offering equitable trauma care? This assumption of equity in trauma, health safety, and road safety is a dogma worth challenging. Inspired by Caroline Criado Perez's book Invisible Women, which highlights inequalities in areas such as car and road design, research was conducted to explore the equity of tranexamic acid administration.

This study analyzed TARN (Trauma Audit and Research Network) data to address two key questions: does tranexamic acid work as effectively for females as it does for males, and is it being delivered equitably? A single chart from this analysis encapsulates the findings, shedding light on whether equity in trauma care is truly being achieved.

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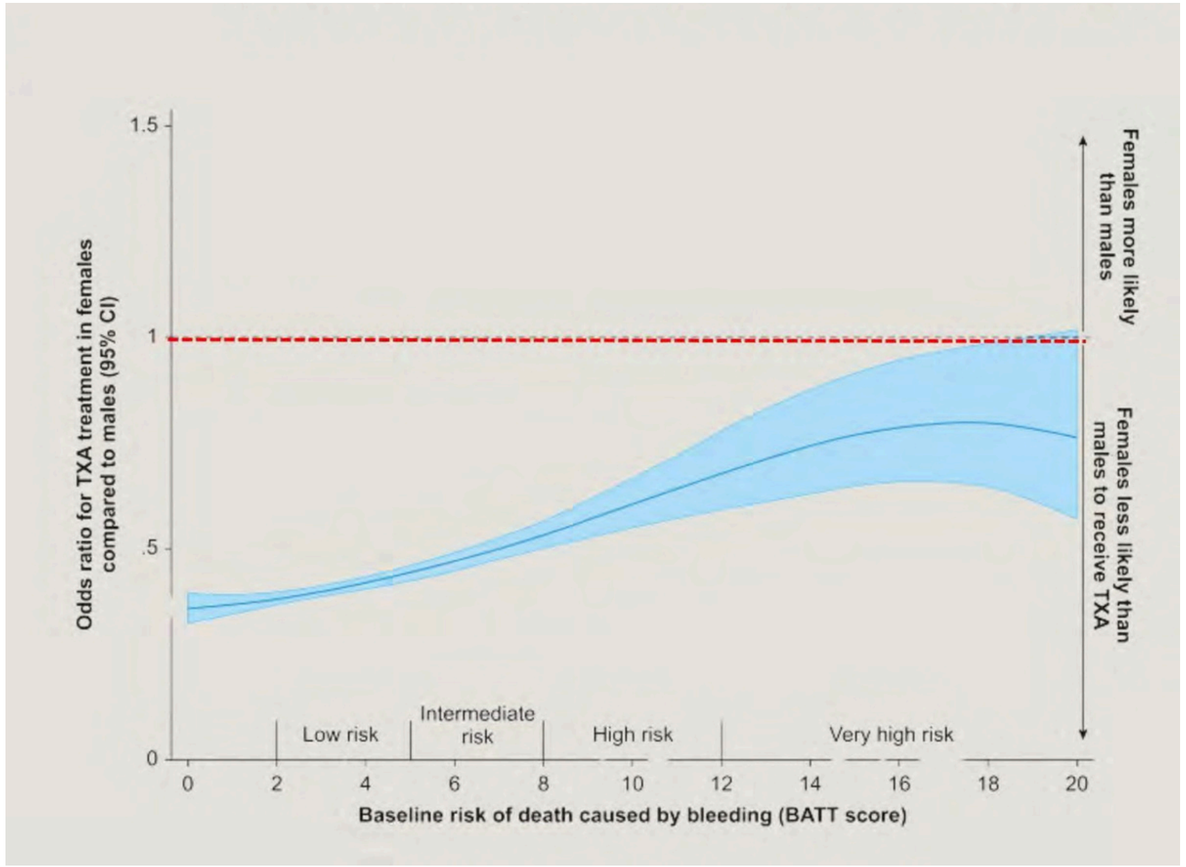
Example 2

The analysis examined the likelihood of receiving tranexamic acid based on gender, using a chart that plots the risk of death (horizontal axis) against the odds ratio of receiving tranexamic acid (vertical axis). Ideally, equitable care would result in data points clustering near the red line, indicating similar treatment likelihood for both males and females, with slight variations.

However, the reality in current UK practice reveals significant disparities. Women are approximately half as likely as men to receive tranexamic acid for the same level of trauma or physiological disruption. The disparity is even more pronounced for older women, who are much less likely to receive this critical treatment. These findings highlight a serious inequity in trauma care that demands urgent attention and corrective action.



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Example 2

Research confirms that tranexamic acid is equally effective for both women and men, with no differences in its efficacy. However, women are significantly less likely to receive this life-saving treatment compared to men, highlighting a clear inequity in trauma care. This leads to an unavoidable conclusion: we do not currently offer equitable care to all trauma patients.

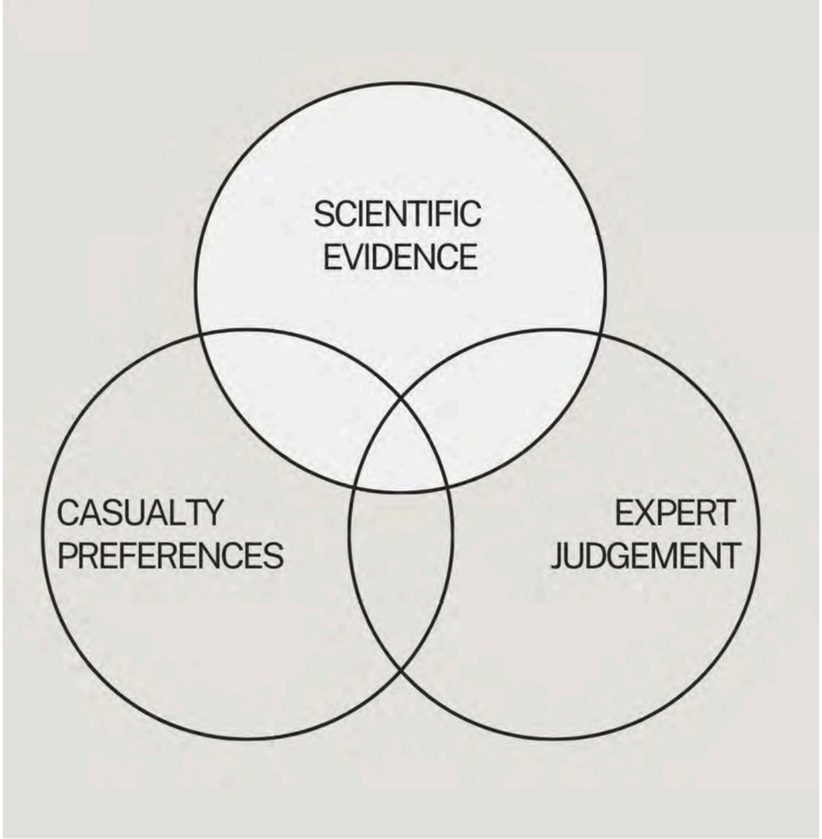
The key takeaway is that dogmas exist in many areas of practice, influencing decisions and outcomes. By working collaboratively and sharing diverse perspectives, we can identify these entrenched beliefs and take meaningful steps to address them, ultimately improving care and outcomes for all.

Part 2: Dogmalysis

Dogmalysis refers to the dissolution of authoritative beliefs or principles that are accepted without adequate evidence, achieved through rigorous, evidence-based methods. This concept highlights the importance of challenging entrenched ideas and replacing them with approaches grounded in data and research.

Drawing from clinical research practices, the principles of evidence-based medicine offer valuable insights for the road safety community. This approach integrates three key elements: scientific evidence, the preferences of patients or casualties, and expert judgment. It is at the intersection of these three elements that the most effective and practical solutions can be found.

In this context, the focus is on leveraging scientific evidence to guide strategies and decisions, ensuring that road safety interventions are not only effective but also informed by robust data and real-world considerations.



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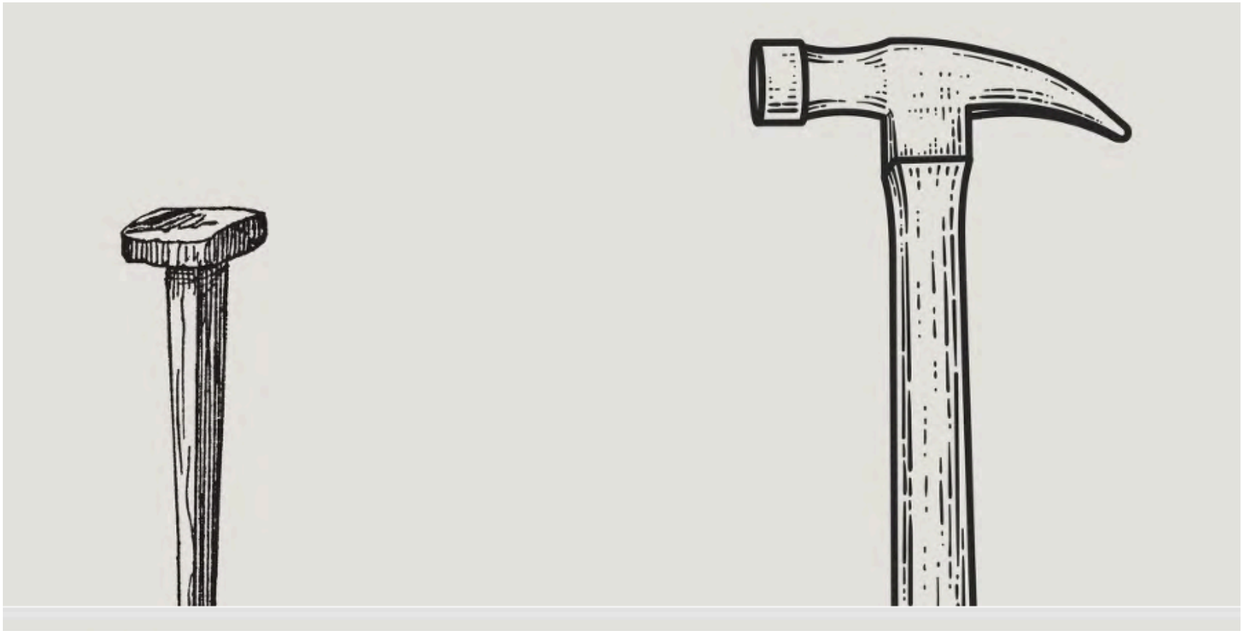
Part 2: Dogmalysis

The Nail and Hammer Metaphor for Research

This metaphor illustrates the relationship between the complexity of a problem and the research methodology used to address it. The nail represents the complexity of a problem—larger nails signify more complex issues, such as significant road safety challenges, while smaller nails represent simpler questions, like deciding whether road signs should be painted red or white. The hammer, on the other hand, symbolises the research methodology or scientific approach applied to address the problem. A bigger hammer reflects greater investment in the methodology—methodologically sound, internally valid, and externally valid research.



Part 2: Dogmalysis

Mistake 1: Mismatched Tools for the Problem

One common mistake in research is using a small hammer to address a large nail—a minimal methodology, such as a survey of only 20 people, to tackle a highly complex road safety issue. Unsurprisingly, the small hammer fails to achieve the desired results. However, instead of revisiting the approach, there's often a tendency to repeat the mistake by using multiple small hammers, hoping to eventually solve the problem. This ineffective strategy is all too familiar across various fields, including both clinical and road safety research.

Mistake 2: Overinvestment in Simple Problems

Sometimes, we face a small nail—a simple problem that is easily solvable. However, we bring in an unnecessarily massive hammer—a large, complicated, and expensive solution. While this approach works and solves the problem, it represents a significant waste of resources. Those extra resources could have been better allocated to address other pressing issues, but instead, they are spent on an overly elaborate solution for a minor challenge.

Mistake 3: Redundancy in Solving Solved Problems

In some cases, we have a nail and a perfectly matched hammer, solving the problem efficiently. However, instead of moving on to other challenges, we continue to hammer the same nail repeatedly because it feels good and yields results. This redundancy occurs when we fail to share our findings or communicate that the problem has already been resolved. As a result, valuable resources are wasted on solving the same issue over and over again, rather than tackling new challenges.

Part 2: Dogmalysis

Mistake 4: Failure to Learn from Unsuccessful Research

In other instances, we have a well-matched nail and hammer, but the research doesn't succeed. External factors, such as changes in the environment or legislative landscape, can derail the project. Alternatively, the intervention itself may fail to produce results, or contaminants might spoil the experiment. Failure is a natural part of scientific exploration. However, what compounds the issue is the reluctance to share these failures. Without communicating unsuccessful attempts, future researchers are left unaware of what doesn't work and risk repeating the same mistakes, further wasting resources and time.

Mistake 5: Avoidance of Complex Problems

Then there are the massive, challenging nails—issues that seem too large or daunting to tackle. Instead of attempting to find solutions, researchers may avoid these problems altogether. These "elephants in the room" remain unresolved, perpetuating significant gaps in understanding or intervention.

Part 2: Dogmalysis

The Hierarchy of Evidence

The hierarchy of evidence is a well-established framework in scientific research, with each level of the pyramid representing different types of studies. At the base are consensus and expert opinions, followed by case series and reports, case-control studies, and cohort studies. At the top are randomised controlled trials (RCTs), widely considered the gold standard for evaluating new interventions. Above even RCTs sits meta-analysis, which synthesizes data from multiple RCTs to provide a comprehensive overview of evidence.

This pyramid highlights the increasing specificity, complexity, time, and cost of RCTs:

- Specificity: RCTs address narrow questions, not broader issues like road safety.
- Complexity: They require strict governance, resources, and risk management.
- Time: RCTs span years; e.g., PARAMEDIC-3 took 5+ years, with implementation taking longer.
- Cost: Averaging £3 million in healthcare, similar funding is scarce in other fields.

Given the significant investment in time, money, and resources required for RCTs, selecting this method must be done with great care. It is crucial to match the method to the problem and ensure the potential impact justifies the effort.
Fortunately, the research landscape is evolving. While the traditional hierarchy remains important, new trial methodologies and innovative approaches are emerging. These developments hold promise for addressing the challenges of traditional research methods, particularly in fields like road safety, where resources are often limited.

Part 2: Dogmalysis

The landscape of research is evolving rapidly with unprecedented advancements in technology and methodology. Today, we have access to massive datasets—big data that was unimaginable just a few years ago. For instance, devices like iWatches serve as ambulatory monitoring tools, and black boxes in cars provide vast amounts of data that can now be effectively analyzed. These datasets have the potential to offer profound insights and reshape our understanding of complex issues.

Innovative Research Methodologies

- REMAP Trials (Randomised, Embedded, Multi-factorial, Adaptive Platform Trials): This new methodology enables researchers to build platforms, such as specific roads or paramedic networks, to conduct multiple sequential or concurrent trials. Trials can be adapted dynamically, with new interventions added or removed as needed, making the process significantly more efficient and cost-effective compared to traditional randomised trials. This approach is already challenging the dogma surrounding clinical trials.
- Artificial Intelligence: The capabilities of AI, when combined with big data, are transformative. Projects leveraging AI show immense potential to provide deep insights and cost-effective solutions, particularly in the road safety and healthcare sectors.

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Part 2: Dogmalysis

Harnessing the Potential

With these advancements, it is an incredibly exciting time to be conducting research. By embracing big data, novel trial methodologies, and artificial intelligence, we can run more efficient trials within limited budgets, generating valuable insights to inform practice and ultimately save lives.

Beyond Research: Translating Findings into Practice

Having cutting-edge tools and methodologies is essential, but their value lies in how the findings are applied in real-world contexts. Science must move beyond academic publications and regional applications to broader implementation. Writing up findings in peer-reviewed journals is important, but ensuring those insights are translated into practical, actionable solutions is equally critical. Effective translation is often resource-intensive and requires dedicated expertise, but it ensures that research achieves its ultimate goal—impacting lives positively.

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Key Takeaways from Part 2

- Choose the Right Tools: Not every problem requires a randomised controlled trial. While RCTs have their place, they are expensive, highly specific, and often unsuitable for addressing broader environmental challenges.
- Share All Results: Transparency is key. Share not only successes but also failures to build collective knowledge and avoid repeated mistakes.
- Prioritise Translation: Discovery is only part of the process. The real value lies in taking research off the shelf and implementing it effectively on roads, in policies, and in practice.

By integrating these principles, the research community can ensure that its efforts are impactful, efficient, and aligned with real-world needs.

Part 3: Collaboration

- Collaboration is often the most vital component in addressing complex challenges, and the road safety community has proven to excel in this area. The issues we face in road safety and clinical science are not merely complicated—they are deeply complex, requiring diverse perspectives and expertise to uncover comprehensive solutions.

The Limits of a Single Perspective

While clinicians, for instance, can address specific aspects of a problem, their limited range of perspectives often leaves other parts of the puzzle unsolved. Solving complex problems requires more than a single viewpoint. A narrow approach may solve only one piece, leaving the rest untouched. The intricate nature of these challenges calls for broader, more inclusive collaboration.

The Power of Collaborative Efforts

True progress emerges when multiple disciplines come together. For example, through the EXIT project, collaboration extended beyond clinicians to include rescue professionals, statisticians, road safety experts, bio-mechanics, psychologists, and patients. With contributors from around the world—Switzerland, France, Brazil, Spain, and Botswana—this diverse group managed to tackle significant aspects of complexity. While the challenges are not entirely solved, collaboration has proven to be a critical step forward.

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Part 3: Collaboration

IMPACT: A Centre for Collaboration

The IMPACT initiative, currently underway, aims to become a hub for collaboration—a "water cooler" for the post-collision space. By bringing together statisticians, engineers, patients, road safety professionals, and more, IMPACT seeks to facilitate the sharing of ideas, perspectives, and solutions to address the most difficult problems. It welcomes contributions from anyone with relevant expertise, enabling a collective approach to problem-solving.

The Future of Collaboration

. Effective collaboration requires diverse representation across:

- Disciplines and sectors: Combining expertise from various fields.
- Geographical regions: Learning from global experiences.
- Diversity: Ensuring inclusive perspectives.
- Patients and those impacted: Centering the voices of those directly affected.

By fostering meaningful collaboration across these areas, the road safety and clinical science communities can develop innovative, comprehensive solutions to the pressing challenges we face today.

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Bringing It All Together

- Dogmas are pervasive, but by leveraging our diverse perspectives and working together, we can uncover and address them. The key lies in selecting the right tools—choosing the appropriate "hammer" for the specific problem at hand. This means using resources wisely, avoiding an overreliance on randomised controlled trials (RCTs), and ensuring that our methods align with the complexity of the challenges we face.
- Equally important is the act of sharing findings. Science must not end at discovery; effective translation of insights into actionable changes is essential to ensure that our work makes a tangible impact.
- Collaboration is the foundation for tackling the complex problems we face. The diverse perspectives within this community—spanning disciplines, sectors, and geographies—offer an extraordinary opportunity to develop innovative solutions.
- Above all, we must keep our focus on those we aim to help: the patients, casualties, and individuals whose lives we strive to improve. They are the heart of our work and the driving force behind our collective efforts.

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Freddie's Story

Freddie, just 19 years old, was driving with friends one morning when a tragic incident occurred at a junction. A fully loaded lorry, carrying bricks, collided with his vehicle. Applying the principles of road injury analysis—kinematics, safety systems, and tissue tolerance—this was a devastating scenario. The sheer momentum of the lorry overwhelmed all safety measures, and even Freddie's young age and high tissue tolerance could not prevent significant injuries.

Rather than adhering strictly to traditional patient immobilisation techniques, the team employed innovative thinking. By relocating the lorry—releasing its handbrake and rolling it down a hill—they freed Freddie more quickly. This unconventional approach (informed by the EXIT project) would have been considered highly controversial under older protocols, but it was critical in this case.

Freddie received immediate, life-saving treatments at the scene, including tranexamic acid, resuscitation, blood products, and an anaesthetic to optimise his condition. He was flown to the hospital, where he received extensive care, including 30 units of blood and intensive treatment. Remarkably, within just three weeks, Freddie was walking out of the hospital, ready to resume a full and happy life.

This story is a testament to the importance of challenging dogmas and embracing innovative practices in trauma care. It highlights the potential of collaborative efforts, evidence-based approaches, and a willingness to rethink traditional methods to save lives.

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Conclusion

- This lecture emphasized the importance of questioning long-held assumptions (dogmas) in trauma care and road safety. By embracing evidence-based methods, innovative approaches, and collaborative solutions, we can address complex challenges and improve outcomes for patients and road users alike.

Key takeaways:

- Challenge dogma through evidence and innovation.
- Use resources wisely by choosing the right tools for the problem.
- Prioritize collaboration across disciplines and sectors to solve complex issues.
- Keep patients and casualties at the heart of all efforts.

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Event Highlights

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Acknowledgements

PACTS would like to thank Lord Hogan-Howe for opening the Westminster Lecture and introducing Professor Tim Nutbeam.

Professor Tim Nutbeam would like to thank The Road Safety Trust for their support of the EXIT project.

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Making Roads Safer

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Research Links

- Nutbeam T, Kehoe A, Fenwick R, Smith J, Bouamra O, Wallis L, Stassen W. Do entrapment, injuries, outcomes and potential for self-extrication vary with age? A pre-specified analysis of the UK trauma registry (TARN). Scand J Trauma Resusc Emerg Med. 2022 Mar 5;30(1):14. doi: 10.1186/s13049-021-00989-w. PMID: 35248129; PMCID: PMC8898443. **Access here.**
- Nutbeam T, Fenwick R, Smith J, Bouamra O, Wallis L, Stassen W. A comparison of the demographics, injury patterns and outcome data for patients injured in motor vehicle collisions who are trapped compared to those patients who are not trapped. Scand J Trauma Resusc Emerg Med. 2021 Jan 14;29(1):17. doi: 10.1186/s13049-020-00818-6. PMID: 33446210; PMCID: PMC7807688. **Access here.**
- Nutbeam T, Weekes L, Heidari S, Fenwick R, Bouamra O, Smith J, Stassen W. Sex-disaggregated analysis of the injury patterns, outcome data and trapped status of major trauma patients injured in motor vehicle collisions: a prespecified analysis of the UK trauma registry (TARN). BMJ Open. 2022 May 3;12(5):e061076. doi: 10.1136/bmjopen-2022-061076. PMID: 35504646; PMCID: PMC9066497. **Access here.**

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Appendix

Previous Westminster Lectures on Transport Safety

The Westminster Lecture is an annual event in which leaders in transport safety address topics of concern to practitioners, researchers, and policymakers in the field. It is organised by PACTS

- **31st** - Prof. Nicola Christie, director of engagement, The Department of Civil, Environmental and Geomatic Engineering - UCL

Title: Why we need to level up road safety

- **30th** - Simon French OBE, Former Chief Inspector, Rail Accident Investigation Branch.

Title: Reflections on 18 years as a railway accident investigator

- **29th** - Robert L. Sumwalt, FRAeS, Chairman, US National Transport Safety Board

Title: Lessons from the Ashes: Improving Transportation Safety through Accident Investigation

- **28th** - Prof. Alan F. T. Winfield, Bristol Robotics Laboratory, UWE Bristol

Title: The Implications of Robots in the Transport Sector

- **27th** - Christian Friis Bach, Executive Secretary & Under-Secretary-General, United Nations Economic Commission for Europe

Title: Road Safety and the Global Goals for Sustainable Development

- **26th** - Ruth Sutherland, Chief Executive, Samaritans

Title: Working Together to Reduce Suicide in Transport

- **25th** - Tony Bliss, Global Road Safety Advisor, Monash University Accident and Research Centre, Australia

Title: Road Safety in the 21st Century: Public Expectations of Government

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Appendix

Previous Westminster Lectures on Transport Safety

- **24th** - Dr Rob Hunter, Head of Flight Safety, BALPA Staying Awake

Title: Staying Alive: The problem of fatigue in the transport sector

- **23rd** - Jeanne Breen, OBE, FRSA, MCIHT, Jeanne Breen Consulting

Title: Managing for Ambitious Road Safety Results

- **22nd** - Dr Jillian Anable, Centre for Transport Research, University of Aberdeen

Title: More haste, less speed: changing behaviour for safety and sustainability

- **21st** - Danny Dorling, Professor of Human Geography, University of Sheffield

Title: Roads, casualties and public health: the open sewers of the 21st century?

- **20th** - Fred Wegman, Managing Director, SWOV Institute for Road Safety Research, The Netherlands

Title: Putting People at the Centre: How to Improve Road Safety in the 21st Century

- **19th** - Professor Oliver Carsten, University of Leeds

Title: Technology: Curse or Cure?

- **18th** - Professor James Reason CBE, Emeritus Professor, University of Manchester

Title: Recurrent patterns in transport accidents: Conditions and causes

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- **17th** - Professor Phil Goodwin, Professor of Transport Policy at the Centre for Transport and Society, UWE Bristol, Emeritus Professor at University College London
Title: Determination and Denial: The Paradox of Safety Research and Traffic Policy

- **16th** - Professor Ronan Lyons, Professor for Public Health, University of Wales at Swansea
Title: Connecting Public Health and Transport Safety

- **15th** - Professor Helen Muir, Director, Cranfield Institute for Safety
Title: Risk and Reliability In times of crisis how do passengers react?

- **14th** - Professor David Begg, Chairman, Commission for Integrated
Title: Transport Transport Safety and Integration: putting the two together

- **13th** - Mr Ken Smart, CBE, Chief Inspector, Air Accidents Investigation Branch
Title: Transport Accident Investigations: a question of trust

- **12th** - Professor Richard Allsop, Centre for Transport Studies, UCL
Title: Road Safety: Britain in Europe

- **11th** - Dr Rod Kimber, Director of Science and Engineering, TRL 2010
Title: Getting there in one piece

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- **10th** - Simon Folkard D.SC, Department of Psychology, University of Wales at Swansea

Title: Transport Rhythm and Blues

- **9th** - Dr Dianne Parker, University of Manchester

Title: The social psychology of driver behaviour: is it time to put our foot down?

- **8th** - Professor Frank McKenna, Department of Psychology, Reading University

Title: Death by Accident: the psychology of human error

- **7th** - Mr Stefan Nillson, Director, Automotive Safety Centre, Volvo

Title: A Holistic View on Automotive Safety

- **6th** - Sir Alastair Morton, Co-chairman, Eurotunnel

Title: There is no such thing as perfect safety in transport, but life is life, however you travel

- **5th** - Dr Leonard Evans, Principal Research Scientist, GM R&D Centre

Title: Traffic Safety Measures, Driver Behaviour Responses and Surprising Outcomes

- **4th** - Mr Brian O'Neil, President, Insurance Institute for Highway Safety

Title: Progress in Transport Safety: the US experience

- **3rd** - Mr Robert Coleman, Director General, DG VII, European Commission

Title: Transport Safety and the EC

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Previous Westminster Lectures on Transport Safety

- **2nd** - Dr Ian Johnston, Executive Director, Australian Road Research Board

Title: Effective strategies for transport safety: an Australian's perspective

- **1st** - Dr Jan C. Tetlow, Secretary General, European Conference of Ministers of Transport

Title: Transport Safety: European cooperation for the 90's

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ON TRANSPORT SAFETY

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